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HUGO CARCANHOLO IASCO PEREIRA

ESSAYS ON EXCHANGE RATE AND ECONOMIC PERFORMANCE

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HUGO CARCANHOLO IASCO PEREIRA

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For my family and friends whose love encourages me to move forward.

For Helena, the love of my life.

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RESUMO

O objetivo desta tese é investigar os efeitos de uma política econômica de desvalorizações cambiais na performance econômica. A tese é composta por seis ensaios. O primeiro ensaio, "Kaldorian Growth Models: a critical discussion", discute o crescimento econômico na perspectiva kaldoriana. À luz da discussão sobre a limitada compreensão da Lei de Thirlwall sobre os efeitos de desvalorizações cambiais no crescimento econômico, o segundo ensaio, "Endogenous Productivity Regime and the Impact of Devaluations of Real Exchange Rate on Economic Growth", desenvolve um modelo teórico de causação circular e cumulativa, endogenizando o regime de produtividade em relação ao progresso tecnológico induzido por uma taxa de câmbio real desvalorizada. O terceiro ensaio, "Exchange Rate and Growth: empirical evidence (1995-2018)", apresenta evidências empíricas sobre a influência de uma taxa de câmbio real desvalorizada no crescimento de longo-prazo. O quarto ensaio, "Exchange Rate and Structural Change: a study using aggregated and sectoral data", investiga se uma taxa de câmbio real competitiva está associada com a composição setorial das economias em termos agregados e setoriais. O quinto ensaio, "Exchange Rate and Prices: an extended Kaleckian approach for Brazilian manufacturing sectors (2010-2019)", apresenta um modelo teórico e regressões de séries temporais sobre os efeitos inflacionários de se perseguir uma taxa de câmbio real desvalorizada para os setores manufatureiros da economia brasileira. O sexto ensaio, "Real Exchange Rate and Growth: identifying transmission channels", investiga alguns possíveis canais através dos quais a taxa de câmbio real influencia o crescimento econômico. Os resultados do modelo teórico indicam que perseguir uma taxa de câmbio real desvalorizada é potencialmente benéfica para o crescimento econômico de longo-prazo. Isto é, os efeitos de câmbio real desvalorizado são positivos (negativos) para economias com regimes de demanda e acumulação de capital *profit-* (*wage-*) *led* através de sua influência no crescimento da demanda e no progresso tecnológico. Em poucas palavras, os resultados empíricos sugerem que a taxa de câmbio real não é neutra em relação à promoção do crescimento de longo prazo. Os resultados também indicaram que a taxa de câmbio real está relacionada com alterações na estrutura produtiva, na composição da renda nacional em termos de consumo e investimento/poupança, eficiência econômica em termos de *social capabilities* e produtividade total dos fatores. Contudo, as evidências também sugerem que uma taxa de câmbio real desvalorizada produz custos sociais relacionados com inflação mais elevada e piora (melhora) na distribuição funcional (pessoal) de renda.

Palavras-chave: Taxa de Câmbio Real, Teoria Kaldoriana do Crescimento Econômico, Performance Econômica.

ABSTRACT

This thesis seeks to investigate the effects of pursuing a competitive real exchange rate on economic performance. The thesis is compounded by six essays. The first essay, "*Kaldorian Growth Models: a critical discussion*", aims to comprehend how the Kaldorian models understand the influence of real exchange rate on growth. In light of the discussion about the limited comprehension of Thirlwall's law (the benchmark of this tradition) about the impact of pursuing a competitive real exchange rate, the second essay, "*Endogenous Productivity Regime and the Impact of Devaluations of Real Exchange Rate on Economic Growth*", develops a model of cumulative and circular causation, endogenizing the productivity regime in relation to the technological progress induced by a competitive real exchange rate. The third essay, "*Exchange Rate and Growth: empirical evidence (1995-2018)*", provides empirical evidence about the influence of a competitive real exchange rate on the long-run performance. The fourth essay, "*Exchange Rate and Structural Change: a study using aggregated and sectoral data*", studies whether pursuing a competitive real exchange rate influences the sectoral composition of economies in aggregated and sectoral perspectives. The fifth essay, "*Exchange Rate and Prices: an extended Kaleckian approach for Brazilian manufacturing sectors (2010-2019)*", provides a simple theoretical model and a succession of time series regressions to study the inflationary effects of pursuing a competitive real exchange rate for the manufacturing sectors of the Brazilian economy. The sixth essay, "*Real Exchange Rate and Growth: identifying transmission channels*", investigates some possible channels through which the real exchange rate influences growth. The thesis' theoretical results point out that pursuing a competitive real exchange rate (possibly) spurs the growth of economies under profit- (wage-) led regime of demand/capital accumulation via changes in demand and in technological progress. In a nutshell, the empirical results suggest that the real exchange rate is not neutral in promoting the long-run growth. Furthermore, the results also indicate that the real exchange rate is linked with changes in productive structure, in the composition of national income in terms of consumption and investment/saving, and the economic efficiency in terms of social capability and Total Factor Productivity. However, the shreds of evidence suggest that pursuing a competitive real exchange rate produces social costs by increasing inflation and a worsening (improving) functional (personal) income distribution.

Keywords: Real Exchange Rate, Kaldorian Growth Theory, Economic Performance.

SUMMARY

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INTRODUCTION

The exchange rate represents the price of domestic currency in terms of other foreign currency. As a relative price, associated with the prices of imported and exported goods, this variable is linked with economic performance concerning short-run aspects (as demand growth, jobs creation, inflation) as well as regarding medium- and long-run aspects (as income distribution, structural change, the composition of national income in terms of consumption, saving, investment, and net-exports). In this regard, the exchange rate may boost, or hamper, the long-run growth. When used as a policy oriented for the economic development, the exchange rate can trigger important drivers of long-run growth. Yet, when used as a tool merely associated with other aspects – as nominal anchor, policies of artificial risings in real wages (decoupled from the labor productivity growth), the exchange rate can exert a devastating impact on the aforementioned drivers of long-run growth.

Many studies showed the importance of managing the exchange rate as an oriented policy for the economic development. There is an extensive literature that indicates robust evidence – theoretically and empirically, that a devalued real exchange rate may exert a positive influence over the long-run growth. Various authors have been suggested possible transmission channels through which the real exchange rate influences economic development/growth (as it will be discussed in detail, at the appropriated time, throughout this thesis). Making the real exchange rate misaligned in relation to its long-run fundamentals (a more depreciated national currency) sparks a prosperous process of economic development grounded on international competition, exports, capital accumulation and, ultimately, on the labor productivity growth.

However, a development strategy based on pursuing a competitive real exchange rate implies making renunciations in the short-run in order to reach a more developed society in the medium- and long-run. In the short-run, the inflationary pressures induced by a weak national currency require a lower real wage to do not corrode the gains of international competitiveness via a strengthened inflationary process. Put differently, assuming the existence of a lower and controlled inflation, in the short-run, an exchange rate policy oriented for the economic development reduces consumption, at detriment of a greater investment, saving and exports. In the medium- and long-run, nonetheless, into the extent that the labor productivity grows, induced by the greater pace of capital accumulation, it opens the rooms for greater real wages in a sustainable path, without incurring in a profit-squeeze situation.

It turns out, however, that there is no guarantee that the greater labor productivity growth (if this is the case) will be passed on into the real wages in the medium- and/or long-run. There might well be that the fruits of the economic development are not shared equally in the medium- and long-run. This applies specially to developing countries, in which the heterogeneous productive structure co-exists with a numerous people unemployed, or even engaged in informal activities. In fact, this is the Achilles' heel of this growth-story: there is no guaranteeing that the economic growth, induced by a growth-strategy based on a competitive real exchange rate, and its fruits will be shared with all individuals of society in medium and long-run.[1]

On the other hand, literature suggests that the influence of real exchange rate on economic development is not confined to the picture designed above. As a relative price associated with the sectoral profitability (income distribution as a whole), the exchange rate is associated with the structural composition of the economy. Pursuing a competitive real exchange rate leads to a more industrialized and complex productive structure, benefiting the export sectors. The economy becomes outward-oriented. As a result, the external constraint eases as exports increase and the productive structure becomes less dependent on imports and oriented to produce export goods more sophisticated. Moreover, by making the national firms to compete with the more efficient foreign firms in international markets, this development-strategy leads to national firms more efficient and productive.

It was considering this growth-narrative that this thesis has been thought. The main goal is to study the effects, theoretically and empirically, of pursuing a competitive real exchange rate, as an economic policy, on the economic development in a broad sense. For the sake of clarity and organization, it should be stressed that the thesis is structured in six essays independent of each other. Although each essay has specific objectives with different subjects of analysis, the common background of the essays is the idea of measuring and understanding the influence of exchange rate on the economic system.

In the theoretical field, the specific goal is to comprehend the effects of a devalued real exchange rate on long-run growth from the Kaldorian point of view. The novelty is to

[1] It is possible that the economy grows at the expense of the worst income inequality. The GDP becomes greater, as well as the investment and net exports, the productive structure is more industrialized and complex. Yet, the distribution of the greater income becomes more concentrated. The economic prosperity does not reflect in the standard of living of population. Such a situation is similar to the "economic miracle" of the Brazilian economy over the 1970s: the fast pace of growth of GDP, capital accumulation and manufacturing exports was induced by a lower real wage face to a devalued real exchange rate and a lower and stable inflation. The result was a historically high growth rate of GDP, which has been accompanied by an incredible raising in income inequality.

understand this relation via the natural growth rate of economy, and not via the actual growth rate (Thirlwall's law), as it is usual in this literature. The Kaldorian approach developed in this thesis comprehends that the influence of real exchange rate on economic growth occurs through the interaction between demand growth and labor productivity growth, considering the intensity of the Kaldor-Verdoorn mechanism endogenous to the technological progress induced by devaluations of real exchange rate.

The justification for this new theoretical framework derives from the fact that the usual approach, in the Kaldorian growth theory, accounts for the effects of the real exchange rate on the growth in terms of Thirlwall's law. The fundamentals of long-run growth, in this perspective, come down to the magnitude of income-elasticities of exports and imports. Various studies have explored the endogeneity of the income-elasticities in relation to aspects of the supply-side. In particular, a large body of this literature has endogenized the long-run growth fundamentals of Thirlwall's law, concerning the changes in productive structure induced by the real exchange rate. The argument is that pursuing a competitive real exchange rate promotes a structural change towards the manufacturing sectors. This process increases the importance of the more complex and modern sectors within the productive structure, increasing (reducing) the income-elasticity of exports (imports). Ergo, the long-run growth/the actual growth rate becomes greater.

It turns out, however, that Thirlwall's law provides a limited comprehension of the effects of real exchange rate on growth, as discussed in the first essay of this thesis, because: a- the relative prices are dismissed due to the assumption of the law of one price, b- the labor productivity growth, technological progress, and capital accumulation do not play any role in explaining the growth, c- the effective demand growth is not taken into account, d- the supply-side, in the Kaldorian manner - Kaldor-Verdoorn mechanism - is disregarded, which means to put away the notion of circular and cumulative causation, d- the supply-side does not matter, in steady-state, the potential output growth (determined by the elements of supply-side, i.e., by the interaction between demand growth and productivity growth) adapts to the actual output.

It is worth noting other important aspect of Thirlwall's law. This approach does not explain the economic growth by its own. As indicated by the structuralist literature, the growth rate of output consistent with the equilibrium in balance of payment (i.e., the parameters of income elasticities) is more a consequence of the drives behind the long-run growth than its cause. The main elements that determine the long-run growth are in the supply-side of the economy, in the Kaldorian sense. It is the interaction between demand growth and labor productivity growth that determines the long-run growth. Thirlwall's law simply explains the maximum growth of output consistent with the equilibrium in balance of payment. It is in this regard that the theoretical contribution of this thesis is grounded on: understanding the influence of real exchange rate on long-run growth through the supply-side within the Kaldorian approach.

It is noteworthy to stress that the theoretical model developed in this thesis is more closely related to be a complementary approach than a disowning of Thirlwall's law. Indeed, both perspectives should be taken together. There is no way to boost the long-run growth of an economy under an effective external constraint. The supply-side of the economy (in the Kaldorian sense) requires an ease external constraint in order to act as a boosting vector of long-run growth. However, a growth theory that does not incorporate the supply-side, in the Kaldorian manner, is a meaningless approach because it does not really explain growth.

Motivated by these considerations, the new theoretical approach developed in this thesis seeks to understand the effects of pursuing a competitive real exchange rate over the long-run growth via the supply-side of the economy (in the Kaldorian way) – or, in other words, via the natural growth rate. The argument is that pursuing a competitive real exchange rate exerts influence on the long-run growth through two channels: i- by affecting the income distribution and, then, the effective demand growth; ii- by influencing the firms' decisions of making new investments, which changes the intensity of the circular and cumulative causation: i.e., a faster pace of capital accumulation, induced by a competitive real exchange rate, enlarges the parameters of the productivity regime (the Kaldor-Verdoorn mechanism becomes more intense). In both cases, pursuing a competitive real exchange rate may spur long-run growth under certain conditions.

In this sense, it is with the previous discussion in mind that the first two studies of this thesis should be regarded. The first essay, "*Kaldorian Growth Models: a critical discussion*", is more a discussion about the long-run growth in the kaldorian perspective, with an appointment of an agenda of theoretical research, than an original contribution to literature. The main goal of this chapter is to discuss the long-run growth in the Kaldorian tradition in order to shed light on the limitations of Thirlwall's law to understand the influence of real exchange rate on economic growth. This essay seeks to address the following questions: a- *What is the nature of economic growth within the theoretical Kaldorian models*? b- *What are the fundamentals and the shortcomings behind the Kaldorian approach to comprehend the long-run growth*? c- *What are the consequences for the understanding about the influence of real exchange rate over the long-run growth when the Thirlwall's law is taken as the* *theoretical approach?* For this purpose, two groups of models are discussed: i- the export-led growth model - developed by Kaldor (1970) and Dixon and Thirlwall (1975), and ii- the Thirlwall's law - developed by Thirlwall (1979), and its main extensions. Special attention is paid to understand how the supply-side is considered, as well as its consequences for a growth theory that aims to explain the influence of real exchange rate on growth.

The second essay, "*Endogenous Productivity Regime and the Impact of Devaluations of Real Exchange Rate on Economic Growth*", deliveries an original contribution to the theoretical literature, for the best of my knowledge. It provides a model of cumulative and circular causation. The leading question of this study is: *What is the effect of devaluations of real exchange rate over the long-run growth in a Kaldorian growth model of cumulative and circular causation when the productivity regime is endogenous regarding the real exchange rate*? The new approach endogenizes the parameters of the productivity regime to capture the influence of real exchange rate over the capital accumulation/technological progress on the labor productivity with the demand growth. The argument is that the real exchange rate impacts labor productivity growth and the intensity of the Kaldor-Verdoorn mechanism by influencing firms profit rate and, then, its investment decision. The results suggest that devaluations of the real exchange rate spur the growth of economies under profit-led regimes of demand and capital accumulation, while its effects are ambiguous in economies under a wage-led regime of demand and wage- (profit-) led capital accumulation regime.

The contribution of this thesis to the existing literature is not limited to theoretical discussion. In the empirical field, the thesis tested the influence of real exchange rate on the economy from a broad perspective. A specific goal is to study empirically the direct impact of pursuing a competitive real exchange rate on the long-run growth. For that, the third essay, "*Exchange Rate and Growth: empirical evidence (1995-2018)*", studies the empirical association between the real exchange rate and economic growth. The studied problems of this essay are: a- *Are the devaluations of real exchange rate associated with a greater long-run growth?* b- *Could this possible association be different if the exchange rate misalignments were calculated using different fundamentals?* c- *Could this possible association be different for countries classified in accordance with the income-level, or by different countries' samples?* d- *Is the Washington Consensus' view on the relation between misalignments of real exchange rate and growth valid?* e- *Does the influence of real exchange rate on growth follow a non-linear pattern*? Various econometric models and specifications are estimated using various measures of real exchange rate misalignments with different fundamentals. The results provide robust pieces of evidence that pursuing a competitive real exchange rate is associated with greater long-run growth.

The remaining specific goals of this thesis are associated with testing the influence of pursuing a competitive real exchange rate on drivers of long-run growth. In other words, it is tested the indirect influence of a competitive real exchange rate on long-run growth. Specifically, it is tested its effects on i- the structural change (the importance of manufacturing, services and primary activities within the productive structure, and economic complexity), ii- the sectoral performance in terms of job creation, iii- the costs of pursuing a competitive real exchange rate in terms of the pass-through onto the manufacturing prices, iv- income distribution (functional and personal), v- the composition of national income in terms of investment, consumption/saving and the performance of net exports, vi- and, lastly, over the economic efficiency represented by the social capability and Total Factor Productivity. Thus, the remaining three chapters of this thesis are empirical articles.

The fourth essay, "*Exchange Rate and Structural Change: a study using aggregated and sectoral data*", tests the association between the real exchange rate and structural change using both aggregated as sectoral database. The basic questions addressed by this essay are: a- *Why does the real exchange rate matter for the composition of productive structure*? b- *How does the real exchange rate influence the structural change*? c- *Are the devaluations of real exchange rate a driver of the structural change towards an industrialized and more complex productive structure*? d- *What is the influence of real exchange rate over the sectoral performance in terms of job creation for developing countries*? e- *Are the degree of outward-orientation, technological regime and labor costs of the sectors associated with such possible influence?* The result suggests that a competitive real exchange rate promotes a structural change, mainly towards the manufacturing activities in terms of income and employment. The evidence also indicates that pursuing a competitive real exchange rate boosts the diversification and the knowledge embedded in the productive structure. In other words, the economy becomes more complex. Furthermore, the sectoral estimates point out that a competitive real exchange rate expands the manufacturing employment, especially for countries more outward-oriented. At last, the study provides suggestive shreds of evidence that the sectoral effects of pursuing a competitive real exchange rate are associated with sectoral characteristics, such as the technological regime and financial constraint of sectors (low mark-up rate or labor costs).

The fifth essay, "*Exchange Rate and Prices: an extended Kaleckian approach for Brazilian manufacturing sectors (2010-2019)*", investigates the effects of pursuing a competitive real exchange rate on the prices of industrial sectors of the Brazilian economy over the period between 2010 and 2019. This essay is guided by the following research problems: a- *What determines the inflationary effects of exchange rate devaluations using the Kaleckian cost-push approach*? *and When it is used an extended approach that considers the structuralist idea of neutral inflation?* b- *What are the variables that influence the magnitude of the exchange rate pass-through into prices*? c- *What is the magnitude of the exchange rate pass-through into the prices of manufacturing sectors of Brazilian economy*? *d- What are the explanations for the differences of exchange rate pass-through into the prices across the sectors*? Firstly, a simple model is developed to extend the Kaleckian approach in order to understand the exchange rate pass-through onto prices. The model indicated that the exchange rate pass-through is associated with a- the share of imported inputs/wages in all costs, b- the influence of real exchange rate over the mark-up rate, and c- structural composition of the economy. The time-serials evidence indicates that pursuing a competitive exchange rate has costs in terms of inflation, even that this influence is partial and varies across the sectors (in accordance with mark-up rate, outward orientation, firms' competition, and imported costs).

The sixth essay, "*Real Exchange Rate and Growth: identifying transmission channels*", addresses the effects of pursuing a competitive real exchange rate on some possible transmissions channels from real exchange rate into economic growth: a- income distribution (personal and functional), b- the allocation of GDP between consumption and saving/investment, c- the performance of net exports, d- social capability and Total Factor Productivity. The research problem of this study is: a- *How does the income distribution (functional and personal), as well as the composition of national income between investment, saving, consumption and net exports, correlate with misalignments of real exchange rate*? *Is this possible correlation different for developing countries*? The regressions indicate that pursuing a competitive real exchange rate worsens the income distribution function, while it reduces the income inequality in terms of the personal income distribution. In addition, the results also suggest that pursuing a competitive real exchange rate makes the consumption smaller to the detriment of a larger saving/investment and boosts the net exports directly and indirectly (via the smaller labor costs). The study also reveals that increases in the social capability and productivity growth (Total Factor Productivity) are associated with other elements than labor, capital, and human capital, specifically with the adoption of a competitive real exchange rate.

At last, the conclusion ends the thesis, summarizing the results and contributions to the existing literature.

FIRST ESSAY - Kaldorian Growth Models: a critical discussion

Abstract

This paper discusses the Kaldorian growth models and their extensions in order to shed light on the theoretical shortcomings behind the long-term growth of an export-led model and Thirlwall's law. The main goal is to explore how supply-side is introduced in Kaldorian literature and what the implications are in terms of i- a growth theory, and ii- understanding the influence of real exchange rate on growth. For this purpose, it discusses the export-led growth models of Kaldor (1970) and Dixon and Thirlwall (1975), arguing that Thirlwall (1979) is an extension of this tradition that introduces the condition that growth is restricted by balance-of-payments equilibrium. For this purpose, first, this paper presents the literature argument that points to the endogeneity of elasticities with economy's supply-side. Second, this paper presents a post-Keynesian critique on the circular and cumulative logic of Kaldorian models that rises from the manner by which the supply-side is considered. In addition, it discusses, from a structuralist perspective, the assumption of Thirlwall's law that purchasing power parity holds and, hence, the relative prices do not matter. By assuming it, Thirlwall's law would be an inappropriate framework to understand the peripheric economies as the own external constraint accrues from the supply-side peripheric condition. On the other hand, this paper discusses the analytical implications of Kaldorian models as a long-run growth theory and the adjustment mechanisms set out by literature to provide a meaningful interpretation of steady-state. Lastly, the theoretical shortcoming discussed over the paper becomes crisper facing the discussion about the effects of real exchange rate on growth. The main conclusion is the importance of rethinking the manner through which the supply-side is introduced in Kaldorian models and its interaction with demand growth, specially to understand the real exchange rate influence on long-run growth.

Keywords: Long-term growth; Kaldorian theory; Export-led growth models; Balance of payment growth models; Kaldor-Verdoorn mechanism; Demand and supply sides.

1- Introduction

Demand-led is the core of Kaldorian growth models. Exports are the major source of long-term growth. The export-led tradition was originally developed by Harrod (1933) and reintroduced in growth literature by Kaldor (1970) and Dixon and Thirlwall (1975).

Thirlwall (1979) advanced in this bunch of models introducing a restrictive condition according to which imports equal exports. As a result, the growth rate of output is given by the ratio of income-elasticities for exports and imports multiplied by world income growth. This results from what became widely known as Thirlwall's law, one of the most important post-Keynesian contributions (Davidson, 1991). Several extended versions have been developed considering new stylized facts and theoretical aspects from other heterodox theories since then. However, ultimately economic growth continues being explained essentially by the ratio of income-elasticities and demand growth (Setterfield, 2011).

There is an endogenous logic of Kaldorian tradition as productivity grows hand-to-hand with demand growth, which accrues from a specific way to introduce supply-side; the Kaldor-Verdoorn mechanism. Growth is characterized by a circular and cumulative process (purely path-dependent). Economies that grew more in the past have higher productivity growth and higher export competitiveness, which leads to higher demand growth, reinforcing the process. The strong emphasis on initial growth does not allow the theoretical possibility of catching up/falling behind; there would be a deterministic growth path from initial conditions (Setterfield, 1995, 1997). This paper argues that this manner of introducing supply-side does not fully agree with a post-Keynesian cornerstone, the historical time (Setterfield, 1995, 1997), or even with an endogenous growth theory as far as the technological progress and capital accumulation are not explicitly modeled. Considering the influence of the real exchange rate on the drivers of long-run growth, such as capital accumulation and technological progress, is a manner to remedy this theoretical shortcoming of post-Keynesian models, specifically in order to build up a strategy of catching up for poor countries.

In the case of Thirlwall's law, the long-run growth sticks to the growth rate consistent with balance-payment-equilibrium (Thirlwall, 2001). There is no supply-constraint in Kaldorian models. As the supply-side adapts to demand growth, the unique constraint is the lack of demand growth. The natural growth rate adapts to the actual growth rate (Thirlwall's law) (Thirlwall, 2001). Thus, the economy's long-run growth rate revolves around the growth rate consistent with a balance of payment constraint.

The result of Thirlwall's law is reached assuming that the Purchasing Power Parity (PPP) holds. Once the empirical literature supports that PPP holds only for the long-run, the Kaldor-Verdoorn mechanism is valid only for medium-run periods (Blecker, 2013). This way, the long-run growth would be given by the exogenous parameters of income-elasticities for exports and imports. In a structuralist outlook, this paper argues that there is an incompatibility between how Kaldorians introduce the supply-side in growth models and how structuralists think about peripheric economies' long-run growth. By assuming that PPP holds, it disregards the Prebisch-Singer hypothesis and the center-periphery analysis. Moreover, as peripheric condition accrues from a supply-side condition, Thirlwall's law dismisses the interweaving of supply-side and deterioration of terms of trade. Then, Thirlwall's law would not be valid for less developed countries as terms of trade exhibit a tendency to change (Dutt, 2002).

This article aims to discuss the Kaldorian growth models represented by the export-led model and Thirlwall's law, focusing on how the supply-side is introduced in this literature and what are the analytical implications in terms of i- a growth theory, and ii- the understanding of the influence of real exchange rate on growth.[2] The main conclusion is that Kaldorian models should rethink the interaction between supply-side and demand growth.

After this introduction, Section 2 discusses the Kaldorian export-led growth model. Section 3 discusses Thirlwall's law and its extensions with capital flows, endogenous elasticities, and the strong emphasis of Kaldorian models given to initial conditions. Section 4 presents a structuralist criticism and argues that the terms of trade must be considered endogenous for the supply-side in order to understand the long-term growth of peripheral countries. Section 5 discusses the long-run problems of Kaldorian models accrued from how the supply-side is considered, which requires an adjustment mechanism to provide an interpretation in steady-state. Facing empirical evidence that real exchange rate affects long-term growth via channels of transmission dismissed by Kaldorian models. Section 6 plays up the necessity to rethink how to incorporate supply-side intending to build up a development strategy for Latin American economies. Conclusions end the article.

[2] This paper does not aim to discuss the empirical literature. For that, see Romero (2016). See Marconi *et al.* (2016) for an empirical test of first and second Kaldor's laws.

2- Export-led growth theory: unrestricted growth

Harrod (1933) develops a theoretical model in which exports (demand) are the major source of long-run growth. Harrod assumes the absence of investment, government and that the national income is spent on national and imported goods (McCombie and Thirlwall, 1994). Harrod (1933) assumes the following equation to describe the imports *M*, where *Y* is GDP and μ is the propensity to import:

$$M_t = \mu Y_t \qquad (1)$$

As the equilibrium of trade balance requires that exports X equal the imports:

$$X_t = \mu Y_t \qquad (2)$$

Resolving (2) for Y:

$$Y_t = \mu^{-1} X_t \qquad (3)$$

The first derivative of equation (3) with respect to exports leads to the static version of Harrod's foreign trade multiplier dy/dx = 1/μ: the multiplier assures that the exports equal imports through variations in national income (McCombie and Thirlwall, 1994). Rewriting the equilibrium's condition of trade balance in terms of growth rate and solving it for the growth rate of Y:

$$\frac{\Delta y}{y} = \frac{\frac{\Delta y}{y}}{\frac{\Delta m}{m}} \frac{\Delta x}{x} \qquad (4)$$

Equation (4) is the dynamic version of Harrod's foreign trade multiplier (McCombie and Thirlwall, 1994). As the income-elasticity for imports $\frac{1}{\mu}$ is represented by $\frac{\frac{\Delta y}{y}}{\frac{\Delta m}{m}}$, equation (4) becomes:

$$\dot{y} = \frac{1}{\mu}\dot{x} \qquad (5)$$

Equation (5) sets that the economic growth rate is determined by the growth rate of exports divided by income-elasticity for imports; high (low) export growth rates, or low (high) income-elasticity, entail high (low) growth.

Kaldor (1970) developed a model, formalized by Dixon and Thirlwall (1975), according to which the growth rate of economy g_t is defined as a function of exports growth x_t:

$$g_t = \gamma(x_t) \qquad (6)$$

The export's function is described by equation (7), where P_{dt} and P_{dt} are the domestic and competitor's price respectively, Z_t is the abroad income level, *n* is the price elasticity of demand for exports, δ is the price elasticity of demand for imports, ∈ is the income-elasticity of demand for exports:

$$X_t = P_{dt}^{n} P_{ft}^{\delta} (Z^{\in})_t \tag{7}$$

The first difference of equation (7) - in logarithm form, with respect to time leads to:

$$x_t = np_{dt} + \delta p_{ft} + \in z_t \tag{7.1}$$

The domestic prices are described by equation (8), in which W_t is the level of nominal wage, R_t is the average labor productivity, T_t is the mark-up over the labor cost:

$$P_{dt} = (\frac{W}{R})_t T_t \tag{8}$$

The first difference of equation (8) - in logarithm form, with respect to time leads to:

$$p_{dt} = w_t - r_t + t_t \tag{8.1}$$

A central and fundamental assumption of Kaldor is the Kaldor-Verdoorn mechanism according which the growth of productivity r_t depends exclusively on demand growth:

$$r_t = r_a + \lambda g_t \tag{9}$$

where r_a stands for autonomous productivity growth and λ is the Verdoorn's coefficient. Combining the equations (6), (7.1), (8.1), and (9):

$$g_t = \gamma \frac{[n(w_t - r_t + t_t) + \delta(p_f)_t + \in(z)_t]}{1 + \gamma n \lambda} \tag{10}$$

Equation (10) explains economic growth via export growth. Dixon and Thirlwall (1975) assume that the parameters of price and income-elasticities depend on the nature of the products produced. In turn, autonomous productivity and Verdoorn's coefficient are related to technical dynamism and capital accumulation induced by demand growth, which embodies the technical progress (Kaldor, 1957). Such relationship is described by equation (9), whose interpretation comes from Kaldor's (1966) reading about Verdoorn's (1949) ideas and relates positively the labor productivity and industrial demand growth (Soro, 2002). The Kaldorian interpretation relies on the stylized fact that the industrial sectors have increasing returns of scale *a la* Young (1928). Then, labor productivity is positively associated with demand growth.

Dixon and Thirlwall (1975) employed the technical progress function of Kaldor (1957), in which the capital accumulation is a function of demand growth, to formalize the Verdoorn's mechanism by assuming that the parameters r_a and λ are a linear function of demand growth:

$$\mathrm{r_a} = \alpha_1 + \mathrm{b}_1(\mathrm{g_t}) \tag{9.1}$$

$$\lambda = \alpha_2 + \mathrm{b}_2(\mathrm{g_t}) \tag{9.2}$$

The intercept term is the autonomous rate of capital accumulation per worker. Verdoorn's coefficient represents the pace of capital accumulation induced by demand growth and the pace of technical progress incorporated in capital accumulation (Dixon and Thirlwall, 1975). Introducing equations (9.1) and (9.2) into (9) leads to the following equation to describe the Verdoorn mechanism:

$$\mathrm{r} = (\alpha_1 + \alpha_2\mathrm{g_t}) + (\mathrm{b}_1 + \mathrm{b}_2)\mathrm{g_t} \tag{9.3}$$

Equation (9.3) shows that demand growth is central in the determination of labor productivity. This is the unique way through which the supply-side is incorporated in Kaldorian models.

The model of Dixon and Thirlwall (1975) does not take the Kaldorian idea of path dependence (Setterfield, 1997; McCombie, 2002). Setterfield (1997) modelled it assuming explicitly that the size of Verdoorn's coefficient is a cumulative function of economy's past growth rate in a manner that $\lambda_t = f(\mathrm{g}_0, \mathrm{g}_1, \dots, \mathrm{g_t})$, being $f_t{}' \neq 0$ for all *t*.

This way, the Verdoorn mechanism has a crucial role in determining the economic performance to the extent that it is assumed a channel of transmission from labor productivity to prices variation of exports. Economies with higher demand growth in the past tend to have higher productivity growth rates, increasing the goods' competitiveness, which leads to higher growth rates via export's increases. The endogenous nature of growth provides a circular and cumulative logic in such a manner that the economic growth is an exclusively demand-constrained process instead of a supply-constrained process. The supply-side accommodates the demand growth automatically.

3- Thirlwall's law: growth restricted by the balance of payments

The idea upon which Thirlwall's law relies is that the growth is not explained by the Harrodian multiplier anymore. Thirlwall's (1979) insight is to consider the external constraint as the main explanation of economic growth.

The external constraint is represented by the equation (11), where P_{dt} is the price of exports in national currency, X_t is the exports, P_{ft} is the price of imports in foreign currency, and E_t is the exchange rate:

$$P_{dt}X_t = P_{ft}M_tE_t \tag{11}$$

Which in logarithm becomes:

$$p_{dt} + x_t = p_{ft} + m_t + e_t \tag{11.1}$$

The functions to describe the behavior of imports and exports are:

$$M_t = (P_{ft}E_t)^{\psi}P_{dt}^{\Phi}Y_t^{\pi} \tag{12}$$

$$X_t = (\frac{P_{ft}}{E_t})^{n}P_{ft}^{\delta}Z_t^{\epsilon} \tag{13}$$

where ψ is the elasticity-price for imports of domestic economy (<0), Φ is the cross elasticity for imports (>0), π is the elasticity-income of imports (>0), n is the elasticity-price of exports of domestic economy (<0), δ is the cross elasticity of exports (>0), Z_t is the world income, ϵ elasticity-income of exports (>0). In logarithm form:

$$m_t = \psi p_{ft} + \psi e_t + \Phi p_{dt} + \pi y_t \tag{12.1}$$

$$x_t = np_{dt} - ne_t + \delta p_{ft} + \epsilon z_t \tag{13.1}$$

Introducing (12.1) and (13.1) in (11.1):

$$y_{Bt} = \frac{p_{dt}(1+n-\Phi) - p_{ft}(1-\delta+\psi) - e_t(1+n+\psi) + \epsilon z_t}{\pi} \tag{14}$$

Assuming that: i- $\Phi = \psi$ and $n = \delta$ – PPP, and ii- the Marshal-Lerner condition is satisfied:

$$y_{Bt} = \frac{\epsilon}{\pi} z_t \tag{15}$$

Equation (15) is the corollary of Thirlwall's law. The growth rate consistent with the current account's equilibrium is a function of exports multiplied by exports' ratio and imports income-elasticities.

Lavoie (2015) points out the existence of two possible interpretations:

i- First: Thirlwall's law may be seen as the growth rate consistent with external equilibrium condition - this is not the problematic one;

ii- Second: Thirlwall's law represents the long-run growth - this is the problematic one and it is open to criticism (Lavoie, 2015).

Thirlwall's law must be interpreted as the maximum growth rate that can be sustained over the long-run (Lavoie, 2015). The growth rate predicted by Thirlwall's law is the upper limit of economic growth of developed and developing countries, and it is possible that the economy grows at this rate without full capacity utilization (Missio and Gabriel, 2016).

It should be noticed that, in equation (15), the Kaldor-Verdoorn mechanism has no role to play since the prices' competitiveness is not present in it (Soros, 2002). The growth rate is determined by the exogenous parameters of Thirlwall model: high exports (imports) income-elasticity suggests high (low) growth rates. The assumption of the non-existence of relative price effects in the long run is crucial to reach the corollary of Thirlwall's law, which is not fully clear that can be completely overlooked since this assumption holds only for long-run (Blecker, 2013). Ergo, the export-led growth models would be valid for medium-time, and the balance payment constraint would be for long-run time (Blecker, 2013).[3]

On the other hand, if it is considered the full model without the restrictions $\Phi = \psi$ and $n = \delta$, and the Marshal-Lerner condition, it is obtained the equation (14), which represents the medium-run growth rate given by Thirlwall's law. Such a result has an infinite number of solutions because it depends on all combinations between the endogenous and exogenous variables. However, under some assumptions, the possible interpretation with respect to growth rate consistent with the equilibrium of the current account are (Thirlwall, 1979):

i- A domestic inflationary process reduces the growth (if $|n + \Phi| > 1$), while an abroad inflationary process increases it (if $|\delta + \psi| > 1$);

ii- As greater is the growth rate of world income, the greater is the growth rate consistent with the equilibrium of the current account;

iii- As greater are the income elasticities for exports (imports), higher (lower) is the growth rate consistent with the equilibrium of the current account.

In contrast, in equation (14), the Kaldor-Verdoorn mechanism has an important role to play since the prices' competitiveness is present in it - which furnishes the model with a path of a dependence logic or with an endogenous nature. Nevertheless, as the relative prices matter only in the medium run (Blecker, 2013), the Kaldor-Verdoorn mechanism does not affect the maximum growth rate that can be sustained over the long-run (given by the ratio of elasticities). Therefore, the growth is constraint not only by lack of demand growth in medium run but also

[3] The long-run is understood as a long period of time (e.g., half-century), no being related to steady-state.

by the external constraint. Hence, the circular and cumulative logic of the Kaldorian model, engendered by the Kaldor-Verdoorn mechanism, is constrained by the external conditions.

3.1- Extended version with capital flows

Thirlwall's corollary is achieved only if strong assumptions are made; one of them is the idea that the current account is balanced in the long run (Blecker, 2013). There are elements that may cause deviates from the growth rate consistent with the equilibrium of current, as it is the case of capital flows (Thirlwall and Hussain, 1982).

The external constraint is now represented by equation (16) with an additional term in order to introduce the capital flows C_t (Thirlwall and Hussain, 1982):

$$P_{dt}X_t + C_t = P_{ft}M_tE_t \tag{16}$$

In logarithm form:

$$\left(\frac{E}{R}\right)(x_t + p_{dt}) + \left(\frac{C}{R}\right)c_t = p_{ft} + m_t + e_t \tag{16.1}$$

whereas $\frac{E}{R}$ and $\frac{C}{R}$ are respectively the shares of exports and capital flows as a proportion of total receipts (the share of imports financed by exports/capital flows). The growth rate consistent with the equilibrium of the current, considering the capital flows, is:

$$y_{Bt} = \frac{\left(\frac{E}{R}\eta+\psi\right)(p_{dt}-e_t-p_{ft})+(p_{dt}-e_t-p_{ft})+\frac{E}{R}\epsilon z_t+\frac{C}{R}(c_t-p_{dt})}{\pi} \tag{17}$$

The first part of (17) is the volume effect of relative price changes; the second term is the terms of trade effect; the third term is the effect of variations of abroad income; the fourth term is the effect of capital flows (Thirlwall and Hussain, 1982).

Assuming that: i- $\Phi = \psi$ and $n = \delta$ – relative purchasing power (PPP), and ii- the Marshal-Lerner condition:

$$y^*_{bt} = \frac{\frac{E}{R}x_t+\frac{C}{R}(c_t-p_{dt})}{\pi} \tag{18}$$

In this case, if there is no initial disequilibrium in the current account, the share of imports financed by capital inflows is zero; thus, the growth rate is described by equation (15). However, if it exists an initial disequilibrium not financed by capital inflows, the growth rate consistent with balance payment constraint is $y^{**}_{bt} = \frac{\frac{E}{R}x_t-\frac{C}{R}(p_{dt})}{\pi}$: the national income must grow lesser to generate the external equilibrium ($y^{**}_{bt} < y^*_{bt}$) (Thirlwall and Hussain, 1982).

On the other hand, if the external deficit is financed by capital inflows and the national income does not reduces itself in order to achieve the external equilibrium between exports and imports, the external deficit is financed by capital inflows (Thirlwall and Hussain, 1982). Thus, Thirlwall's law underpredict/overpredict the growth rate depending on the difference between capital inflows and exports (Thirlwall and Hussain, 1982).

However, the foreign debt generated by capital inflows cannot be sustained boundless, and the speed of accumulation of foreign debt may rise an exchange crisis (Moreno-Brid, 1998). Moreno-Brid (1998) introduced a rule of a constant ratio between current account deficit and domestic income. Moreno-Brid (1998) redefines the balance payment in terms of nominal national income in the following way:

$$B = \frac{(p^{*}m - px)}{py} = \frac{(M - X)}{Y} \tag{19}$$

The first differential of (19) equating to zero (assuming $\mu = \frac{p^{*}m}{(p^{*}m - px)} > 1$) leads to:

$$dB = 0 = (\mu \frac{dm}{m} - (\mu - 1)\frac{dx}{x} - \mu(\frac{dp}{p} - \frac{dp^{*}}{p^{*}}) - \frac{dy}{y}) \tag{20}$$

Solving it for the growth rate of output (where $\theta = px/p^{*}m$):

$$y_b = \frac{\theta n\, dz/z + (\theta\eta + \varphi + 1)(dp/p - dp^{*}/p^{*})}{\pi - (1 - \theta)} \tag{21}$$

In this case, if there is not a current account deficit, θ is one, and equation (21) becomes equal to (15). However, the existence of a current account deficit implies that θ is lesser than one and the long-term income multipliers of terms of trade and foreign income is are changed by a ratio equal to $\frac{\pi}{(\pi - 1 + \theta)}$ leading to three possibilities: i- surplus in the current account ($1 < \theta$): the long-terms multipliers are smaller in relation to the model of Thirlwall and Hussain (1982); ii- deficit in the current account ($1 > \theta$ and $\pi - (1 - \theta) > 0$): the long-term multipliers are higher in relation to the model of Thirlwall and Hussain (1982); iii- deficit in the current account surplus ($1 > \theta$ and $\pi - (1 - \theta) < 0$): the long-term multipliers are negative, and the domestic growth would be negatively related to foreign growth.[4]

[4] As there is no empirical evidence to support it, Moreno-Brid (1998) proves mathematically that this case is compatible with decreases in the current account deficit as a proportion of national income.

In sum, introducing capital flows is part of efforts to make Thirlwall's law more realistic.[5] By doing so, the long-run growth rate consistent with balance payment constraint has been changed as far as the deficit of external accounts must be financed by capital flows. The growth continues to be explained essentially by external constraint.

3.2. Endogenous nature of growth and emphasis on initial conditions

One of the cornerstones of the post-Keynesian theory is the concept of historical time to the detriment of logical time (Robinson, 1980). The logical time relies upon the notion that the same final solution is always reached regardless of the past events. The parameters change themselves automatically, leading the economy to equilibrium instantaneously (Lavoie, 2006). *It does mean that all future movements and changes are already predetermined by the fundamental real parameters of the system* (Davidson, 2002, p. 48-49); therefore, the future becomes forecastable.

Conversely, according to historical time, history matters in a manner that the economy adapts itself at every moment to past and current events. The equilibrium is unlikely, and nothing ensures that it will be reached, as originally discussed by Keynes (1936).[6] The own equilibrium changes over time, leading to the conception that time is irreversible, which furnishes the post-Keynesian theory with the notion that history matters for the long-run solution. In this regard, the Post-Keynesian macrodynamic is an endogenous theory in the sense that current growth is related to past growth (Setterfield, 2011b).

A growth theory is endogenous according to two notions (Setterfield and Roberts, 2007):

i- First: in equilibrium, the growth rate of the economy is determined by its own solution;

ii- Second: the technical progress is explicitly modeled.

Setterfield and Roberts (2007) claim that the export-led growth model is in agreement with both notions. The first notion is undoubtedly confirmed (see equation 10).

Nevertheless, it is not entirely clear the argument that technical progress is explicitly modeled. In two footnotes, Setterfield and Roberts (2007) state that the technical progress is modeled by means of the Kaldor-Verdoorn mechanism, which would be associated with the technical progress function of Kaldor (1957) (see equations 9.1, 9.2 and, 9.3).[7] However, the

[5] Another interesting model is developed by Moreno-Brid (2003), who introduced capital inflow and real net interest payment in Thilwall's law; the results are very similar to Moreno-Brid (1998).

[6] See Kregel (1976) and Dutt (1992) for a detailed discussion on post-Keynesian macro-dynamics.

[7] Verdoorn's law, or the second law of Kaldor, is a very particular "technological" interpretation of Kaldor (1966) about Verdoorn (1949) (Soro, 2002). Verdoorn's law can be supported by the supply-side (e.g., Arrow, 1962, Lucas, 1988) or demand-side (Keynesian) theories (Pugno, 2002).

capital accumulation[8] does not appear in the final solution (there is not even a function to describe it). What does appear is the productivity growth induced by the share of capital accumulation induced by demand growth. The technical progress is modelled implicitly utilizing Kaldor-Verdoorn's law. Therefore, as far as Kaldorian theory (export-led, or Thirlwall's law) does not have an explicitly modeled capital accumulation function, the second notion is not fulfilled.

The Kaldor-Verdoorn mechanism plays a central role in export-led and Thirlwall's law as it furnishes them with an endogenous nature of growth (even that such effect is valid only up to the medium-run in the latter case). Such endogeneity is notable by the strong emphasis given to initial conditions; economies that grew up more in the past have higher current growth rates. Though those models have the path dependence and the non-existence of equilibrium solution as major hallmarks, they do not fully agree to the historical time insofar as the strong emphasis on initial conditions entails a deterministic path for the economy (Setterfield, 1997). *Initially high relative growth gives rise to subsequently high relative growth, and initially slow relative growth leads to subsequently slow relative growth in perpetuity* (Setterfield, p. 371, 1997).

The cumulative causation logic of Kaldorian growth models does not explain why an economy with higher growth rates in earlier times becomes an economy with lower growth rates (Setterfield, 1997), or the reasons why an economy with lower rates of growth in earlier times becomes an economy with higher rates.

The solution of Setterfield (1995) is to endogenize the Verdoorn coefficient with respect to the accumulation of social capabilities in a specific technological paradigm.[9] Economies that developed itself under an obsolete technological paradigm (or in a specific social structure as slave-labor societies, ex-colonies, etc.) create a social structure (institutions, human capital, political power, etc.), which endogenously creates the self-conditions for a lock-in point in a period with lower growth rates (lower increasing returns of scale and labor-productivity).

Other authors displayed that the intensity of the response from productivity growth to demand growth is associated with other variables; as the P&D (Romero and Britto, 2017) and colonial institutions (Iasco-Pereira *et al.*, 2021), for instance. Hence, the Kaldor-Verdoorn

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[8] It is assumed that technical progress is embodied in capital accumulation.

[9] The terms "social capabilities" and "technological paradigms" are not originally employed by Setterfield (1997). The first term is originally used by Abramovitz (1986) and refers to social characteristics that possibilities the technological progress (or the absorption of it) in order to increase the labor-productivity. The second term is a neo-Schumpeterian concept of Perez (1983) to describe technological innovation waves.

mechanism is not an exclusive function of demand growth as far as other further important aspects are deemed to explain why some economies grow more than others, including the possibility of catching up/falling behind.

Thus, endogenizing the Verdoorn coefficient with respect to supply-side elements might fulfil the criticisms that Kaldorian growth models are not fully in agreement with historical time.[10] However, to the best of our knowledge, there is a lack of works modelling explicitly the capital accumulation function associating it to the Kaldor-Verdoorn mechanism.

3.3- The exogeneity of elasticities: endogenizing them

Thirlwall's law explains the economic growth rested on the ratio of income-elasticities of imports and exports, but it does not explain why these parameters differ among the countries. Thirlwall's law's theoretical derivation from import and export functions cannot explains, endogenously, the growth rate consistent with balance payment constraint.[11]

The multisectoral framework of Araújo and Lima (2007) – developed employing theoretical aspects of Pasinetti (1981, 1993) and Thirlwall (1979), considers the income-elasticities of the whole economy endogenous with respect to the sectorial composition of the economy.[12] Following the simplified Setterfield's (2011) derivation, the imports and exports of the whole economy are the sums of sectorial imports and exports. By assuming that each sector has a different income-elasticity, and the relative prices are constant, the growth rate of imports and exports are described as:

$$m = y \sum_{j=1}^{k} \omega_{mj} \pi_j \tag{22}$$

$$x = z \sum_{i=1}^{k} \omega_{xi} \epsilon_i \tag{23}$$

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[10] See O'Hara (2008, 2009) for arguments in favor of merging the Myrdalian tradition (institutions, human capital, income distribution, the political power of elites, etc.) and the Kaldorian tradition (structural change, demand growth and supply-side) in cumulative causation models.

[11] Krugman (1989) offers an explanation of elasticities differences between countries based on the '45º degree rule'. The author disregards the Kaldorian notion that elasticities determine economic growth; his explanation accrues exclusively from the supply-side of the economy. The favorable income-elasticities of more developed countries come from the higher range of goods produced in these economies vis-à-vis the higher growth rates.

[12] The sectorial elasticities are considered exogenous by Araújo and Lima (2007). However, the elasticities of the whole economy in aggregate are a weighted sum of sectorial elasticities, then the elasticities of whole economy are endogenous with respect to its sectorial composition.

where π_j and ϵ_i are the sectorial income-elasticities, ω_{mj} and ω_{xi} are the weights of sectorial imports and exports, respectively. In a balance payment restriction, the growth rate consistent with balance payment constraint is:

$$y = z\frac{\sum_{i=1}^{k}\omega_{xi}\epsilon_i}{\sum_{j=1}^{k}\omega_{mj}\pi_j} \tag{24}$$

Equation (24) suggests that the growth rate consistent with balance payment constraint is higher (lower) for an economy with a low (high) proportion of sectors with high income-elasticities of imports, and it is lower (higher) when the economy has a lower (higher) proportion of sectors with high income-elasticities of exports. A further result is that the sectoral composition of exports and imports determines the impact of demand growth (exports) on the economy; the higher the weight of exporting sectors with high income-elasticities higher the growth rate originated from demand growth.

Since exports and imports are connected to sectorial structure, structural changes necessarily affect the income-elasticities in the sense that economies more industrialized (with high/low proportion of sectors with high/low income-elasticities of exports/imports *a la* Engel's law) obtain higher growth rates consistent with balance payment constraint. The export growth is not an indispensable condition to grow, which can be sparked since a structural change focused on sectors with high income-elasticities of exports is promoted. The aggregate economy's income-elasticities are no longer exogenous; they are endogenous to the economy's sectoral composition (Araújo and Lima, 2007).

Missio *et al* (2017) extended the multisectoral framework of Araújo and Lima (2007) by considering the sectorial elasticities endogenous to real exchange rate. The idea behind it is that a devalued real exchange rate would increase exports leading to technological progress and, hence, to higher productivity via the Verdoorn mechanism. The growth compatible with balance payment constraint becomes greater: the share of industry increased, and the exports (imports) income-elasticities increased (decreased). The multisectoral approach of Missio *et al* (2017) is an explicit effort to endogenize the Thirlwall's law with respect to supply-side.

On the other hand, there are those who argue in favor of the endogeneity of elasticities regarding other aspects of economy, even that the supply-side is not considered explicitly.

Palley (2002) and Oreiro (2016) consider the income-elasticity for imports as a function of the difference between actual and potential output growth rates. McCombie and Roberts (2002) consider the ratio of income-elasticities as a positive function of the past growth rate.

Ferrari *et al* (2013), Missio and Jayme Jr. (2012), Missio *et al* (2017) state that the income-elasticities are endogenous to real exchange rate by assuming that technological progress and the rate of elasticities are a function of capital accumulation which, in turn, depends on the functional income distribution between workers and capitalists *a la* Bahduri and Marglin (1990). As the real exchange devaluations alter income distribution in favor of profit share (assuming a profit-led regime of accumulation, for instance), it will increase the technological progress and the ratio of elasticities (Missio, 2012). Plus, there are ones who states the endogeneity of elasticities with respect to institutions (Setterfield, 1997), to National System of Innovation (Resende and Raposo, 2016, Missio and Gabriel, 2016).[13]

In sum, post-Keynesian tradition authors went forward in clarifying the relation between the elasticities and the supply-side economy. In general, these efforts embedded elements from other heterodox theories into the Thirlwall' law.

4- Prebisch-Singer hypothesis and uneven development

The north-south (or center-periphery) analysis is the central element of Latin American structuralism (e.g., Prebisch, 1950, Singer, 1950, and Seers, 1962).

In the structuralist outlook, the economic hegemonic of central economies over the periphery is due to the unequal distribution of technological progress (Di Filippo, 2009). The technological revolution would happen first in the northern economies and, with some lag, the new technologies spread slowly towards the southern economies (Di Filippo, 2009). The technological gap leads the southern economies to specialize in sectors of low technological intensity and low (high) income-elasticity for exports (imports) (Cimoli and Porcile, 2011). The elasticities differences are simply an empirical expression of a deeper structural issue; the north-south technology gap (Di Filippo, 2009).

The effects of technological gap between center and periphery go further. As the central economies would be characterized by a productive structure diversified (with many sectors) and homogenous (the sectoral labor productivity is equitably arranged), the peripheric economies are specialized (few sectors) and heterogeneous (the sectoral labor productivity is unequally arranged) (Cimoli and Porcile, 2011). The peripheric economies are dual with the co-existence of exportation sectors with high productivity and the remaining sectors with low productivity;

[13] See Missio (2015) for a detailed discussion on the literature about the endogeneity of elasticities.

consequently, the bulk of the population would be allocated in subsistence sectors (Cimoli and Porcile, 2011). The differences of elasticities between countries would be conditioned upon specific characteristics of the supply-side.

The growth of southern/peripheral countries (agricultural economies) is explained, from a global perspective, through the trade with the northern/central countries (manufacturing economies). The trade between southern and northern economies would be distinguished by a deterioration of the terms of trade, according to which there would be an upward trend of manufacturing prices and a downward trend of agricultural prices. This is the known Prebisch-Singer hypothesis. To the extent of that, it is assumed that agricultural goods have lower income-elasticity than industrial goods (Ocampo, 1986), the growth process of southern economies would be constrained by the lack of foreign exchange to finance imports.

In structuralist tradition, long-term growth is a process of capital accumulation, technological progress, and labor productivity growth via the transfer of employment from subsistence sectors to industrial sectors with higher productivity (Furtado, 1978). As capital accumulation and technological progress depend on foreign exchange availability to finance its imports (implicit reciprocity), the external sector works as a limit of long-term growth (Cimoli and Porcile, 2011). Thus, even though the elasticities result from the peripheric economy condition, the long-term growth stems essentially from the supply-side; the elasticities of international trade are solely a restriction.

Once the Prebisch-Singer hypothesis is supported by empirical literature (see Spraos, 1980, Sapsford, 1985, Thirlwall and Bergevin, 1985, Grilli and Yang, 1988, Powel, 1991, Harvey *et al* 2010, Erten and Ocampo, 2012), it is unrealistic to assume the constancy of relative prices over time and between countries. Consequently, Thirlwall's law would not be valid for less developed countries insofar as the terms of trade exhibits a tendency to change (Dutt, 2002). The deterioration of trade terms would be endogenously interwoven with the supply-side of the economy, reinforcing the unrealism of Thirlwall's law to peripheric economies as supply-side is not considered.

The north-south framework of Thirlwall's law developed by Dutt (2002) offers a theoretical possibility to overcome the aforementioned shortcomings by taking the real terms of trade endogenously determined. Dutt (2002) assumes that the southern import function represents the northern export function and vice-versa:

$$\frac{y_s}{y_n} = \frac{\pi_n}{\pi_s} \quad (25)$$

where y and π are the growth rate of output and income-elasticity of imports; s and n denote the southern and northern regions, respectively.

By assuming that $\pi_n < \pi_s$, equation (25) means that northern countries' demand for southern imports is inelastic and southern countries' demand for north imports is elastic in relation to income. In terms of Thirlwall's law, such an assumption leads to the conclusion that southern economies have lower growth rates than northern countries ($\frac{y_s}{y_n} < 1$). As the southern economies have higher populational growth, the growth rate of output per capita is lower than the northern rate (Dutt, 2002).

Although the corollary of Thirlwall's law explains the economic growth individually (equation 13) or for a group of economies in an uneven perspective (equation 25), Thirlwall's law has a theoretical inconsistency since it is not explained what determines the growth (Dutt, 2002). Thirlwall's law describes the growth of output consistent with the balance of payment, but it does not explain, in fact, the growth. Dutt (2002) fix it by introducing the supply-side explicitly with different assumptions about the northern and southern economies, including a function to describe the international prices of northern and southern goods.

Dutt (2002) assumes a fixed coefficient production function for both economies with labor and capital as inputs. The northern economy is assumed to be under oligopolistic conditions: excess capacity, mark-up pricing, and output determined by demand, hence the northern prices are described as:

$$p_n = (1 + z)w_n b_n \quad (26)$$

where z, w_n, b_n are respectively the exogenous mark-up, fixed money wage and fixed unit labor per unit of northern good. In turn, the oligopolistic conditions lead to a functional income distribution between capitalists and workers according to which the profit share is given by $\Pi_n = \frac{z}{(1+z)}$ and wage share into national income is $W = \frac{1}{(1+z)}$. Moreover, it is assumed that capitalists save a proportion s_n of their income and workers consume their all income.

A further assumption is that both classes spend the proportion α in southern goods given by:

$$\alpha = \alpha_0 y_n^{\pi_n - 1} p^{1-\psi_n} \quad (27)$$

where π_n and ψ_n are the income-elasticity and price-elasticity for northern imports, *p* is the ratio of southern prices and northern prices (that is, $p = p_s/p_n$). The investment function of the northern economy is a positive function of the rate of capacity utilization[14] (Dutt, 2002):

$$\frac{I_n}{K_n} = \gamma_0 + \gamma_1\left(\frac{y_n}{k_n}\right) \tag{28}$$

The southern economy is assumed to be at full capacity, but restricted by capital stock:

$$Y_s = \frac{K_s}{a_s} \tag{29}$$

where K_s is capital stock and a_s is the fixed-capital output ratio. It is assumed that southern workers receive a real wage given by $V_s = W_S/P_s$, then the profit share is $\Pi_s = (1 - b_s V_s)P_s V_s$. By assuming that southern workers spent all money on southern goods, the share of the spend in southern good β is given by (where σ_s is $(1 - b_s V_s)$):

$$\beta = \beta_0 \sigma_s y_s^{\pi_s - 1} p^{1-\psi_s} \tag{30}$$

The assumption that northern imports are identical to southern leads to (in the short-run[15]):

$$P_s X_s = \alpha\left\{\frac{[1+(1+s_n)z]}{(1+z)}\right\} P_n Y_n \tag{31}$$

Dutt (2002) introduced a mechanism to put the southern excess of demand ED_s as a function of northern output considering the southern consumption C_{ss}, investment I_{ss} and exports X_s:

$$ED_s = C_{ss} + I_{ss} + X_s - Y_s \tag{32}$$

where $Y_s = C_{ss} + I_{ss} + M_s$, so:

$$ED_s = X_s - \frac{1}{P} X_n \tag{32.1}$$

It is further assumed that the excess of demand increases the northern rate of capacity utilization. The northern demand excess is written as:

$$ED_n = C_{nn} + I_n + X_n - Y_n \tag{33}$$

As $Y_n = C_{nn} + S_n + M_n$ and $M_n = PX_s$:

[14] Only northern goods can be used as investment in the investment of north.
[15] Dutt (2002) draws a distinction between short and long-run according to which the capital stock is given, and the market for both goods floats around the northern output and relative prices in short run.

$$ED_n = I_n - S_n + X_n - PX_s \tag{33.1}$$

The short-run solution requires $ED_{s,n} = 0$, then solving for *p* and for the rate of capacity utilization:

$$p = [(\frac{\theta_s}{\theta_n})(uK_n)^{\pi_s}(\frac{K_s}{a_s})^{\pi_n}]^{\frac{1}{(\psi_n+\psi_s-1)}} \tag{34}$$

$$\frac{y_n}{k_n} = \frac{\gamma_0}{[s_n\sigma_n-\gamma_1]}\,;\, s_n\sigma_n - \gamma_1 > 0 \tag{35}$$

In the long run, the growth of the capital stock of both regions (g_n, g_s) is a function of the rate of capital accumulation:

$$g_n = \gamma_0 + \gamma_1(\frac{\gamma_0}{[s_n\sigma_n-\gamma_1]}) \tag{36}$$

The southern investment is given by macroeconomic identity between saving and investment, combining both equations:

$$g_s = s_s P^{\xi}\frac{\sigma_s}{a_s} \tag{37}$$

where ξ <1. In turn, the growth rate of trade terms *p* is (long-run result):

$$p = \frac{1}{(\psi_n+\psi_s-1)}(\pi_n g_n - \pi_s g_s) \tag{38}$$

The results of Dutt (2002) are in line with the structuralist outlook. In the long run, there exist an uneven path of development in a sense that capital and output growth of the north are larger, which comes from the assumption that the southern income-elasticities for imports are larger. Second, the world growth is determined by demand growth of north. Third, in an uneven perspective, the Thirlwall's law can be derived from an explicit consideration from the supply-side (Dutt, 2002). In sum, the Prebisch-Singer hypothesis may be introduced in Thirlwall's law (or the strong assumption that relative prices are constant may be broken) by considering the supply-side explicitly, which makes Thirlwall's law more realistic.

5- The long-run problem

There are two dominant views on long-run growth according to prevalence of the supply- or demand-side. According to mainstream vision, long-run growth is explained by the supply-side (Solow's model is a great example). On another perspective, the Kaldorian interpretation of Verdoorn (1956) yields to the idea that the supply-side would have a passive role that would accommodate demand growth automatically (Pugno, 2002) - like a kind of Say's law reverse (Setterfield, 2012).

However, both theories have a common pitfall, as they failed to reconcile demand and supply-sides together (Setterfield, 2006).

Assuming that steady-stated growth *is defined as a growth in the variables which can be indefinitely prolonged over time without any constraint* (Pugno, 2002, p. 240) implies a meaningless steady-state for Kaldorian growth theory because there is no incorporation of an import function (in the case of export-led growth model) or a capital accumulation function (Pugno, 2002). Thirlwall's law claims that the only restriction of economic performance is the equilibrium between exports and imports (Cortes and Ros, 2015). Investments play no role in the determination of growth, which is a paradox for a growth theory (Ros, 2013).

The lack of supply-side creates a knife-edge problem as the steady-state equilibrium requires that demand and supply grow at the same rate (Palley, 2002). Assuming that the rate of resource utilization is $e = \frac{Y}{Y_p}$ (Y and Y_p are the actual and potential output, respectively: $\dot{e} = e(\dot{y} - y_p)$, in growth rate) (Setterfield, 2012). If the actual output differs from the potential output, the rate of resource utilization can change boundlessly (secular trend), which is absurd since e is a bounded variable (Setterfield, 2012).

The post-Keynesian models need adjustment mechanisms to assure a meaningful interpretation of steady-state assuming that the natural growth rate (supply side) adapts to the actual growth rate (which is, supposed, represented by Thirlwall's law) (Shaikh, 2016).

5.1- Palley-Setterfield's adjustment mechanism

Palley (2002) and Setterfield (2006) developed adjustment mechanisms to reconcile the actual and potential growth rates. It assumes that the actual growth rate (the maximum growth rate without supply constraints) g^d is given by equation (14), and potential growth rate g^s (the maximum growth rate consistent with supply constraints without demand and external constraints (McCombie, 2012)) is the sum of population and productivity growth rates, n and λ respectively:

$$g^s = n + r_t \qquad (39)$$

As productivity is determined by Verdoorn's law, the potential growth rate becomes:

$$g^s = (n + r_a) + \lambda \frac{\epsilon}{\pi} z_t \tag{39.1}$$

In steady-state, g^d must equal g^s in a manner that exists only one rate g to reach this condition, which is given by:

$$g = \frac{(n+r_a)}{\frac{\epsilon}{\pi}-\lambda} \tag{40}$$

This equation shows that, if the actual growth exceeds the growth rate consistent with supply constraint, demand growth will grow more than supply. Alternatively, if actual growth is lower than the growth rate consistent with supply constraint, potential output will grow more than actual growth rate. In the absence of an adjustment mechanism, a secular trend will be sparked, which constitutes a *logical absurdity* in steady-state (Setterfield, 2006).

Palley introduces an adjustment mechanism assuming that income-elasticity for imports is a negative function of the excess rate of resource utilization:

$$g^d = \frac{\epsilon}{\pi(e)} z_t \tag{41}$$

In steady-state, such a result requires:

$$g = \frac{(n+r_a)}{1-\lambda} \tag{42}$$

If the actual growth rate differs from (41), Palley's mechanism ensures the achievement of it by means of increases/decreases in income-elasticities for imports. If the actual rate is higher than potential output growth, elasticities for imports decrease; thus, the growth rate compatible with balance payment constraint grows. In the other case, if potential output growth is higher than the actual rate, the elasticity for imports increases, then the growth rate compatible with balance payment constraint decreases. Palley's mechanism constitutes a model *quasi-supply-determined*, *in which the reconciliation of the actual and potential growth rates is achieved wholly by means of adjustments to the rate of growth of demand* (Setterfield, 2006 p. 56). The natural growth rate would be the potential output growth as far as the balance payment constraint as g^d adjust itself to the supply-side (McCombie, 2011).

Setterfield's mechanism endogenizes Verdoorn's coefficient with respect to rate of capacity utilization. As the supply-side responses to demand growth, the size of this relation is positively determined between the difference of actual and potential output; the Verdoorn's coefficient is $\lambda(e)$, which leads to:

$$g = \frac{(n + c_0)}{1 - c_1(e)} \tag{43}$$

The Setterfield mechanism occurs via potential output growth. If actual rate growth exceeds growth rate consistent with supply growth, the rate of capacity utilizing increases leading to a higher Verdoorn's coefficient and, then, potential output growth g^s rises, which accommodates the output growth. This model is fully-demand-determined and attuned to the post-Keynesian theory (Setterfield, 2006).

5.2- McCombie's Criticisms and Setterfield's response

McCombie (2011) states that Palley's mechanism, according to which actual growth rate adjusts itself to natural growth rate, means that the economy is exclusively restricted by the natural growth rate. The actual growth rate would vary around the natural growth rate; then, the external constraint would not have any role to play. McCombie (2011) argues that external constraint emerges before the supply constraint once economic growth increases imports. Then, potential growth would not be important if growth is constrained by external accounts, in fact. Thus, the actual growth rate would vary around the growth rate compatible with external constraints instead of the potential rate (McCombie, 2011).

McCombie (2011) recognizes that Setterfield's mechanism is in accordance with Kaldorian tradition, according to which supply-side adjust itself to external constraint. Nonetheless, Setterfield considers only the productivity endogenous with respect to demand growth, when the growth of labor is also endogenous (transfers of labor from agricultural sectors to industries and immigration), which implies the existence of various combinations of n and r_t consistent with long-run growth instead of one (McCombie, 2011).

Considering McCombie's criticism, Setterfield (2012) come up with a mechanism of adjustment considering the supply-side explicitly by employing a Leontief function:

$$Y_p = \min\left[\frac{L_c}{a}, \frac{K_c}{v}\right] \tag{44}$$

where L_c is the current labor force, K_c is the current capital stock, a is the ratio of full employment labor and output, and v is the ratio of full capacity of capital's capacity to output.

There are two possible constraints: labor force or capital stock. The labor constraint is represented as:

$$y_p = n - a = n + \lambda \tag{45}$$

In this case, the capital is under-used, and equation (44) is the solution of the potential growth rate of Palley (2002) and Setterfield (2006) (Setterfield, 2012). If Verdoorn's coefficient is one, potential output grows at the same rate as actual output. However, if Verdoorn's coefficient is less than one, the potential output will grow less than the actual output, which makes an adjustment's mechanism necessary again. Nonetheless, if the labor force is endogenous to the actual growth rate $n = \gamma + \ddot{\upsilon}g^{d}$ (Porcile and Lima, 2010). The potential output growth becomes $y_{p} = (\gamma + c_{0}) + g^{d}(\ddot{\upsilon} + c_{1})$; the sufficient condition for potential and actual be equal is $\ddot{\upsilon} + c_{1} = 1$. This way, there is no supply constraint, as suggested by McCombie (2011). However, empirical evidence suggest that Verdoorn's coefficient is lesser than one, then $\ddot{\upsilon} + c_{1} = 1$ is a mere coincidence (Setterfield, 2012).

The second solution is represented by (45), in which the labor is under-used even in the full employment of capital (Setterfield, 2012):

$$y_{p} = \widehat{K}_{c} \tag{46}$$

The adjustment mechanism of Setterfield (2012) consists of assuming that investment I is a function of demand growth. Thus, the supply-side constraint (capital stock) is connected to demand growth by means of an investment function with an accelerator principle:

$$I = v\Delta Y = vyY \tag{47}$$

In case of vy (or *u* in Setterfield's terms) is less than one, supply-constraint is effective, and there is no sustainability of actual growth rate. In case of $u = 1$, the supply-side accommodates demand growth. (T)*his situation only arises as a special case (u = 1) that, in the context of a long-run growth model, must be considered highly unrealistic* (Setterfield, 2012, p. 17).

Therefore, assuming that the supply-side accommodates automatically and equivalently to demand growth is unrealistic because this is a particular solution, very unlikely (Setterfield, 2012). This is a safe way to disregard the possibility of supply constraints on demand-led growth (Setterfield, 2012).

6- Real exchange rate and long-term growth

The positive effects of a devalued real exchange rate in long-term growth are robustly supported by empirical literature (see, for instance, Berg and Miao 2009, Vieira and MacDonald 2012, Gluzmann *et al.* 2013), especially for developing countries (Rodrik 2007, Rapetti 2012). There are various transmission channels behind this relation; capital accumulation, technological progress, relative prices, income distribution, among others, many of which are not explicitly incorporated in original Kaldorian growth models.

A real exchange rate policy generates a positive effect on growth, according to Kaldorian export-led growth models, or with Thirlwall's law, albeit with different effects on growth. Exchange rate devaluations increase the exports' competitiveness and, when carried out over a considerable length of time, spark economic growth via the cumulative and circular process by increasing the efficiency wages, as productivity grows hand-to-hand with demand growth (Kaldor, 1970). The growth sparked by a real exchange devaluation can be carried out without any restriction in the case of export-led growth model.

In the case of Thirlwall's law, external restriction represents a ceiling to the circular and cumulative process induced by exchange rate devaluations. However, as one of the transmission channels of exchange rate policy to growth is the exports prices, the real exchange rate affects the growth only in the medium-run (the relative prices do not play any role in the long-run).

Ros (2015) claims that in very open economies with a flexible exchange rate (initially characterized by a growth-based in the domestic market, with a fixed exchange rate), the external constraint does not have a central role to play anymore.[16] The growth is restricted by the supply-side, specifically by the capital accumulation of tradable sectors. Table 1.1 presents the growth rate consistent with balance of payment constraint, actual growth rate, and natural rate for Latin American countries covering the period between 1977-2002.

Table 1. 1 - Thirlwall's law, actual and natural rate for Latin American Countries (1977-2002)

Country	*Thirlwall's law*	*Actual rate*	*Natural rate*
Argentina	1.66	1.33	0.39
Bolivia	1.90	1.89	0.51
Brazil	5.08	2.70	1.27
Chile	4.24	5.50	1.97
Costa Rica	3.25	3.94	1.61
Dominican Republic	8.52	4.23	
Ecuador	2.94	2.57	1.25
El Salvador	2.04	1.66	
Guatemala	0.57	2.93	1.62
Honduras	1.73	3.41	1.89
Mexico	3.59	3.30	0.89
Nicaragua	1.44	0.45	0.16
Paraguay	2.83	3.73	0.93

[16] Ros (2015) refers to Latin American economies.

Peru	3.37	1.93	
Uruguay	1.90	1.43	0.30
Venezuela	0.46	1.13	0.97

Source: the growth rate consistent with the balance of payment and the actual growth rate is obtained from Pacheco-López and Thirlwall (2006); the natural growth rate was calculated by authors employing the database of Penn World Table 9.0 as the sum of productivity growth (TFP) and population (average for the period 1977-2002); the productivity growth of Dominican Republic, El Salvador and Peru is not available.

Table 1.1 suggests that the growth rate consistent with balance payment equilibrium is close to the actual growth rate, but this does not mean a certain constraint for all Latin American economies since it is higher than the actual rate.[17] On the other side, the supply side is, indeed, a constraint for the growth of most countries as the natural rate is less than the actual rate and the growth rate consistent with balance payment constraint.[18] Table 1.1 suggests that Ros' argument holds, on average, for Latin American economies for the period 1977-2002.

Thirlwall (2001) argues that if the growth rate of output consistent with balance of payment equilibrium is higher than the natural rate, the actual growth rate may exceed the natural growth rate without incurring external constraint. As Verdoorn's mechanism increases productivity, the natural rate equals to growth rate consistent with the balance of payment constraint, in a manner that the supply constraint doesn't matter (Thirlwall, 2001). Ros' argument would be nonsense in this perspective. Although, as already discussed, this automatic adjustment is very unlikely.

This way, assuming that the growth of Latin American countries is restricted by the supply-side instead of external constraints, Ros (2015) puts forwards the necessity to understand the determinants of productivity as a function of capital accumulation per workers *a la* Kaldor (1957).[19] Ros (2015) proposes that capital accumulation ($\frac{I}{K}$) should be added explicitly to the Verdoorn's mechanism to determine productivity growth:

$$r_t = (g_t, \frac{I}{K}) \tag{48}$$

The main question concerns the determinants of capital accumulation (Ros, 2015). Following Baduhri and Marglin (1990), Ros (2015) argues that capital accumulation is a function of profitability, which, in turn, depends on capacity utilization and mark-up (functional income

[17] It is the case of Argentina, Brazil, Dominican Republic, Ecuador, El Salvador, Mexico, Nicaragua, Peru, and Uruguay.

[18] It is the case of Argentina, Bolivia, Brazil, Chile, Costa Rica, Ecuador, Guatemala, Honduras, Mexico, Paraguay, Uruguay, and Venezuela.

[19] It assumes that technical progress is embodied in capital accumulation, such as Kaldor (1957).

distribution between workers and capitalists). As the real exchange rate affects tradable sectors' mark-up, capital accumulation is influenced by real exchange policies. Then, the real exchange rate has a central role in overcoming supply-side constraints insofar as exchange devaluations would increase productivity through income distribution and capital accumulation.

Ros' argument does not mean that balance of payment does not constrain economic growth. His claim means that, in some specific moments, the supply-side can be a restriction more effective than the latter, which does not suggest that a balance of payment restriction may not occur. If the exchange policy promotes capital accumulation and growth successfully, supply-side constraints become secondary, and the balance of payment has come to play a central role again. In this regard, some authors state that a growth rate consistent with balance payment constraint would be endogenous with respect to the real exchange rate (e.g., Missio and Jayme Jr. 2012, Missio *et al.* 2017). Then, both the supply-side and the external accounts would not be constraints, in fact, if a real exchange devaluation policy would be carried out.

When the real exchange rate assumes a central role in determining the growth rate consistent with the balance of payment and the natural rate, the long-run problem appears again. Which mechanism assures a plausible interpretation of steady-state in this case? Oreiro (2016) seeks to solve it by endogenizing the income elasticities for imports with respect to the real exchange rate. It assumes that income elasticities depend on the level of specialization of productive structure (low/high levels of specialization entail high/low-income elasticities for imports), which, in turn, depends on the real exchange rate once this variable increases the domestic profitability. As a devalued real exchange rate is carried out as a development strategy, the productive structure becomes less specialized, reducing the income-elasticities for imports. Oreiro (2016) goes further and assumes that capital accumulation is a function of the real exchange rate (warranted rate) via profitability. Oreiro (2016) has solved this theoretical shortcoming by placing the real exchange rate at the center of post-Keynesian models insofar as this variable determines the actual, potential, and warranted rates.

Concluding remarks

This paper discussed the Kaldorian growth models and their recent extensions in order to shed light on the theoretical shortcomings behind the long-term growth of an export-led model and Thirlwall's law. The main goal was to explore how the supply-side is introduced in this literature and its analytical implications.

The Kaldorian models have a purely path-dependent logic, in which growth is characterized by a circular and cumulative process having demand growth as the starting point. Growth is demand-constrained instead of supply-constrained. There does not exist the possibility that growth may be constrained by the supply-side. The Verdoorn mechanism does not allow it; the unique restriction is the absence of demand growth. It is argued that the strong emphasis on initial conditions entails a determinism path, which would not be in fully agree with historical time as this would not allow the possibility of catching up or falling behind, as Setterfield (1995, 1997) argued. Some authors displayed that Verdoorn's coefficient is endogenous to the supply-side, curbing the determinism of Kaldorian theory and brings it into line with respect to historical time. More than that, the fact that there does not exist a capital accumulation/technical progress function explicitly modeled in Kaldorian growth models (export-led or Thirlwall's law) does not allow to classify it as an endogenous theory.

In the case of Thirlwall's law, the external constraint plays a central role, and the growth rate of the economy is determined by income-elasticities for imports and exports, and demand growth has a limited role to play as PPP holds only for long periods. This way, the path-dependent process of Kaldorian export-led model is constrained by external conditions as far as imports can not grow faster than exports. The exogeneity of elasticities has been doubted by some authors. The elasticities would be endogenous and related to the supply-side, even that this is not taken explicitly into account. Therefore, the growth rate consistent with a balance payment constraint is interwoven with the supply-side of the economy, which is not considered by the theoretical derivation of Thirlwall's law.

The corollary of Thirlwall's law is attained, assuming that relative prices do not matter. The terms of trade do not play any role in determining the growth rate consistent with balance payment constraint. Such assumption results in two issues. Firstly, productivity growth via Verdoorn's mechanism does not matter for Thirlwall's law corollary. Then, assuming that a growth rate consistent with a balance payment represents the long-run growth of the economy (as a Kaldorian one does) would be problematic in terms of a long-run growth theory; since there is no capital accumulation/technological function explicitly incorporated. Thirlwall's law must be seen exclusively as a restriction to growth.

Secondly, Thirlwall's law dismisses the Prebisch-Singer hypothesis, according to which there is a deterioration of the terms of trade represented by an upward trend of manufacturing/northern prices and a downward trend of agricultural/southern prices. As the

Prebisch-Singer hypothesis is supported by empirical literature, it becomes unrealistic dismissing the role of relative prices, especially regarding the peripheric economies. In the structuralist perspective, the differences of elasticities between countries accrue from supply-side elements; the unequal distribution of technological innovation between northern and southern countries (especially), sectorial heterogeneity (duality), and income distribution. The long-run growth is essentially driven by capital accumulation and technical progress; the elasticities would work solely as a constraint. Therefore, in order to consider the Prebisch-Singer hypothesis in the Kaldorian framework, the terms of trade have to be explicitly endogenous to the supply-side, as Dutt (2002) has done.

The steady-state notion of long-run growth points out that all variables must vary at the same rate. That is, the potential and actual rates must be equal. Otherwise, there would exist a secular trend in terms of capacity utilization. There are two possibilities. Firstly, disregarding the steady-state notion. Secondly, building up mechanisms of adjustment between potential and actual rates in order to provide a meaningful interpretation of steady-state for Kaldorian models. Overall, this collection of models' mechanism assumes that potential output always adapts itself to the actual product. One full-blooded Kaldorian would argue that supply-constraints do not matter because the supply-side accommodates demand growth through Verdoorn's mechanism. However, such a situation is one possible solution or a simple way to disregard the possibility of supply constraints on demand-led growth (Setterfield, 2012).

The theoretical limitation of how supply-side is introduced in Kaldorian models becomes crisper, facing the discussion about the effects of real exchange rate on growth. The real exchange rate devaluation policies positively affect economic growth according to export-led or balance of payment growth models. However, the effects are different for each theory. A real exchange rate devaluation policy can generate growth unrestrainedly in the case of export-led growth models, which differs from Thirlwall's law since the external restriction is a ceiling to growth. Notwithstanding the existence of external constraints, some authors point out that the supply-side is a restriction more effective than the external constraint for Latin American economies. As productivity growth is related to Verdoorn's mechanism and capital accumulation/technical progress, a devalued real exchange rate affects the natural growth rate via demand growth induced by exports and via the effects of income distribution induced by real exchange rate changes in capital accumulation. The supply-side constraint can be overcome if a devalued exchange policy is carried out.

In sum, the specific way of introducing the supply-side in Kaldorian theory entails a purely path-dependence logic according to which demand growth plays a central role, chiefly for the export-led models. However, Thirlwall's law's theoretical derivation does not take it seriously, as far as it dismisses the relative prices, the channel by which demand growth acts via Verdoorn's mechanism. More in-depth, the supply-side of the economy represented by a capital accumulation or a progress function is not considered by export-led or Thirlwall's law formulation. This is a paradox in terms of long-run growth theory. In a structuralist perspective, the external constraints rise from the own peripherical conditions related to supply-side aspects, which, in turn, act as a restriction to long-run growth driven by the supply-side. This paper stresses the importance of introducing the supply-side in Kaldorian models and its interaction with demand growth in order to line it up with historical time and Latin American structuralists.

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SECOND ESSAY – Endogenous Productivity Regime and the Impact of Devaluations of Real Exchange Rate on Economic Growth

Abstract

This article studies the influence of the real exchange rate on economic growth. For that, a model of cumulative and circular causation is developed. The argument pursued is that the real exchange rate influences the profit-rate of firms, affecting capital accumulation. The novelty of this article is to endogenize the parameters of the productivity regime regarding capital accumulation. By making the autonomous productivity growth and the magnitude of the Verdoorn's coefficient endogenous, the real exchange rate influences the labor productivity growth and the intensity of the Kaldor-Verdoorn mechanism. The model shows that devaluations of real exchange rate exert a positive impact on the economic growth of economies under profit-led regimes of demand and capital accumulation, provided by its positive effect on the growth rate of demand and labor productivity. The model also indicates that the devaluations of real exchange rate can exert a positive or negative impact on the economic growth of economies under a wage-led regime of demand and wage- (profit-) led capital accumulation regime.

Key words: Real Exchange Rate; Cumulative and Circular Causation; Productivity Regime; Economic Growth.

1- Introduction

Various studies confirmed the positive impacts of devaluations of the real exchange rate (RER, henceforth) on economic growth (e.g., Acemoglu et al., 2003, Easterly, 2001, Rodrik, 2008, Gala, 2008 Vieira and MacDonald, 2012, Rapetti et al., 2011). Usually, the Kaldorian literature explains it in terms of the balance of payment constraint growth models *a la* Thirlwall (1979).

A usual argument of the authors of this literature is the endogeneity of the income-elasticity of exports regarding the effects of RER on the productive structure. The argument is that a competitive RER favors manufacturing activities. As a result, the sectoral composition of income-elasticities of exports changes, in the sense that the share of manufacturing (more complex) goods in exports expands. As the income-elasticity of exports of these sectors are more significant, the consequence is a greater growth rate of output consistent with the equilibrium in balance of payment (Ferrari et al, 2013, Missio at al., 2017a,b are examples of this literature).

The *rationale* behind this approach is that a competitive RER influences the productive structure, which reflects upon the composition of income-elasticities of exports. As the fundamentals of economic growth are the parameters of external constraint, pursuing a competitive RER becomes a strategy to boost it. Such an approach, therefore, explains the influence of RER on economic growth via the actual growth rate (Thirlwall, 2001, McCombie, 2012). This article seeks to study the impacts of RER's devaluations over economic growth via the natural growth rate. The theoretical model, developed in this article, assumes that economic growth is demand-led and is characterized by a process of circular and cumulative causation. The growth rate of demand and labor productivity feed each other *a la* the canonical growth model of Kaldor-Dixon-Thirlwall (KDT, henceforth) (Kaldor, 1970, Thirlwall and Dixon, 1975). Within this framework, two elements are crucial in determining the possible growth paths: the demand growth and the parameters of labor productivity growth.

The canonical growth model KDT has some shortcomings to study the association between RER and economic growth. The demand is determined uniquely by the exports. The domestic demand is disregarded. It turns out, yet, that the devaluations of RER can exert contractionary effects on economic growth as long it reduces the real wages, damaging the domestic demand (Diaz Alejandro, 1963). In order to remedy it, the paper introduces the domestic demand into the picture in accordance with Bahduri and Marglin (1990). Another important shortcoming of the canonical growth model KDT is the exogeneity of the parameters of the Kaldor-Verdoorn mechanism. Although these parameters are crucial to explain the growth path, they are not explained. This paper endogenizes the parameters of the Kaldor-Verdoorn mechanism to the institutional regime, as Setterfield and Cornwall (2002) propose.

The paper's contributions to the existing literature are twofold. First, the paper provides a growth model of cumulative and circular causation, in which the RER influences the growth path by the demand-side and by the supply-side factors. The influence of devaluations of RER on economic growth, via the demand-side, is associated with the regime of demand. The influence of RER's devaluations on economic growth, via the supply-side, is connected with the influence of RER on capital accumulation, which affects the parameters of the Kaldor-Verdoorn mechanism. In this scheme, the demand-growth remains the primary determinant of labor productivity. The capital accumulation induced by the RER appears as an argument that influences the degree of cumulative and circular causation of economic growth. Such contribution means that the labor productivity depends on the demand growth *a la* Verdoorn (1949) and Kaldor (1966) as on the capital accumulation *a la* Kaldor (1957) (Ros, 2015). Second, the paper displays that, in economies under profit-led regimes of demand and capital accumulation, the more intense degree of cumulative and circular causation induced by RER's devaluations boost economic growth. The paper also shows that, in economies under wage-led regimes of demand and capital accumulation, the less intense degree of cumulative and circular causation induced by devaluations of RER can exert a positive influence on the economic growth, under certain assumptions. The paper demonstrates that the more intense degree of cumulative and circular causation induced by RER's devaluations damage economic growth, in economies under a wage-led regime of demand and a profit-led regime of capital accumulation.

This article consists of four sections besides this introduction. Section 2 discusses the canonical Kaldorian growth model KDT, emphasizing its shortcoming to study the influence of RER on economic growth. Section 3 discusses the fundamentals of the developed model. Section 4 solves the model for the equilibrium values and discusses the impact of devaluations of RER on economic growth for different combinations of demand regimes and capital accumulation regimes. Section 5 ends the article with the conclusions.

2- The Canonical Growth Model of Cumulative and Circular Causation: the export-led approach of Kaldor-Dixon-Thirlwall

The growth model of Kaldor (1970), and Dixon and Thirlwall (1975), is the canonical model of the cumulative and circular causation within the Kaldorian tradition. This group of growth models is characterized by a demand-driven approach for economic growth, in which the exports assume preeminent importance. The growth rate of domestic economy $g_{d,t}$ is demand-determined, and the growth of exports $x_{d,t}$ is the unique source of demand:[20]

$$g_{d,t}=\gamma(x_{d,t}) \qquad (1)$$

where the subscripts *d* and *t* denote for domestic economy and time, respectively.

The growth of exports is described as a function of changes in domestic and foreign prices, abroad income, represented by the variables $p_{d,t}$,$p_{f,t}$ and z_t respectively:

$$x_{d,t}= -np_{d,t} + \delta p_{f,t} + \epsilon z_t \qquad (2)$$

where the parameter n, δ and ϵ represent the price-elasticity of demand for exports, the price-elasticity of demand for imports, and income-elasticity of demand for exports, respectively.

The changes in domestic prices are modelled as:

$$p_{d,t} = w_{d,t} - r_{d,t} + \mu_{d,t} \qquad (3)$$

where the variables $w_{d,t}$, $r_{d,t}$, $\mu_{d,t}$ are the growth rate of nominal wage, labor productivity and markup rate on unit labor cost, respectively.

The growth of labor productivity is modelled following Kaldor-Verdoorn's law:

$$r_{d,t} = r_{d,a} + \lambda_d g_{d,t} \qquad (4)$$

The labor productivity is a positive function of demand growth due to the existence of increasing returns to scale (Young, 1928, Verdoorn, 1949, Kaldor, 1966). The parameter $r_{d,a}$ is the autonomous productivity growth, while λ_d is the elasticity of productivity growth to demand growth: as higher is the pace of demand growth, higher the growth rate of labor productivity.

Introducing (4), (3), (2) into (1) leads to the growth rate of the economy:

$$g_{d,t}^* = \gamma[n(w_{d,t} - r_{d,a} + \mu_{d,t})+ \delta p_{f,t} + \epsilon z_t](1+ \gamma n\lambda_d)^{-1} \qquad (5)$$

Assuming that $w_{d,t}$=$\mu_{d,t}$=$z_{f,t}$ =$p_{f,t}$=0 (for the sake of simplicity), as Dixon and Thirlwall (1975) do:

$$g_{d,t}^* = \gamma[n(-r_{d,a})](1+ \gamma n\lambda_d)^{-1} \qquad (5.1)$$

equations (5) and (5.1) are the growth rate of output. The economic performance is positively associated to increases in autonomous productivity (*n* is negative) and to Verdoorn's coefficient. Put differently, as higher are the parameters $r_{d,a}$ and λ_d, greater the growth rate of output. The productivity rises as more rapidly is the growth rate of demand. The cumulative and circular causation logic of the export-led approach of KDT model is provided by the feedback interaction between the growth rate of demand and labor productivity. Demand growth

[20] The lower caser letter means that the variable in growth rate.

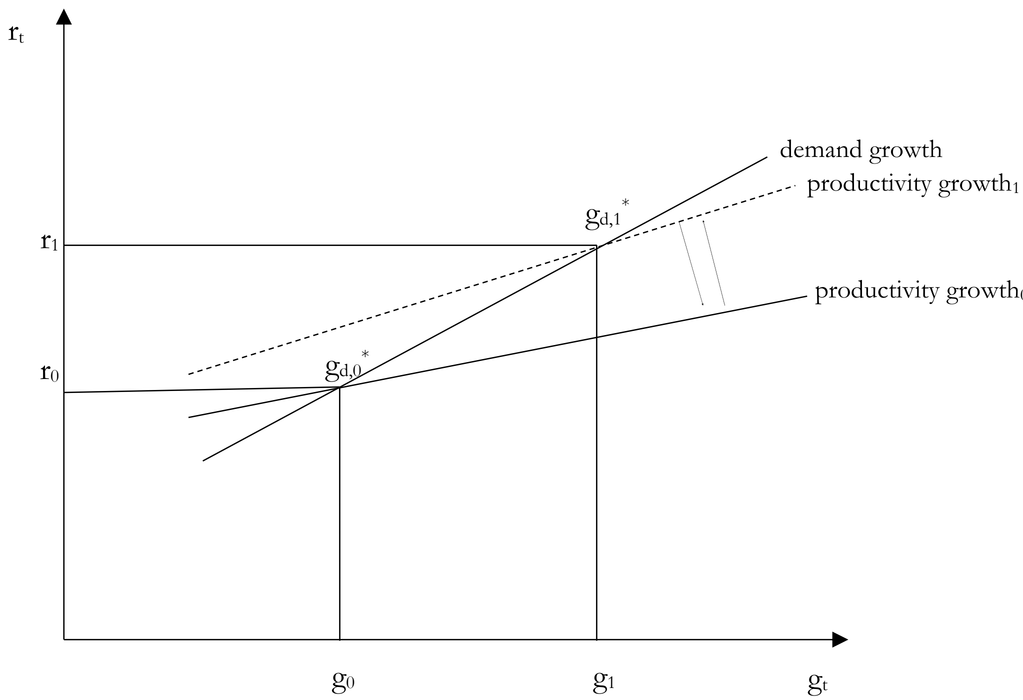
(equation (1)) and labor productivity growth (equation (2)) feed mutually, forming a system of equations presented graphically in Figure 2.1.

The general solution of equation (5.1) is represented by (*Y* is the initial value of income):

$$Y(t) = Ye^{\gamma[n(-r_{d,a})(1+\gamma n\lambda_d)^{-1}]} \tag{6.1}$$

The stationary equilibrium of this system of equation requires that the parameters γn be smaller than one and that $\gamma n\lambda_d$ be smaller than γn: $\gamma n\lambda_d<\gamma n<1$, which is assumed.

Figure 2. 1- Economic growth in KDT Model



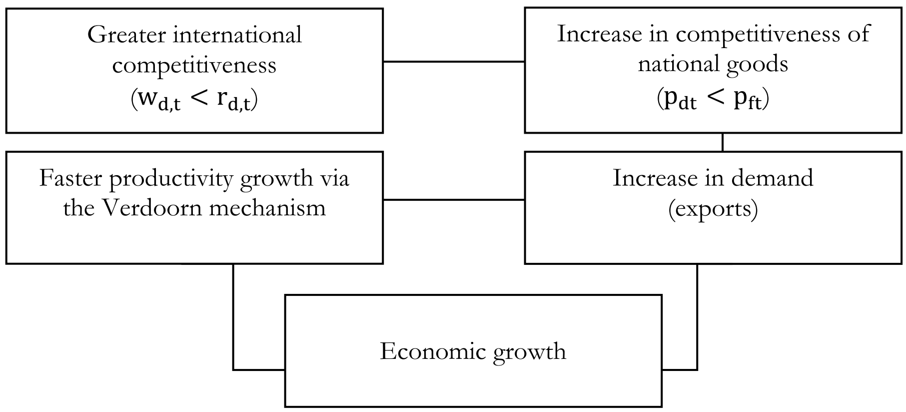
An inspection of Figure 2.1 displays that, *ceteris paribus*, as greater is the productivity growth, greater is the economy's growth. The position of the productivity regime curve determines the economic performance. Displacements upwards (downwards) of productivity line due to changes in $r_{d,a}$ accelerate (slow down) the growth rate of economy $g_{d,t}^*$. Whilst as steeper (flatter) is the productivity equation, higher (lower) the growth rate of economy $g_{d,t}^*$. Figure 2.1 illustrates it: in the equilibrium value $g_{d,0}^*$, the parameters $r_{d,a}$ and λ_d are smaller than in the equilibrium value $g_{d,1}^*$. Similarly, any increment in demand growth (exports) increases the economy's growth, by dislocating the demand line to the right.

2.1- The Limited Comprehension about the effects of RER on Economic Growth

The KDT growth model has a limited comprehension of the effects of RER on economic performance:

i- The RER does not appear as an argument in the canonical model. The international competitiveness of domestic production is represented by the difference between nominal wage and labor productivity. The KDT growth model tells the traditional narrative of an export-led growth theory. A great competitiveness induced by smaller increases in nominal wages than labor productivity promotes economic growth by expanding exports:

Figure 2. 2- International Competitiveness and Economic Growth



ii- The exports are the unique source of demand in a manner that the economy always will grow more rapidly because of a great international competitiveness. However, the effects of great international competitiveness induced by a lower rate of growth from wages go further than merely expanding exports. There are effects associated with other sources of demand via income distribution. The reduction in wages can bring down the demand growth, as its effects on income distribution are also associated with domestic demand (Diaz Alejandro, 1963).

iii- The parameters of the Kaldor-Verdoorn mechanism are central to explain the cross-country differences in terms of economic performance. However, too little attention is paid to explain its determinants. Both parameters $r_{d,a}$ and λ_d are assumed as given and constant in the original KDT model. The autonomous productivity growth and the Verdoorn's coefficient are understood as a function of capital accumulation (which embodies technical progress) induced by the demand growth (Kaldor, 1957). In particular, r_a is the autonomous rate of capital accumulation per worker, while λ is the capital accumulation induced by demand growth and the pace of technical progress incorporated in capital accumulation (Dixon and Thirlwall, 1975).

iv- Taking the Kaldor-Verdoorn mechanism exogenously produce important consequences to understand the economic development and the effects of RER on economic growth. Firstly, there is a strong emphasis on the initial condition that, in the absence of shocks, determines the relative growth of economies (Setterfield, 1997). As productivity equation parameters are given and constant, economies that grew more in the past grow more currently (Setterfield, 1997). Falling behind and catching up between economies are not theoretically possible (León-Ledesma, 2002). Some authors have efforted to remedy this shortcoming. Setterfield (1995, 1997) endogenized the magnitude of the Verdoorn coefficient for institutions. León-Ledesma (2002) argued that non-price variables as innovative activities, investment, and education are important sources of productivity growth, as is demand growth. Ocampo (2005) has argued that either shifts or the productivity regime equation's slope are positively associated with technological progress. The empirical evidence of Romero and Britto (2017) and Romero (2019) confirm the positive association between the magnitude of Verdoorn's coefficient and the research intensity and innovations. Secondly, the effects of RER on labor productivity via demand growth is only a part of the story. The RER influences capital accumulation, technological progress, and the R&D of firms (Souto e Resende, 2018), which is associated with labor productivity. Therefore, the RER influences labor productivity via demand growth and via its effects over technological progress, which should be considered together to provide a better understanding of the effects of RER on economic growth.

A growth model is developed hereafter within the cumulative and circular causation tradition to understand the effects of RER over the economic performance, considering the raised limitations about the canonical KDT growth model.

3- A Growth Model of Cumulative and Circular Causation

The growth model developed in this article follows the analytical structure of Setterfield and Cornwall (2002), in which the economic growth is taken as a cumulative and circular process, and three elements are interwoven that, combined, constitute the macroeconomic regime (MR):

(1) Demand Regime (DR): the demand regime describes the formation of demand growth. The theoretical model of this article expands the sources of demand in addition to the exports, considering the domestic sources of demand: investment, consumption, and imports.

(2) Productivity Regime (PR): the productivity regime describes labor productivity growth determinants. The model of this article assumes that labor productivity growth is determined by the Kaldor-Verdoorn mechanism.

(3) Institutional Regime (IR): the non-price variables that affect the size of r_a and λ constitute the institutional regime. The institutional regime encompasses the macro-institutional structure within the economic behavior that occurs and constitutes the operating system related to the

social infrastructure, uncertainty, social conflict, stability, long-run expectations, income distribution claims (Setterfield and Cornwall, 2002). An institutional regime based on the absence (existence) of distributive conflict and uncertainty, concerning the profit-share of GDP and a growing up (slowing down) demand, generates a period of strong (weak) capital accumulation (Setterfield and Cornwall, 2002). Consequently, the parameters r_a and λ are higher (lower), which enhance (diminish) the growth rate of productivity and demand (Setterfield and Cornwall, 2002).

Furthermore, the model is developed assuming that:

(1) The RER, represented by Θ_t, is the price of foreign currency in terms of the domestic currency (it is the price of the national currency to the eyes of the foreign buyer). As lower is the Θ_t, cheaper is the domestic goods in the international market. It is assumed that Θ_t is determined exogenously by the monetary authority in order to make domestic goods more competitive in relation to foreign goods.

(2) The income distribution between workers and capitalists is the link between RER and demand growth: RER influences consumption (wage-share), investment (profitability), and net exports (international competitiveness).

(3) The productivity regime is endogenous to RER. The argument is that the RER influences the magnitude of parameters r_a and λ via its effects on the investments (that embodies technological progress).

The theoretical model is developed following the subsequent steps. Firstly, the link between RER, prices and income distribution is modeled. The demand and productivity regimes are modeled, connecting RER, income distribution, demand, and labor productivity growth.

3.1- RER, Prices, and Income Distribution

Following the Kaleckian tradition, the prices of exported domestic goods $P_{dx,t}$ (in foreign currency) are modelled following a markup rule under the costs:

$$P_{dx,t}= \Theta_t\{[(\Theta_t^{-1}M_t)^{\sigma}N_t^{1-\sigma})^{\psi}+(W_t/R_t)^{1-\psi}](1+ MK_t)\} \qquad (18)$$

The variables M_t, N_t, E_t, R_t stand for the imported inputs used in production, the national inputs employed in production, the nominal wage, and the labor productivity, respectively. The parameter ψ represents the share of inputs in costs, and (1-ψ) is the share of labor in costs. The parameter σ is the share of imported inputs in all inputs, while (1-σ) is the share of domestic inputs in all inputs employed in production. Lastly, the vector (1+MK_t) is the markup rule.

The log-difference of equation (18) means that the changes in the prices of exported goods are represented by:

$$p_{dx,t} = \theta_t - \psi\sigma\theta_t + \psi\sigma n_t + \psi(1-\sigma)z_t + (1-\psi)(w_t - r_r) + mk_t \quad (19)$$

Assuming that $n_t = m_t = w_t = 0$ (by the benefit of simplicity):

$$p_{dx,t} = (1 - \psi\sigma)\theta_t - (1-\psi)r_r + mk_t \quad (19.1)$$

Blecker (1989) argues that the markup rate is endogenous to RER. The argument is that devaluations of RER allow the domestic firms to increase their markup in order to take benefits from the enhanced competitiveness in relation to foreign goods, then:

$$MK_t = MK_d + mk_1\Theta_t^{-1} \quad (20)$$

Where the constant MK_d represents the desired markup, and the parameter mk_1 captures the sensibility of markup to RER. The equation (20) in log-diff is:

$$mk_t = -mk_1\theta_t \quad (20.1)$$

Equation (20.1) means that the devaluations of RER increase the growth rate of markup.[21]

Introducing the equation (20.1) into (19.1):

$$p_{dx,t} = (1 - \psi\sigma - mk_1)\theta_t - (1-\psi)r_r \quad (19.2)$$

Equation (19.2) means that devaluations of RER make the domestic goods cheaper in international market. However, as greater is the share of imports, used as input in production and markup response to the RER, lower is such effect (assuming that $0 < |\psi\sigma + mk_1| < 1$). Moreover, as it is assumed a declining real wage, labor productivity increases reduce the prices, which is weighted by the share of labor in costs.

Another way to solve the equation (19.1) is for the changes in markup rate of firms:

$$mk_t = p_{dx,t} - (1 - \psi\sigma)\theta_t + (1-\psi)r_r \quad (21)$$

Equation (21) means that the devaluations of RER have a profitability effect as long it increases the markup rate of firms. A devaluation of 1% in RER increases the markup rate by $(1 - \psi\sigma)$ %. In addition, rises in the prices of exported goods increase the markup rate of firms. As it is assumed a declining real wage, the gains of labor productivity are absorbed by the capitalists by a greater markup rate or enhanced profitability.

Kalecki (1956) claims that the functional income distribution between wage- and profit-share in GDP can be written as a positive function of markup rate. The greater the markup rate,

[21] See Marconi *et al.* (2020) for an interesting argument for the Brazilian case.

the greater (smaller) the profit- (wage-) share in GDP. Simply, it is assumed that the equation (21) represents roughly the changes in the profit-share in GDP, represented by π_t:

$$\pi_t = p_{dx,t} - \theta_t(1 - \psi\sigma) + (1 - \psi)r_r \quad (22)$$

Therefore, the income distribution between workers and capitalists is influenced by the RER and by the labor productivity growth. Devaluations of RER/increases in labor productivity increase the profit-share in GDP, or, in another manner, it reduces the wage-share in GDP.

3.2- Demand Regime

The demand regime is formed by consumption, investment, exports, and imports, represented, respectively, by c_t, i_t, x_t and m_t:

$$y_t = c_t + i_t + x_t - m_t \quad (23)$$

The behavior of changes in consumption is modeled as:

$$c_t = (1 - \sigma_\omega)\omega_t + (1 - \sigma_\pi)\pi_t \quad (24)$$

the variables ω_t, σ_ω and σ_π represent the changes in the wage-share in GDP, the marginal propensity to save of workers and entrepreneurs, respectively. The changes in wage-share in GDP can be written as the inverse of the changes in the profit-share in GDP: $-\pi_t$. Therefore, rearranging the equation (24):

$$c_t = (\sigma_\omega - \sigma_\pi)\pi_t \quad (24)$$

The effects of changes in the functional income distribution between workers and capitalists on consumption are associated with the difference between the parameters σ_ω and σ_π. Increases in the profit-share boost (reduce) the consumption if $\sigma_\omega > \sigma_\pi$ ($\sigma_\omega < \sigma_\pi$).

The behavior of investment is modeled using the investment function of Bhaduri and Marglin (1990):

$$i_t = i_0 + i_1\pi_t + i_2y_t \quad (25)$$

where the constant i_0 captures the changes in the expectations of entrepreneurs, the parameter i_1 is the sensibility of investment to changes in profit-share, while i_1 is the sensibility of investment to changes in demand growth. Both parameters are positive.

The behavior of exports and imports is modeled as:

$$x_{d,t} = -np_{d,t} + \delta p_{f,t} + \epsilon z_t \quad (26)$$

$$m_t = m_1y_t \quad (27)$$

equation (26) equals (2), assuming that $p_{f,t} = z_t = 0$, and introducing (19.2) into (26):

$$x_{d,t} = -n[(1 - \psi\sigma - mk_1)\theta_t - (1 - \psi)r_r] \quad (26.1)$$

That is, devaluations in RER and increases in labor productivity increase the exports. The imports, in turn, depend positively on the growth of domestic demand. As higher is the growth of domestic demand, the higher is the growth rate of imports.

Putting (23), (24), (25), (27) and (28) into (22):

$$y_t = (\sigma_\omega - \sigma_\pi)\pi_t + i_0 + i_1\pi_t + i_2 y_t - n[(1 - \psi\sigma - mk_1)\theta_t - (1- \psi)r_r] - m_1 y_t$$

Introducing (22) and solving for y_t:

$$y_t = i_0 - b_1\theta_t + b_2 r_r \quad (28)$$

where the parameter b_1 represents the expression $\{(1 - \psi\sigma)[(\sigma_\omega - \sigma_\pi) - i_1] - n(1 - \psi\sigma - mk_1)\}(1 - i_2 + m_1)^{-1}$, while b_2 represents the expression $\{(1- \psi)[(\sigma_\omega - \sigma_\pi) + i_1] + n(1- \psi)\}(1 - i_2 + m_1)^{-1}$. By assuming that the expression $(1 - i_2 + m_1)$ is positive, the effects of RER and labor productivity on demand growth are ambiguous and are associated with the combinations of parameters:

(1) The wage-led case: if the expressions $\{(1 - \psi\sigma)[(\sigma_\omega - \sigma_\pi) - i_1] - n(1 - \psi\sigma - mk_1)\}(1 - i_2 + m_1)^{-1}$ and $\{(1- \psi)[(\sigma_\omega - \sigma_\pi) + i_1] + n(1- \psi)\}(1 - i_2 + m_1)^{-1}$ are negative, devaluations of RER and increases in labor productivity, by increasing the profit-share in GDP, reduce the demand growth. The demand regime is wage-led. As a result, the smaller wage share in GDP, induced by devaluations in RER or by the greater labor productivity, reduces consumption, which is not compensated by the investment and exports.

(2) The profit-led case: if the expressions $\{(1 - \psi\sigma)[(\sigma_\omega - \sigma_\pi) - i_1] - n(1 - \psi\sigma - mk_1)\}(1 - i_2 + m_1)^{-1}$ and $\{(1- \psi)[(\sigma_\omega - \sigma_\pi) + i_1] + n(1- \psi)\}(1 - i_2 + m_1)^{-1}$ are positive, devaluations of RER and increases in labor productivity, by increasing the profit-share in GDP, increase the demand growth. The demand regime is profit-led. Consequently, the smaller wage share in GDP, induced by devaluations in RER or by the greater labor productivity, reduces the consumption, which is compensated by the investment and exports.

3.3- Productivity Regime: endogenizing the Kaldor-Verdoorn's Mechanism

The productivity regime is determined by the Kaldor-Verdoorn mechanism:

$$r_t = r_a + \lambda_t y_t \quad (29)$$

The demand growth is the main determinant of labor productivity growth. Various authors have pointed out that the parameters of productivity regime are not constant over time or exogenous, such as Setterfield (1995, 1997), Setterfield and Cornwall (2002), Ocampo (2005), Romero and Britto (2017) and Romero (2019). The argument pursued in this article is that the parameters of equation (29) are endogenous to technological progress. As greater is the technological progress, more significant are the parameters of the productivity regime. Consequently, new technologies yields (i) a faster pace of autonomous growth of labor productivity and (ii) a greater labor productivity growth induced by demand growth.

The endogeneity of the parameters r_a and λ_t are modelled in following way:

$$r_{a,t} = F(I_t);\ f'>0 \quad (30)$$

$$\lambda_t = F(I_t);\ f'>0 \quad (31)$$

Assuming that the capital accumulation embodies new technologies, the parameters r_a and λ_t are endogenous to the variable investment.[22] Hence, new investments that embody technological progress increase both parameters. It turns out that the changes in investment are modeled as a function of changes in the profit share of GDP and demand growth. Although devaluations of RER always reduce the profit-share in GDP, its effects over demand growth depend on if the demand regime is wage- or profit-led:

(1) The wage-led case: in this scenario, devaluations of RER reduce the pace of capital accumulation because its contractionary effects over the demand growth are not compensated by the expansionary effects over the profit-share in GDP. The regime of capital accumulation is wage-led. Devaluations of RER make the pace of technological progress slower. As a result, the parameters r_a and λ_t become smaller: the autonomous labor productivity growth become smaller and the Kaldor-Verdoorn mechanism is less intense.

(2) The profit-led case: in this scenario, devaluations of RER increase the pace of capital accumulation because it produces a greater demand growth and profit-share in GDP. The regime of capital accumulation is profit-led. Devaluations of RER make the pace of technological progress faster. As a result, the parameters r_a and λ_t become greater: the autonomous labor productivity growth becomes greater, and the Kaldor-Verdoorn mechanism is more intense.

4- Interaction between Demand and Productivity Regimes: the impact of devaluations of RER

Solving the system of equations, as Naastepad (2005) solves:

$$y_{t,dr} = i_0 - b_1\theta_t + b_2 r_r \quad (28)$$

$$y_{t,pr} = (r_t - r_{a,t})\lambda_t^{-1} \quad (29)$$

[22] In this case, the variable investment I_t (in upper letters) represents the variable investment in level.

where $y_{t,dr}$ represents the demand growth associated with the labor productivity growth and RER, and $y_{t,pr}$ is the demand growth derived from the productivity regime. Equaling the equations (28) and (29) yields the equilibrium labor productivity growth r_r^*:

$$r_t^* = (i_0 - b_1\theta_t + \lambda_t^{-1}r_{a,t})(\lambda_t^{-1} - b_2)^{-1} \quad (30)$$

Introducing (30) into (28) yields the equilibrium growth rate of demand y_r^*:

$$y_t^* = i_0(1 + b_2) + [-b_1 - b_1b_2(\lambda_t^{-1} - b_2)^{-1}]\theta_t + b_2[\lambda_t^{-1}r_{a,t}(\lambda_t^{-1} - b_2)^{-1}] \quad (31)$$

The inclinations of regimes of productivity and demand regarding changes in RER are:

$$dr_t^*/d\theta_t = -b_1(\lambda_t^{-1} - b_2)^{-1} \quad (32)$$

$$dy_t^*/d\theta_t = -b_1 - b_1b_2(\lambda_t^{-1} - b_2)^{-1} \quad (33)$$

The effects of RER on the equilibrium values r_t^* and y_r^* are associated with the combinations of parameters. It is assumed that the expression $(\lambda_t^{-1} - b_2)^{-1}$ is positive, which is very reasonable as the Verdoorn coefficient is around 0.5 (λ_t^{-1} is around 2), and b_2 is likely to be less than 1. Therefore, the combinations of regimes of demand and capital accumulation determine how the RER influences r_t^* and y_r^*. The effects of devaluations of RER will be discussed for three different combinations of demand and capital accumulations regimes in what follows.

4.1- Profit-led Regimes of Demand and Capital Accumulation

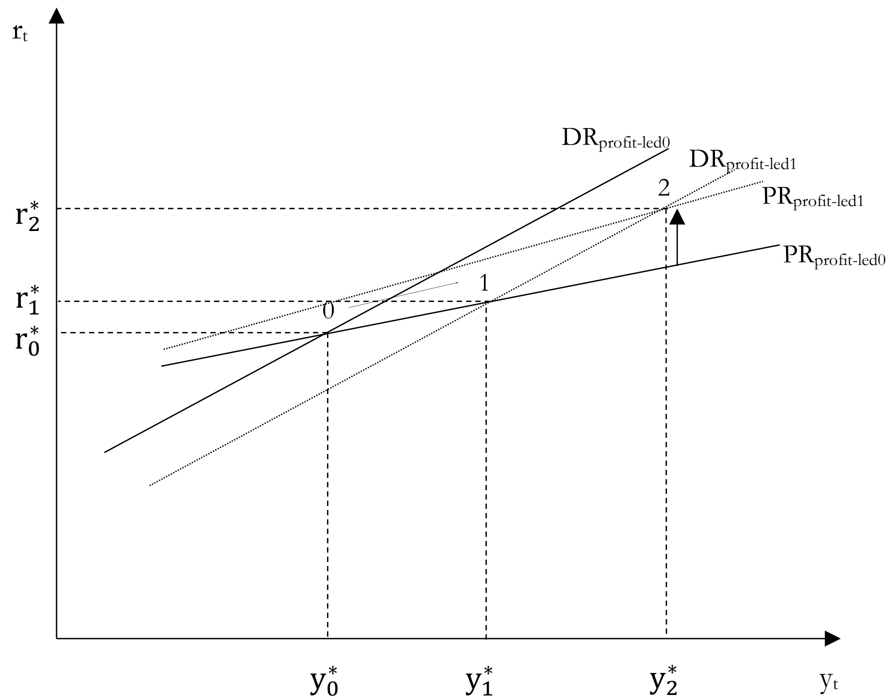
In the scenario in which the regimes of demand and capital accumulation are profit-led, devaluations of RER increase both demand growth as productivity growth: the parameters b_1 and b_2 are positive. Therefore, the expressions (32) and (33) are negative:

$$dr_t^*/d\theta_t = -b_1(\lambda_t^{-1} - b_2)^{-1} < 0$$

$$dy_t^*/d\theta_t = -b_1 - b_1b_2(\lambda_t^{-1} - b_2)^{-1} < 0$$

This suggests that devaluations of RER boost the growth of demand and labor productivity. Figure 2.3 illustrates the effects of devaluations of RER.

Figure 2. 3- Profit-led Regimes of Demand and Capital Accumulation



Part of the story about RER devaluations' effects is represented by the displacement of the demand regime upwards. As the demand regime is profit-led, RER devaluations boost the demand growth. As a result of the circular and cumulative process, the growth rate of labor productivity increases: the equilibrium values provided by the model change from the point 0 to 1 ($y_1^*>y_0^*$, $r_1^*>r_0^*$).

The other part of the story is associated with the effects of devaluations of RER over the productivity regime. Within an economy under a profit-led regime of capital accumulation, devaluations of RER boost the capital accumulation/technological progress. Consequently, the parameters r_a and λ_t of productivity regime become larger: the autonomous labor productivity growth enlargers and the Kaldor-Verdoorn mechanism becomes more intense. Graphically, the line of productivity regime dislocates upwards and turns steeper: the equilibrium values provided by the theoretical model change from the point 1 to 2 ($y_2^*>y_1^*$, $r_2^*>r_1^*$).

Therefore, devaluations of RER boost the economic growth in economies under profit-led regimes of demand and capital accumulation.

4.2- Wage-led Regimes of Demand and Capital Accumulation

In the wage-led scenario, the parameters b_1 and b_2 are negative, consequently, the expression (32) is positive:

$$dr_t^*/d\theta_t = -b_1(\lambda_t^{-1} - b_2)^{-1} > 0$$

which suggests that devaluations of RER harm the growth of labor productivity.

On the other hand, the effects of devaluations of RER on the demand growth are not straightforward. Devaluations of RER reduce the demand growth, but its contractionary effects over the labor productivity increase the wage-share in GDP, which has the opposite (expansionary) effect on demand growth. Then, the effects of RER devaluations on the demand growth depend on which effect prevails:

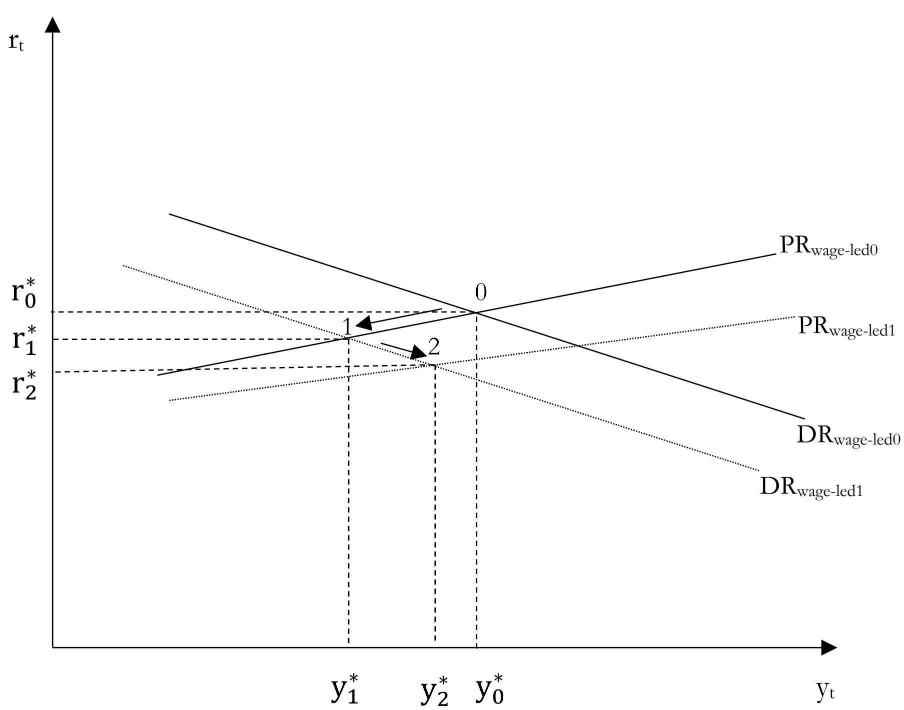
(1) The first scenario of wage-led demand regime: if the parameter $|b_1|$ is greater than the expression $|b_1 b_2(\lambda_t^{-1} - b_2)^{-1}|$, the expression (33) is positive:

$$dy_t^*/d\theta_t = -b_1 - b_1 b_2(\lambda_t^{-1} - b_2)^{-1} > 0$$

this suggests that the contractionary effects of RER devaluations on demand growth prevail to detriment of its positive effects on wage-share in GDP via the lower labor productivity growth. Therefore, RER devaluations reduce demand growth.

Figure 2.4 illustrates the effects of devaluations of RER for an economy under wage-led regimes of Demand and Capital Accumulation of the first scenario.

Figure 2. 4- Wage-led Regimes of Demand and Capital Accumulation (first scenario)



Once again, part of the story about the effects of devaluations of RER is represented by the displacement of the demand regime downwards. As the demand regime is wage-led, and $|b_1| > |b_1 b_2(\lambda_t^{-1} - b_2)^{-1}|$, devaluations of RER harm the demand growth. As a result of the circular and cumulative process, the growth rate of labor productivity reduces. Hence, the equilibrium values provided by the theoretical model change from point 0 to 1 ($y_1^* < y_0^*$, $r_1^* < r_0^*$).

The other part of the story concerns the effects of RER on the productivity regime. As the economy is under a wage-led capital accumulation regime, devaluations of RER harm the capital accumulation/technological progress. Consequently, the parameters r_a and λ_t of the productivity regime become smaller. Graphically, the line of productivity regime dislocates downwards and turns flatter: the equilibrium values provided by the model change from point 1 to 2 ($y_1^* < y_2^*$, $r_2^* < r_1^*$).

Therefore, devaluations of RER harm the economic growth in economies under wage-led regimes of demand and capital accumulation of the first scenario. It should be noticed, however, that endogenizing the productivity regime implies a better situation after devaluations of RER, when compared to the situation in which the productivity regime is exogenous: $y_1^* < y_2^* < y_0^*$ and $r_2^* < r_1^* < r_0^*$. This is because of the reduction of labor productivity induced by the lower pace of technological progress (a result of the devaluation of RER), which increases the wage-share in GDP.

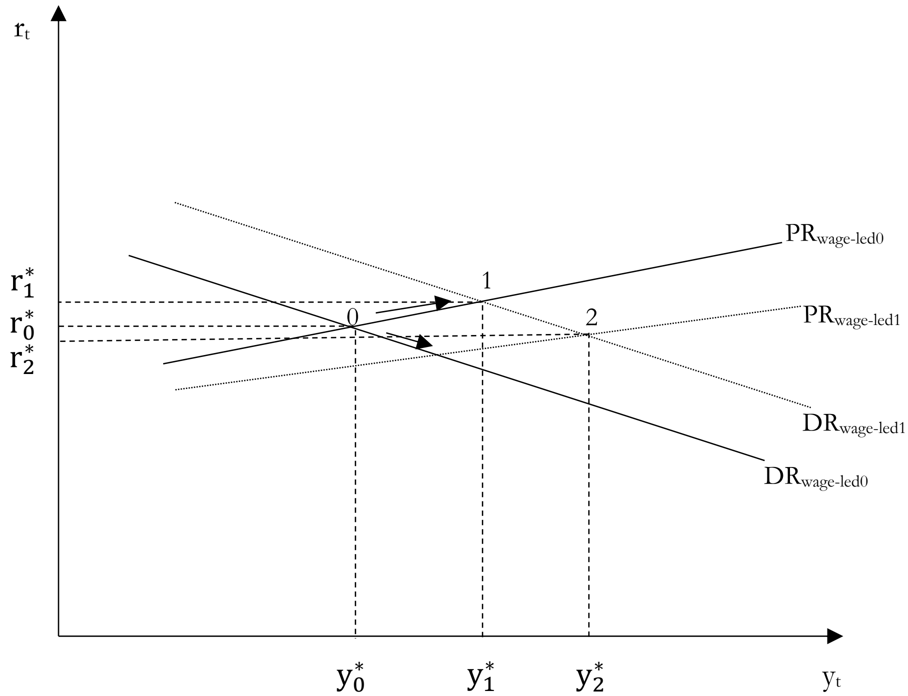
(2) Second scenario of wage-led demand regime: if the parameter $|b_1|$ is smaller than the expression $|b_1 b_2(\lambda_t^{-1} - b_2)^{-1}|$, the expression (32) is negative:

$$dy_t^*/d\theta_t = -b_1 - b_1 b_2(\lambda_t^{-1} - b_2)^{-1} < 0$$

This suggests that the expansionary effects of RER on wage-share in GDP via the lower labor productivity prevail to detriment of its negative effects on demand growth. Therefore, devaluations of RER boost the demand growth.

Figure 2.5 illustrates the effects of devaluations of RER for an economy under wage-led regimes of Demand and Capital Accumulation of the second scenario.

Figure 2. 5- Wage-led Regimes of Demand and Capital Accumulation (second scenario)



Devaluations of RER displace the demand regime upwards. The demand regime is wage-led, but $|b_1|<|b_1b_2(\lambda_t^{-1} - b_2)^{-1}|$, thus, that devaluations of RER boost the demand growth and the growth rate of labor productivity. Hence, the equilibrium values provided by the model change from point 0 to 1 ($y_1^*>y_0^*$, $r_1^*>r_0^*$).

However, as the economy is under wage-led capital accumulation regime, devaluations of RER harm the capital accumulation/technological progress. Consequently, the parameters r_a and λ_t of the productivity regime become smaller. Graphically, the line of productivity regime dislocates downwards and turns flatter: the equilibrium values provided by the model change from point 1 to 2 ($y_1*<y_2*$, $r_2*<r_1*$).

Therefore, the effects of devaluations of RER, when the expansionary effects of RER on wage-share in GDP via the lower labor productivity prevail to the detriment of its negative effects on demand growth, are positive, boosting the economic growth.

4.3- Wage-led Regime of Demand and Profit-led Regime of Capital Accumulation

In the scenario in which the regime of demand is wage-led (the parameters b_1 and b_2 are negative), and the regime of capital accumulation is profit-led, the expression (32) is positive:

$$dr_t^*/d\theta_t = -b_1(\lambda_t^{-1} - b_2)^{-1}>0$$

this suggests that devaluations of RER harm the growth rate of labor productivity.

In contrast, once again, the effects of RER's devaluations on the demand growth are not straightforward. Its effects on the demand growth depend on which effect prevails (the contractionary effects on demand growth or its expansionary effects on wage-share in GDP):

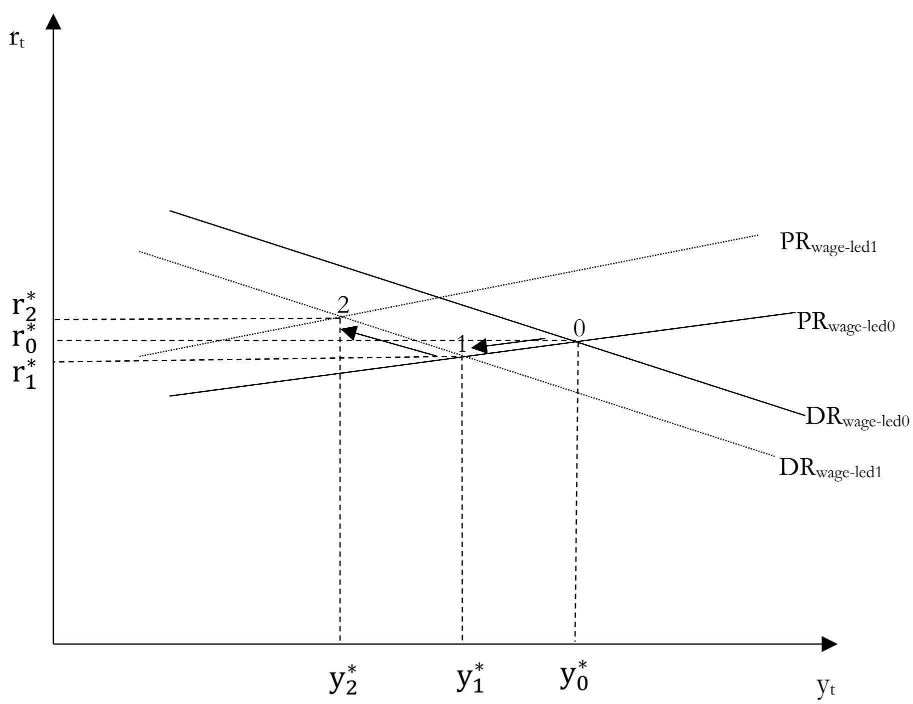
(1) First scenario of wage-led demand regime: if the parameter $|b_1|$ is greater than the expression $|b_1 b_2(\lambda_t^{-1} - b_2)^{-1}|$, the expression (33) is positive:

$$dy_t^*/d\theta_t = -b_1 - b_1 b_2(\lambda_t^{-1} - b_2)^{-1} > 0$$

this suggests that the contractionary effects of RER on demand growth prevail in the detriment of its positive effects on wage-share in GDP via the lower labor productivity. Therefore, devaluations of RER reduce demand growth.

Figure 2.6 illustrates the effects of devaluations of RER for an economy under a wage-led regime of demand and a profit-led regime of capital accumulation of the first scenario.

Figure 2. 6- Wage-led Regime of Demand and Profit-led Regime of Capital Accumulation (first scenario)



In this scenario, devaluations of RER reduce the growth rate of demand and labor productivity: the demand regime line dislocates downward, from 0 to 1 ($y_0^* > y_1^*$, $r_0^* > r_1^*$). As the economy is under a profit-led capital accumulation regime, devaluations of RER increase the parameters r_a and λ_t. The line of productivity regime dislocates upwards and turns steeper: the equilibrium values provided by the model change from point 1 to 2 ($y_1^* > y_2^*$, $r_2^* > r_1^*$).

In sum, devaluations of RER harm the economic growth in economies under wage-led regimes of demand and a profit-led regime of capital accumulation of the first scenario. It should be noticed that endogenizing the productivity regime implies a worse situation after devaluations of RER, compared to the situation in which the productivity regime is exogenous: $y_2^* < y_1^* < y_0^*$ and $r_1^* < r_0^* < r_2^*$. This is due to the increment of labor productivity induced by the greater pace of technological progress, which reduce the wage-share in GDP.

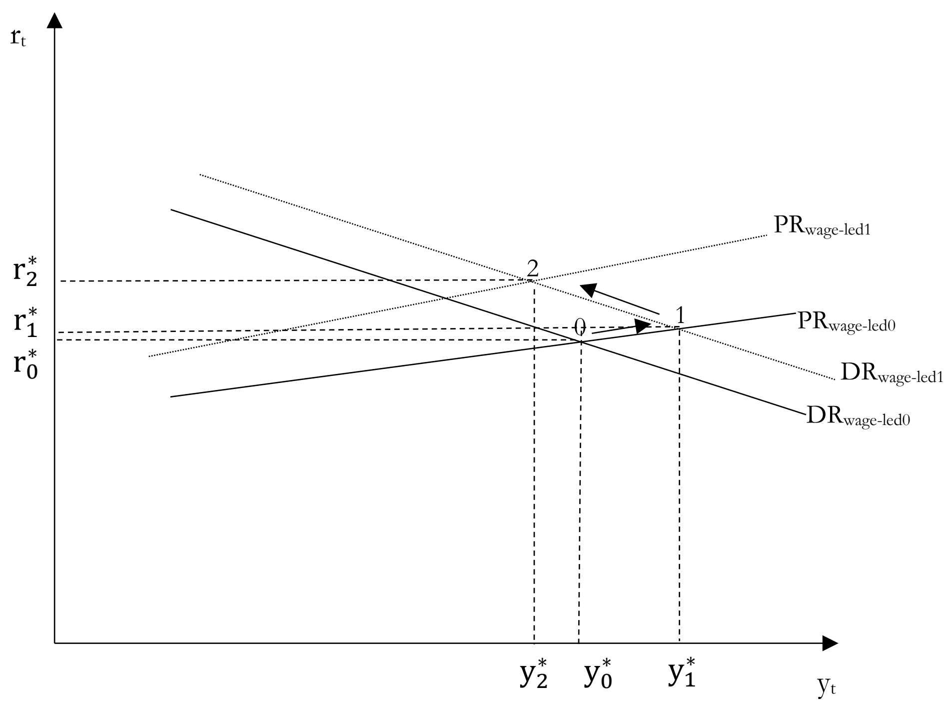
(2) Second scenario of wage-led demand regime: if the parameter $|b_1|$ is smaller than the expression $|b_1 b_2(\lambda_t^{-1} - b_2)^{-1}|$, the expression (32) is negative:

$$dy_t^*/d\theta_t = -b_1 - b_1 b_2(\lambda_t^{-1} - b_2)^{-1} < 0$$

this suggests that the expansionary effects of RER on wage-share in GDP via the lower labor productivity prevails in the detriment of its negative effects on demand growth. Therefore, devaluations of RER boost the demand growth.

Figure 2.7 illustrates the effects of devaluations of RER for an economy under a wage-led regime of demand and a profit-led regime of capital accumulation of the second scenario.

Figure 2. 7- Wage-led Regime of Demand and Profit-led Regime of Capital Accumulation (second scenario)



In this scenario, devaluations of RER increase the growth rate of demand and labor productivity: the demand regime line dislocates upwards, from 0 to 1 ($y_0^* < y_1^*$, $r_0^* < r_1^*$). As the economy is under a profit-led capital accumulation regime, devaluations of RER increase the parameters r_a

and λ_t. The productivity regime line dislocates upwards and turns steeper: the equilibrium values provided by the model change from point 1 to 2 (y_1*>y_2*, r_2*>r_1*).

Therefore, devaluations of RER harm the economic growth in economies under wage-led regimes of demand and a profit-led regime of capital accumulation of the second scenario. Once again, by endogenizing the productivity regime, the situation after devaluations of RER is worse, compared to the situation in which the productivity regime is exogenous: y_2*<y_0*<y_1* and r_0*<r_1*<r_2*. This occurs due to the increment of labor productivity induced by the greater pace of technological progress, which reduce the wage-share in GDP.

5- Concluding Remarks

This paper proposed a growth model, within the Kaldorian tradition of circular and cumulative causation, to study the influence of RER devaluations on economic growth, solving some limitations of the canonical KDT growth model on this issue. The most interesting characteristic of this model is the fact that it explicitly considers the RER, whilst its influences on economic growth occur via both demand-side as supply-side factors. Put differently, the influence of RER is not restricted uniquely to the demand-side, but it also occurs via the supply-side.

From the demand side, the influence of RER on economic growth is associated with the regime of demand. Devaluations of RER, in economies under a profit-led regime, positively impact the growth rate of demand and labor productivity. Nevertheless, in economies under a wage-led regime, the effects of RER devaluations are not straightforward. Its influence depends on which effect prevails: its direct contractionary effects on demand growth or its indirect expansionary effect on demand growth via its negative influence on labor productivity (that exerts a positive influence on wage-share in GDP). If the first effect prevails, devaluations of RER reduce the growth rate of demand and labor productivity. However, if the second effect prevails, devaluations of RER boost the growth rate of demand and labor productivity.

From the supply side, the influence of RER on economic growth is associated with the regime of capital accumulation. The model endogenized the parameters of productivity-regime regarding capital accumulation (which embodies technological progress). As faster is the pace of capital accumulation, the greater is the autonomous productivity growth. Moreover, the intensity of the Kaldor-Verdoorn mechanism also depends on capital accumulation, which means the RER influences the magnitude of the effect of growing demand on labor productivity. The demand growth is still the primary determinant of labor productivity. The RER influences labor productivity by changing productivity-regime parameters via its effects on capital accumulation/technological progress. In this regard, devaluations of RER in economies under a profit-led regime boost capital accumulation, which positively impacts labor productivity: the autonomous productivity increases, and the Kaldor-Verdoorn mechanism becomes more intense. In contrast, devaluations of RER in economies under a wage-led regime damage the capital accumulation, which negatively impacts labor productivity: the autonomous productivity reduces, and the Kaldor-Verdoorn mechanism becomes less intense.

As a circular and cumulative causation process, the impact of devaluations of RER on economic growth is associated with the interaction between the demand-side and supply-side factors. The model has shown that devaluations of RER:

(i) in economies under a profit-led regime of demand and capital accumulation, expand the demand growth, which, via the Kaldor-Verdoorn mechanism, increases labor productivity growth. In addition, the devaluations of RER induce a faster pace of capital accumulation/technological progress. Thereby, autonomous productivity increases and the Kaldor-Verdoorn mechanism becomes more intense, reinforcing the expansionary cycle. Therefore, the impacts of devaluations of RER on economic growth, in this case, are positive.

(ii) in economies under wage-led regimes of demand and capital accumulation, if the contractionary effects on demand growth prevail (first scenario), shorten the demand growth. Moreover, the devaluations of RER induce a slower pace of capital accumulation/technological progress in a way that the autonomous productivity reduce, and the Kaldor-Verdoorn mechanism becomes less intense, counterbalancing the contractionary process. Therefore, the impacts of devaluations of RER on economic growth, in this case, are negative. Nevertheless, it should be highlighted that making the parameters of the productivity regime endogenous to RER, implies a better situation after devaluations of RER, when compared to the situation in which the productivity regime is exogenous. In contrast, if the expansionary effects of RER devaluations on demand growth via its negative influence on labor productivity (that exerts a positive influence on wage-share in GDP) prevails (second scenario), devaluations of RER exert a positive influence on demand growth. Once again, the devaluations of RER induce a slower pace of capital accumulation and technological progress, reducing the autonomous productivity and the intensity of the Kaldor-Verdoorn mechanism. Into the extent that the labor productivity lowers (the wage-share in GDP increases), the economic growth accelerates. Therefore, the impacts of devaluations of RER on economic growth, in this case, are positive.

(iii) in economies under a wage-led regime of demand and a profit-led regime of capital accumulation, in the first scenario, shorten the demand growth. Furthermore, RER devaluations induce a faster pace of capital accumulation/technological progress. In this way, autonomous productivity increases, and the Kaldor-Verdoorn mechanism becomes more intense, reinforcing the contractionary process. In the second scenario, RER devaluations boost the demand growth, but the increases in labor productivity induced by the RER devaluations damages economic performance. Therefore, the impacts of devaluations of RER on economic growth, in both cases, are negative. It should be highlighted that making the productivity regime endogenous worsens the economic performance after RER devaluations, compared to the situation in which the productivity regime is exogenous.

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Appendix A- Real Exchange Rate, Endogenous Productivity Regime and External Constraint

Thirlwall (1979) claims that the growth rate of an economy is determined by the external constraint. This is Thirlwall's law. The equilibrium in the balance of payment determines economic growth. The growth rate of the economy is determined by the ratio of the income-elasticity of exports and the income elasticity of imports multiplied by the growth rate of foreign demand. In the case that the output grows more than the growth rate consistent with the equilibrium in the balance of payment, exports are not enough to finance imports. As a result, an external crisis emerges; the demand curtails, the supply turns underused, and then the investment is reduced (Thirlwall, 1979). Such an outcome is especially valid for developing countries.

There is a thought-provoking debate on that each Kaldorian growth model explains the economic growth of countries: the Thirlwall's law or the KDT model. Blecker (2013) argues that the KDT model provides the growth rate of the economy in the medium-run. Whereas Thirlwall's law provides the growth rate of an economy in the long-run (long period, not steady-state) (Blecker, 2013). As long Thirlwall's law assumes the Purchasing Power Parity (PPP), the argument of Blecker (2013) is that the PPP is not valid the in medium-run but only in the long-run. In order to obtain a meaningful interpretation of the growth process, the Kaldorian literature requires adjustment mechanisms between both growth rates (Shaikh, 2016). Usually, this literature assumes that the cumulative and circular causation of KDT adapts to the growth rate of demand consistent with the external constraint (see Thirlwall, 2001, Palley, 2002, Setterfield, 2006, McCombie, 2011, Setterfield, 2012, on this topic, for example).

This appendix provides a simple model in which the growth rate of output consistent with the external constraint, derived without the assumption of PPP, is associated with the parameters of the productivity regime. Therefore, RER devaluations influence the growth rate of output in the KDT framework as the growth rate of output consistent with the external constraint.

The external equilibrium requires that exports equal imports. Equaling the equations (26) and (27), introducing (19.2) and assuming that the foreign prices are determined as the same way that domestic prices (the lower letters *f* represent the foreign economy):

$$m_1 y_t = -n[(1 - \psi_d\sigma_d - mk_{d,1})\theta_{t,d} - (1- \psi_d)r_{t,d})] + \delta[(1 - \psi_f\sigma_f - mk_{f,1})\theta_{t,f} - (1- \psi_f)r_{t,f}] + \epsilon z_{t,f}$$

solving it for the growth rate of output, and assuming that $z_{t,f}=0$ and (for the sake of simplicity):

$$y_{t,bp} = m_1^{-1}\, \beta\{[(1 - \psi_f\sigma_f - mk_{f,1})\theta_{t,f} - (1 - \psi_d\sigma_d - mk_{d,1})\theta_{t,d}] + [(1- \psi_d)r_{t,d})- (1- \psi_f)r_{t,f}]\} \qquad (1A)$$

whereas $y_{t,bp}$ is the growth rate of output consistent with the equilibrium in the balance of payment.

Assuming that $\theta_{t,f} = r_{t,f} = 0$ (for the sake of simplicity)

$$y_{t,bp} = m_1^{-1} \cdot n\{(1 - \psi_d\sigma_d - mk_{d,1})\theta_{t,d}] + [(1 - \psi_d)r_{t,d})\} \quad (2A)$$

Introducing the productivity regime (equation 29) into the expression (2A), and assuming that the output grows at the growth rate of output consistent with the equilibrium in the balance of payment:

$$y_{t,bp} = -n\{(1 - \psi_d\sigma_d - mk_{d,1})\theta_{t,d} - (1 - \psi_d)r_a\}[1 - (1 - \psi_d)\lambda_t + m_1]^{-1} \quad (3A)$$

The expression (3A) provides the growth rate of output consistent with the balance of payment. The economic growth provided by the cumulative and circular causation is constrained by the external equilibrium. In the case that the real growth rate of output be greater than the output consistent with the balance of payment, an external crisis emerges. It should be noticed that:

i- RER devaluations expand the growth rate of output consistent with the equilibrium in the balance of payment. A devalued real exchange rate increases the exports, which allows that the internal demand grows without incurs in problems over the balance of payment.

ii- The parameters r_a and λ_t play a central role in determining the external constraint. As more productive is the economy, higher are the gains of competitiveness via the Kaldor-Verdoorn mechanism: the growth of exports tends to be relatively stronger, and the external constraint becomes ease. Therefore, the effects of RER devaluations on supply-side factors also act over the growth rate of output consistent with the balance of payment constraint.

Furthermore, the effects of RER go beyond than the simple price effect. In economies under a profit-led regime of capital accumulation, RER devaluations make the pace of capital accumulation and technological progress faster. Consequently, the parameters concerning the autonomous productivity growth $r_{d,a}$ and Kaldor-Verdoorn's coefficient λ_d become greater. As a result, the growth rate of output consistent with the balance of payment equilibrium increases, as equation (3A) shows. In economies under a wage-led regime of capital accumulation, devaluations of RER make the pace of capital accumulation and technological progress slower: the autonomous productivity growth $r_{d,a}$ and Kaldor-Verdoorn's coefficient λ_d become smaller. However, the impact of devaluations of RER over the growth rate of output consistent with the balance of payment equilibrium depends on if the latter effect is stronger than the expansionary effect over exports growth.

THIRD ESSAY - Exchange Rate and Growth: Empirical Evidence (1995-2018)

Abstract

This article assesses the effects of exchange rate movements on long-term growth for a set of one hundred and fifty-one countries over the period 1995-2018. Firstly, it was performed various econometric models to estimate the exchange rate values at equilibrium and then to construct measures of exchange rate misalignments. Following the literature, various fundamentals were considered, namely, the Balassa-Samuelson effect, net foreign assets, and terms of trade. A new variable was introduced as a determinant of the equilibrium exchange rate, the labor costs. The findings point out that the exchange rate is not neutral for growth. Devaluations promote long-run growth, and overvaluations hurt it. The results are robust to different growth model specifications, measures of exchange rate misalignments, and to different sets of countries. Such an effect is especially valid for developing countries. Further results suggest that the pursuit of a competitive exchange rate helps to explain the more rapid growth of Asian economies in relation to Latin America and Africa ones. Lastly, it was not found robust evidence that the effect of exchange movements on growth follows a non-linear pattern.

Keywords: Exchange Rate Misalignments, Long-run Growth.

1- Introduction

The exchange rate is a relative price that represents the price of domestic currency in terms of other national currency. In recent years, a growing literature has shown empirical evidence pointing out that the exchange rate is not neutral for economic growth. However, the exchange rate has been the subject of controversy in economic growth models (Schröder, 2013). On the one hand, the exchange rate is disregarded in mainstream growth models – elaborated for closed economies as Solow's model and endogenous growth theories (Schröder, 2013). On the other, two opposite views compete concerning the best exchange rate policy for economic growth (Schröder, 2013).

The Washington Consensus view claims that any misalignment of the exchange rate from its equilibrium situation hurts growth (Williamson, 1990). An overvalued exchange rate leads to crises in the balance of payments that requires the "stop-and-go" strategy to reduce imports or import controls (Berg, 2010). However, an exchange rate strongly competitive produces inflationary pressures that reduce investment, which curbs potential output growth (Willianson, 1990). Although an overvalued domestic currency is worse than an undervalued, economic growth is associated with maintaining the exchange rate at equilibrium (Schröder, 2013).

The opposite view claims that an overvalued exchange rate hurts economic growth, whilst a devalued currency boosts it. It is identified some mechanisms in theoretical literature to explain such a relationship. In export-led economic growth models (e.g., Kaldor, 1970, Dixon and Thirlwall, 1975), an exchange rate policy that keeps a stable and devalued exchange rate may work as an engine, promoting growth as it increases exports' competitiveness. The effects of this outward orientation policy go further as it reduces risks, shorter investment horizons and benefits the tradable sectors, which, to an extent, explains the reasons why Asian countries have grown more rapidly than Latin America and Africa ones (Sachs, 1985, Cavallo at all, 1990, Dollar, 1992).

Another strand states that the exchange rate drives capital accumulation by changing income distribution in favor of real wages (overvaluations) or profit-margin (devaluations) (Blecker, 1989, Bahduri and Marglin, 1990). Within profit-led economies, reductions in real wage – generated by exchange rate devaluations or not, boost output growth. The *rationale* behind it is that the reductions in labor costs increase the competitiveness of tradable sectors and then boost exports. The effects are broader, exchange rate devaluations – by increasing companies' revenue and cutting real wages - increase internal funds of firms to finance new investments.

The distributive effects of exchange rate favor differently the sectors, promoting a structural change towards non-tradable or tradable sectors (Frenkel and Ros, 2006, Rodrik, 2008, Bhalla, 2012 and Ros, 2013, among others). Exchange rate overvaluations favor real wage – consumption, and non-tradable sectors, represented by services. Devaluations, in turn, increase profit-rate – saving and investment, and tradable sectors; as it encompasses industry - the sector with more innovative activities and backward/forward linkages, and increasing returns to scale, devaluations of the exchange rate may promote a structural change *a la* Lewis (1954), Hirschmann (1958) and Kaldor (1956), leading to higher growth rates of *per capita* income.

The other growth mechanism is associated with the effects of the exchange rate on income-elasticities of exports and imports within the balance of payment growth models *a la* Thirlwall (1979). Devaluations of exchange rate boost firms' investments in technological progress (by increasing its internal funds), which *ceteris paribus* enlarges the income elasticity of exports and the growth rate of output compatible with external constraint. (Ferrari et al., 2013, Missio and Jayme Jr., 2012, Missio et al, 2017). Overvaluations of the exchange rate, in turn, reduce the availability of internal funds to finance investment of firms in technological progress, which leads to higher income elasticity of imports and then to lower growth rate of output compatible with external constraint (Ferrari et al., 2013, Missio and Jayme Jr., 2012, Missio et al, 2017).

This article seeks to assess the effects of exchange rate movements on long-term growth for a set of one hundred and fifty-one countries over the period 1995-2018. The first step was to construct measures of exchange rate misalignment, which was carried out following the well-established procedure of Rodrik (2008). Various fundamentals suggested by the literature were considered; Balassa-Samuelson effect, net foreign assets, and terms of trade. A novelty of this article is the introduction of labor costs as a fundamental of the exchange rate. The argument is that higher (lower) labor costs make the tradable goods more expensive (cheap), leading to real exchange rate appreciations (depreciations).

A series of growth regressions were performed employing different exchange of rate measures, specifications, methods, controlling for other covariates and sets of countries. The results suggest that the exchange rate is not neutral for growth. Devaluations of exchange rate boost long-run growth as overvaluations hurt it. Furthermore, keeping the exchange rate at equilibrium values has not shown enough to explain growth, as Washington Consensus suggested. The effects of exchange rate are especially valid for developing countries, which is associated with the *per capita* income cut line used to define countries in development. It was also found suggestive evidence that the exchange rate policy pursued by Asian countries helps to explain its better economic performance compared to Latin America and Africa. Lastly, there is no robust evidence that the effects of exchange rate on growth follow a non-linear pattern.

The article consists of eleven parts. After this introduction, Section 2 provides a discussion on the practices of the empirical literature on the relationship between exchange rate, and growth, highlighting the different estimating methods, exchange rate concepts and database employed, as well as its main conclusions. Section 3 discusses the different exchange rate concepts and the underpinning ideas of equilibrium and exchange rate misalignment. Special attention is given to the theory of purchasing power parity (PPP, henceforth) and the Balassa-Samuelson hypothesis (BSH, henceforth) once these theories are the benchmark theoretical-conceptual understanding of empirical literature. Plus, it is also discussed the theory of behavioral equilibrium of exchange rate (BEER, henceforth) because the calculation of measures of exchange rate misalignment follows this approach. Section 4 presents the estimates of exchange rate misalignments. Section 5 discusses the empirical strategy and database employed in growth estimates, which, in turn, are discussed in Section 6. Section 7 delivers additional regressions to test the validity of Washington Consensus claims. Sections 8 and 9 provide robustness checks for growth estimates employing a different specification and the measure of exchange rate calculated by Couhard (2017). Section 10 tests the non-linearity between the exchange rate and growth. Section 11 ends the article with the main conclusions derived from empirical estimates.

2- Review of empirical literature

The empirical cross-country literature employs different exchange rate concepts, econometric methods, and databases to assesses the exchange rate's effects on economic performance. Most of the empirical literature is focused on explaining the effects of the exchange rate in the long-run growth (growth rate of GDP per capita).

Cottani et all (1990) assessed the effects of exchange misalignments and exchange volatility in the growth rate of GDP per capita, exports, imports, investment, agriculture production, and incremental capital-output ratio for 24 less developed countries over the period 1960-1983 employing cross-sectional regressions. The author concluded that higher exchange volatility and misalignments of real exchange rates hurt all dependent variables' growth rate, except for the capital-output ratio. Dollar (1992) performed cross-sectional regressions to assess the effects of exchange misalignments from the hypothetical free-trade level (trade orientation of economy; outwards or inwards) in the growth rate of GDP per capita for 95 less developed countries over the period 1976-1985. The results of Dollar (1992) point out that higher exchange volatility hurts the growth rate of GDP per capita and the outward-orientation (trade liberalization, devaluations and stability) is positively associated with higher growth rates.

Razin and Collins (1997) performed regressions in a panel data setting to test the relationship between the real exchange rate misalignment and the growth rate of GDP per capita for 93 countries over the period 1975-1992 (20 developed countries and 73 developing countries). Their conclusions stressed the existence of a non-linear relationship between real exchange rate and growth. Only high over-valuations are associated with slower economic growth and moderated to high (but not too high) under-valuations are associated with a higher economic growth rate. Easterly (2001), in turn, assessed the relationship between exchange misalignment and the growth rate of GDP for developing countries over the period 1980-1998, employing seemingly unrelated regressions. Easterly (2001) concluded that devaluations are associated with higher growth rates.

In a historical perspective, Acemoglu (2005) tested the effects of exchange misalignments in the standard deviation of the growth rate of GDP per capita (growth volatility) for the countries of Penn World Table over the period 1970-1997 (and the average of each decade) using cross-sectional regressions (OLS and 2SLS) and panel regressions (FE and RE). Acemoglu associates the weak institutions inherited from colonial times (extractive institutions) with distortionary macroeconomic policies, encompassing an overvalued exchange rate (high inflation and budget deficit. The overvalued exchange rate partially explains the high volatility of the growth rate of GDP per capita. Acemoglu (2005) concluded that the real exchange overvaluation is used as a method of income redistribution in favor of elites and a self-perpetuating way this elite in the power.

Aguirre and Calderón (2005) estimated the relationship between exchange misalignments and the growth rate of GDP per capita for 60 countries over the period 1965-2003 in a panel data setting. The authors pointed out the existence of a negative relationship between exchange misalignment and growth. Besides, they showed that overvaluation and undervaluation adversely affect the growth with different intensity following a non-linear pattern. The higher overvaluation lowest is the growth, while moderate real exchange undervaluations are positively associated to growth rates of GDP per capita.

Hausmann, Pritchett and Rodrik (2005) assessed the association between the real exchange rate and the episodes of rapid acceleration in economic growth for all countries of Penn World Table 6.0 (excluding the countries with a population less than 1 million and with fewer than 20 data points). They assessed this relationship employing cross-sectional regressions for 83 episodes of growth accelerations concentrated in the period between 1957 and 1992. Their conclusions point out that growth accelerations require more investment, exports, and a more competitive exchange rate. In this line, Johnson, Ostry and Subramanian (2007) also tested the existence of an association between the episodes of rapid acceleration in economic growth and the real exchange rate for sub-Saharan African Countries. They concluded that avoiding real exchange rate overvaluation is essential to escape from poverty and the historical trap of weak institutions as it increases the manufacturing exports.

Gala (2007) performed growth regressions in a panel data set for 58 developing countries over the period 1960-1999 to explain the growth rate of GDP capita. Gala (2007) concluded that exchange overvaluations (devaluations) hurt (boost) the growth rate of GDP per capita. Rodrik (2008) performed very similar growth regressions in a panel data set for 184 countries over the period 1950-2004. Rodrik (2008) displayed that exchange overvaluation hurts growth meanwhile undervaluation helps economic growth following a linear pattern. This result is especially valid for developing countries (Rodrik, 2008).

Employing the same sample and estimating procedures of Rodrik (2008), Berg and Miao (2010) concluded that exchange overvaluation hurts growth, and undervaluation helps economic growth following a linear pattern. Besides, the authors showed that different measures of the exchange rate (Rodrik's measure and other specifications that consider other determinants of equilibrium exchange rates) lead to the same obtained results. Following Rodrik (2008) – with the same database and estimating procedures, Rapetti, Skott, and Razmi (2011) concluded that exchange undervaluation is stronger correlated and more robust with economic growth in developing countries. Still, they pointed out that this result depends on the GDP per capita cut-off that defines the developing countries.

Levy-Yevati and Sturzernegger (2009) associated the monetary authority intervenes to avoid the appreciation of national currency with the growth of real GDP for 179 countries over 1974-2004. They created two variables to represent this "fear of appreciation" as (i) the interventions of the monetary authority to avoid the appreciation of national currency represented by the annual average of the absolute value of monthly interventions (the average change in net international reserves relative to the monetary base in the previous month) and (ii) the annual change of the ratio between the foreign assets and broad money. Levy-Yevati and Sturzernegger (2009) pointed out that the "fear of appreciation" has a positive effect on growth.

Berg, Ostry and Zettelmeyer (2012) performed regressions to explain the length of sustained growth periods for 140 countries. Their conclusions state that the length of growth periods is negatively associated with external shocks and macroeconomic volatility. On the other hand, the growth periods' length is positively associated with good political institutions and an income distribution more equal. Their results also suggest that the export composition and the real exchange rate matter as the manufacturing exports are associated with a more extensive period of growth, and the avoidance of overvaluation is favorable for the duration of growth periods.

Vieira and MacDonald (2012) tested seven different specifications of exchange misalignments to explain the GDP growth rate for 90 countries over the period 1980-2004 using regressions in a panel data set. They concluded that a more depreciated exchange rate boosts the economy's growth rate, and the different specifications of exchange misalignments produce different estimates in growth regressions, notwithstanding it leads to similar results.

Schröder (2013) performed regressions in a panel data set to explain the growth rate of GDP capita for 63 developing countries over the period 1970-2007. Schröder (2013) concluded that exchange rate undervaluations hurt growth. Besides, the prescription of Washington consensus, according to which exchange rate's equilibrium position is better to foster growth. However, Schröder (2013) states that this is not a sufficient condition to grow more. A non-misaligned exchange rate is simply a facilitating condition.

Missio *et al* (2015) performed growth regressions in a panel setting for three samples of countries over the period 1980-2008 to understand how the exchange rate affects the growth rate of GDP per capita. Their results state that an undervalued real exchange rate boosts the growth rate. The novelty of their estimates is testing the possible non-linearity using quantile regressions, confirming a non-linear relationship between real exchange rate and growth for countries of average income. Ribeiro et al. (2020) re-evaluated the relationship between real exchange rate and long-run growth by considering further aspects of income distribution, technological capability within developing countries. The regressions performed by the authors indicated that the exchange rate has not directly influenced the growth of developing countries. Nevertheless, the authors indicate that the exchange rate influences (negatively) the long-run growth through its effects on income distribution and cross-country technological capabilities.

On the other hand, few cross-country studies that assessed the effects of exchange rate movements in other variables associated with economic growth. Bahmani-Oskooee and Hajilee (2010), Razmi and Rapetti and Skott (2012), employing different databases and econometric methods, showed that exchange devaluations have a positive effect on investment. Glüzmann, Levy-Yeyati and Sturzenegger (2012) showed that exchange devaluations reallocate the national income towards investments and savings to the detriment of consumption. Some studies showed that exchange rate devaluations are positively associated with the decisions of investment at the firm-level through different channels (Dao, Minoiu and Ostry, 2017, Avdjiev, Bruno, Koch and Shin, 2018, Brito, Magud and Sosa, 2018), with industrial employment and output of exporting sectors (Galindo, Izquierdo and Montero, 2007, Lanau, 2017) and with structural changes towards manufacturing and more complex sectors (Gabriel and Missio, 2018).

In sum, the exchange rate effects on long-run growth are confirmed by empirical literature. Still, the direction and the intensity are not consensual in literature as it can vary according to the database, the different concepts of the exchange rate, empirical methods, samples and specification.[23] The next section discusses the real exchange rate's theoretical notions, facing various exchange rate concepts employed in the empirical literature, equilibrium and misalignment.

3- Real exchange rate, Equilibrium and Misalignment

The exchange rate is a relative price because it represents the domestic currency's price in a foreign currency. There are various concepts and understandings of exchange rate and exchange rate equilibrium, and each one is related to different relative prices of the economy (Driver and Westaway, 2004). In a broader sense, adopting a specific theoretical concept means adopting a specific interpretation of the relationship between the exchange rate and economic performance (Driver and Westaway, 2004).

One of the first definitions of exchange rate and notions of equilibrium of exchange rate is present in the PPP theory developed by Cassel (1918). Following Dornbusch (1985), it is

[23] Table 3.A 1 (in Appendix A) offers a synthesis more detailed concerning the exchange rate measure employed, dependent variables, sample, econometric methods, and results on the papers discussed in this section.

assumed that P_i and P_i^* stand for the prices' level of *ith* commodity respectively of the domestic and foreign economy and E stands for the nominal exchange rate that denotes the domestic currency in dollar. The strong version of PPP (the law of one price) states that, in the absence of frictions of international trade, the prices in dollar at the nominal exchange rate E of the same goods equal in all countries (Dornbusch, 1985):[24]

$$P_i = EP_i^* \text{ or } E = P_i/P_i^* \quad (1)$$

This way, the nominal exchange rate always equals one; there is an arbitrage mechanism that assures the law of one price holds (Dornbusch, 1985). If the domestic price is higher than the foreign price, the imports of foreign goods reduce the domestic price; thus, that the absolute version of PPP is a long-run relationship (MacDonald, 2007).

The weak - or the relative version, of PPP rewrites the equation (1) in terms of growth rate, considering the constant θ to represent the obstacles to trade (tariffs, delivering costs, etc.), that is, $P_i=\theta EP_i^*$ (Blanchard, 1985):

$$p_i = e + p_i^* \text{ or } e = p_i - p_i^* \quad (1.1)$$

In the weak version, the PPP states that rises in domestic prices, concerning abroad prices appreciate the national currency (Blanchard, 1985). The *law of one price* does no longer hold, and the exchange rate stems from the difference between domestic and abroad price variations (Blanchard, 1985). This is a monetary theory of exchange rate determining as the exchange rate adapts to prices (Blanchard, 1985).

There are various criticisms on the PPP, among which: the need that the consumption basket of all countries must be the same in order to provide comparable price indexes; domestic and foreign goods are strictly homogenous; and the fact that the PPP theory considers only the tradable prices to compute the exchange rate (Dornbusch, 1985). An alternative way is to split the exchange rate into two relative prices: the prices of tradable and the non-tradable goods. Assuming that the overall price of economy p_t is compounded by the price of tradable goods p_t^T and the price of non-tradable goods p_t^{NT} (MacDonald, 2007):

$$p_t = \beta_t p_t^T + (1 + \beta_t) p_t^{NT} \quad (2)$$

$$p_t^* = \beta_t p_t^{T*} + (1 + \beta_t) p_t^{NT*} \quad (3)$$

[24] The price of identical domestic and foreign consumption baskets.

where the parameter β represents the share of tradable goods that ranges from 0 to 1 (all variables are denoted in a logarithmic form). MacDonald (2007) assumes that the real exchange rate q_t and the real exchange rate for tradable goods q_t^T are:

$$q_t = e_t - p_t + p_t^* \tag{4}$$

$$q_t^T = e_t - p_t^T + p_t^{T*} \tag{5}$$

By introducing (3), (4) and (6) into (5):

$$q_t = q_t^T + (\beta_t - 1)[(p_t^{NT} - p_t^T) - (p_t^{NT*} - p_t^{T*})] \tag{6}$$

or

$$q_t = q_t^T + q_t^{NT,T} \tag{6.1}$$

where the second term of (6) is the relative price of non-tradable and tradable sectors compared to the domestic and the foreign countries $q_t^{NT,T}$. According to equation (6.1), the movements of the real exchange rate (deviations of PPP) are related to the relative price of traded goods q_t^T and the internal relative prices $p_t^{NT,T}$ (MacDonald, 2007). Hence, there is the possibility that the real exchange rate differs from the PPP equilibrium as q_t^T does not equal $q_t^{NT,T}$ (MacDonald, 2007). Thus, in ignoring the difference between the relative prices/productivity of tradable and non-tradable sectors in the domestic economy, the relationship between real exchange rate and relative prices become skewed in a cross-country perspective (Asea and Corden, 1994).

As the productivity of the tradable sector is higher than the non-tradable sector in a higher-income economy, the higher real wages of tradable sectors will spread towards the non-tradable sector, increasing its relative price (Balassa, 1964). The *law of one price* would not be valid and, the difference in productivity between the economies leads to systematic deviation of the real exchange rate from PPP (Balassa, 1964). The higher-income economy's currency will be persistently overvalued in relation to PPP, and such a difference is associated with income level (Balassa, 1964). This is the criticism of Balassa (1964) and Samuelson (1964). The theory developed by them to explain the systematic deviations of the real exchange rate from PPP is known as the Balassa-Samuelson hypothesis (BSH).

Following the BSH model developed by Balassa (1964) and derived by Obstfeld (1993), Asea and Corden (1994), and MacDonald (2007) for a small open economy that uses labor L

and capital K[25] to produce tradable goods T (agricultural and manufacturing goods whose price is determined in international market) and non-tradable goods NT (services whose price is determined in domestic market), it is assumed that the law of one price holds for tradable sector and that they determine nominal wages. The economy is assumed to be at full employment, and the production Y of tradable T and non-tradable NT sectors is described by a Cobb-Douglas function:

$$Y_T = \theta_T K_T^{\beta_T} L_T^{\alpha_T} \equiv \theta_T L_T f(k_T) \quad (7)$$

$$Y_{NT} = \theta_{NT} K_{NT}^{\beta_{NT}} L_{NT}^{\alpha_{NT}} \equiv \theta_{NT} L_{NT} f(k_{NT}) \quad (8)$$

Where $k_{T,NT}= K_{T,NT}/L_{T,NT}$ and $\theta_{T,NT}$ represents the stochastic productivity parameters.

The capital receives its marginal product which equals the interest rate i and the labor receives the wage. As the world interest rate i is given for the small economy:

$$i = \theta_T \beta_T k_T^{\beta_T - 1} \quad (9)$$

$$i = q_t^{NT,T} \theta_{NT} \beta_{NT} k_{NT}^{\beta_{NT} - 1} \quad (9.1)$$

k_t is given by (9) and the factor-price frontier (FPF) determines the wage w of the economy (Obstfeld, 1993), so that:

$$w = \theta_T[f(k_T) - f'(k_T)k_T] = \theta_T(1 - \beta_T)k_T^{\beta_T} \quad (10)$$

Solving (9) for k_t and introducing it into (10):

$$w = (1 - \beta_T)\theta_T^{\frac{1}{1-\beta_T}} (\frac{\beta_T}{i})^{\frac{\beta_T}{1-\beta_T}} \quad (10.1)$$

given the international prices, the economy's wage is determined entirely by the productivity of tradable goods. Consequently, higher the productivity of tradable sectors higher the wage of economy.

As k_{NT} is given by (9.1), introducing it with (8) and (10.1) into the condition that the perfect competition requires[26], it obtains the dynamic of $q_t^{NT,T}$ (in growth rate and assuming that i is constant):

$$\widehat{q_t^{NT,T}} = \frac{1-\beta_T}{1-\beta_{TN}} \widehat{\theta_T} - \widehat{\theta_{NT}} \quad (11)$$

---

[25] With perfect mobility of both inputs across the domestic sector, but, at the international level, with the immobility of L and perfectly mobility of K (Obstfeld, 1993, Asea and Corden 1994, and MacDonald, 2007).

[26] $ik_{NT}+w=q_t^{NT,T}\theta_{NT}f(k_{NT})$

equation (11) shows that the deviations of PPP equilibrium are caused by the difference of productivity between the tradable and non-tradable sectors (MacDonald, 2007).

Following Balassa (1964), the *rationale* behind equation (11) is that, as the higher productivity is concentrated in the tradable sectors, its higher wages increase the wages of non-tradable sectors. This dynamic increases the prices of non-tradable goods (the services are most expensive in the richest countries with higher productivity of tradable sectors) and the domestic price-index, which leads to an overvalued exchange rate in terms of PPP (Balassa, 1964). The higher the tradable sector's productivity is, the higher is the deviation of the real exchange rate from the PPP equilibrium (Balassa, 1964). Assuming that the GDP per capita represents the different productivity level of countries, the deviations of exchange rate from PPP equilibrium level becomes an increasing function of income level (Balassa, 1964).

The various concepts of exchange rate, equilibrium and misalignment underpin different definitions of exchange rate with distinct interpretations about the relative prices (Driver and Westaway, 2004). The exchange rate concepts produce an extensive literature about the empirical procedures to estimate the equilibrium and misalignments of the exchange rate (Driver and Westaway, 2004). As each concept is related to a specific relative price of the economy, choosing a specific meaning of exchange rate leads to a peculiar understanding of exchange movements' effects on economic performance through transmission channels inherent to each concept (Driver and Westaway, 2004).

In this sense, the BEER approach is a modeling strategy of the behavior of exchange rate that considers relevant economic variables pointed by the economic theory to explain it (Clark and MacDonald, 1998).[27] The equilibrium notion arises from the values of economic variables considered in estimates (Clark and MacDonald, 1998). The BEER may be estimated using the following reduced-form equation (Clark and MacDonald, 1998):

$$q_t = b_1' Z_{1t} + b_2' Z_{2t} + \tau' T_t + \varepsilon_t \qquad (12)$$

the variables q_t, Z_{1t}, Z_{2t}, T_t stand respectively for the actual value of exchange rate, a vector of fundamental variables that have persistent effects over the long-run, a vector of fundamental variables that influence the exchange rate over the medium-run (business cycle) and a vector of transitory variables that influences the exchange rate over the short-run, b_1', b_2' and τ are the

[27] The empirical estimates of this study use the BEER approach, so the explanations strive for to discuss this approach. Table 3.A 2 (appendix A) presents the summary of Driver and Westaway (2004) on the different concepts of exchange rate.

respective coefficients and ε_t is a random disturbance term (Clark and MacDonald, 1998). The misalignment of exchange rate mis_t is the difference between the effective exchange rate q_t and the estimate of the equilibrium exchange rate (Clark and MacDonald, 1998).

Distinguishing Z_{1t} and Z_{2t} is an arduous task, so that both vectors of fundamentals are not differentiated in estimates (Clark and MacDonald, 1998). The equilibrium of exchange rate $q_t^{'}$ is represented by two sets of fundamentals Z_{1t} and Z_{2t} (Clark and MacDonald, 1998):

$$q_t' = b_1' Z_{1t} + b_2' Z_{2t} \tag{13}$$

The exchange misalignment mis_t is the difference between q_t and the estimated q_t (Clark and MacDonald, 1998). The misalignments of exchange rate mis_t result from the random term and the vector of transitory variables that influences the exchange rate over the short-run (Clark and MacDonald, 1998):

$$mis_t = q_t - q_t' = \varepsilon_t + \tau' T_t \tag{14}$$

Driver and Westaway (2004) discuss the exchange equilibrium in terms of time horizon according which to the equilibrium situation is reached. The short-run equilibrium q_t^{sr} is the exchange rate that results from washing out the influence of random effects ε_t (e.g., financial bubbles) (Driver and Westaway, 2004). The short-run equilibrium is when agents have full knowledge of reality (Driver and Westaway, 2004).:

$$q_t^{sr} = b_1' Z_{1t} + b_2' Z_{2t} + \tau' T_t \tag{15}$$

The short-run misalignment mis_t^{sr} is given by $mis_t = q_t - q_t^{sr} = \varepsilon_t$. So, the short-run exchange misalignment results purely from the random term (Driver and Westaway, 2004).

The medium-run equilibrium corresponds to that exchange rate compatible with the internal and external balance of economy *a la* Nurkse (1945) (Driver and Westaway, 2004). This exchange rate pertains to periods more extensive than a year (to exclude the seasonal fluctuations) and closer to five or ten years (to exclude the cyclical fluctuation) (Nurkse, 1945). Such an exchange rate allows reaching the equilibrium of external accounts at the end of this length of time in the absence of importation restrictions or exportation stimulations (Nurkse, 1945). The medium-run equilibrium of the exchange rate is associated with the internal equilibrium of the economy. There is an equilibrium of domestic variables in terms of capacity utilization, demand growth, unemployment, inflation, income distribution, among other variables, associated with exchange rate (Nurkse, 1945). This equilibrium is one according which the output gap is zero, and the unemployment rate does not accelerate the inflation (Driver and

Westaway, 2004). Reaching the external equilibrium by reducing the internal demand or by disturbing the internal equilibrium is an artificial way to do it (Nurkse, 1945). The "true" exchange rate is reached only through "natural" or "normal" levels of domestic macroeconomic variables (Nurkse, 1945).

The long-run exchange equilibrium pertains to a situation in which there is a stock-flow equilibrium for all agents, in a way that there is no change of assets stock as a percentage of GDP and there is no endogenous tendency of change (Driver and Westaway, 2004). This equilibrium takes many years to be reached (Driver and Westaway, 2004).

4- Exchange Rate Misalignments

This section presents the empirics of measuring real exchange rate misalignments employed in growth regressions. The procedure of Rodrik (2008) is the benchmark of literature in calculating the real exchange rate misalignments, and it is employed in this article. For that, it uses data from World Bank for the real exchange rate (RER):

$$LRER_{it} = L(PPP_{it}/XRAT_{it}) \qquad (16)$$

where *i* and *t* denote country and time (5-year) index, respectively. The variables PPP_{it} and $XRAT_{it}$ stand for conversion factor and nominal exchange rate, expressed as national currency units per U.S. dollar, (L denotes that variables are in logarithm form). When *LRER* is greater than zero, it means that currency's valor is higher (more appreciated) than the purchasing power parity. Otherwise, when *LRER* is lower than zero, it means that the valor of the currency is lower (more depreciated) than the purchasing power parity.

Following the BEER approach, the fundamentals should be considered to calculate the measures of exchange rate misalignments. Rodrik (2008) calculated it considering the Balassa-Samuelson effect (BS) captured by a regression of RER on *per capita* GDP (PIBCAPITA):

$$LRER_{it} = \alpha + \beta LPIBCAPITA_{it} + f_t + u_{it} \qquad (17)$$

where f_t and u_{it} are a time fixed effect (5-year) and the error terms. The estimates of Rodrik (2008) provided the estimated coefficient around 0.24 and statistically significant for β, suggesting that increases of 1% in *per capita* GDP increases the valor of national currency by 0.24% (more appreciated). Our estimates of equation (17) - Model 1 presented in Table 3.B 1 (appendix B), suggested that β is statistically significant at 1% and equals 0.19.

Following Vieira and MacDonald (2012), other variables are introduced in estimates of exchange rate misalignments. Six additional specifications are performed controlling other fundamentals. The data involves a set of 151 countries ranging the period from 1990 to 2018, presented in Table 3.C 1 (appendix C). The variable net foreign asset (ASSET) is employed to capture the external adjustment. Countries with better current account positions are associated with an (the) appreciation of their national currencies (Viera and MacDonald, 2012). Higher prices of exports in relation to prices of imports are positively associated with exchange rate, so the variable terms of trade (TOT) are introduced to capture such effect (Viera and MacDonald, 2012). The government consumption (GOV) is introduced, in estimates, to capture changes in the demand composition, which is positively associated with exchange rate (Viera and MacDonald, 2012). Lastly, the wage-share of GDP (W) is considered to capture the effects of labor costs in tradable goods' prices. The argument is that higher (lower) labor costs make the exports more (less) expensive, then the outcome is a real exchange rate appreciation (depreciation).

Table 3.B 1 in appendix B reports the estimates of exchange rate misalignments for our various specifications. The Hausman test indicated that the random effect model is the most appropriated for Models 1, 6, and 7, while the fixed effect is suitable for Models 2, 3, 4, and 5. Models 1-5 regressed RER on PIBCAPITA, considering the other four fundamentals individually (ASSET, TOT, GOV, and W). The BS remained positive and statistically significant, even though its magnitude has varied across the Models. No other fundamental is statistically significant in Models 1-5. Models 6 and 7 regressed RER on other fundamentals disregarding the variable PIBCAPITA. Only the variable wage-share of GDP is statistically significant, at least, at 5% in both Models. The parameter equals 0.29 in Model 6 and 0.24 in Model 7, which indicates that increases (decreases) in wage costs strength (weaken) the national currencies, making them more appreciated (depreciated).

Once estimated the equilibrium real exchange rate considering various fundamentals (PIBCAPITA, ASSET, TOT, GOV, and W), the last step in constructing the index of exchange rate misalignment was to calculate the difference between the real exchange rate (LRER) and the exchange rate adjusted by the different fundamentals provided by Models 1-7; Mis_1, Mis_2, Mis_3, Mis_4, Mis_5, Mis_6, and Mis_7. This is done following the procedure of Rodrik (2008). Negative (positive) values of exchange rate misalignments indicate that the exchange rate is undervalued (overvalued) in relation to the equilibrium real exchange rate.

The next section discusses the empirical strategy and the database used in growth regressions.

5- Empirical Strategy and Database

The empirical strategy consists of estimating econometric regressions to explain the long-run growth employing databases in a panel setting for 151 countries over the period between 1995- 2018. The dependent variable is the log-difference of real GDP per capita (PPP). This variable comes from the World Bank. The first basic growth equation is represented as follow:

$$y_{ti}=\alpha+\beta Y_{bi}+\beta_1 mis_{t-1,i}+ \beta_2 controls+f_t+f_i+ u_{it} \quad (18)$$

where f_t and f_i are a time fixed effect (5-year) and country fixed effects, Y_{bi} represents the convergence term (the logarithm of *per capita* GDP at beginning period), the measures of real exchange rate misalignments are used lagged to assure that causality runs from the right side of the equation to left side. A negative signal of β_1 means that exchange devaluations (overvaluations) are positively (negatively) associated with growth. Meanwhile, a positive signal of β_1 means that exchange devaluations (overvaluations) are negatively (positively) associated with growth.

Other variables are controlled, such as years of education (human capital), executive constraints (institutions), saving rate, government consumption (fiscal discipline), openness degree (trade openness), and inflation (macroeconomic stability). The controlling variable is employed in logarithm form, except for institutions and inflation. Table 3.C 1 (appendix C) presents all variables. The *rationale* in our empirical strategy is to estimate a baseline model (more parsimonious) with the lagged dependable variable (dynamic models), the convergence term, human capital, and one measure of real exchange rate misalignment (Model 1). Then, expanding the model by considering the variables saving rate (Model 2), government consumption (Model 3), openness degree (Model 4), and inflation (Model 5) in addition to the variables of the baseline model. At last, a final model is performed considering all independent variables (Model 6).

The estimates are performed using dynamic panel data models in a System of equations employing the levels and differences of independent variables as instruments – endogenous instruments (Blundell and Bond, 1998). This methodology estimates the parameters using the *Generalized Method of Moments* (GMM) and assures the control of individual unobserved characteristics and the elimination of the potential endogeneity of independent variables. The System of GMM was chosen to the detriment of the Difference GMM, developed by Arellano and Bond (1991), because the last methodology can enlarge the variance of coefficients and produce bias in estimates in small samples. Furthermore, the System GMM is a suitable methodology when (Roodman, 2009): periods of time are smaller than the number of cross-sectional individuals (T<N), the estimated equation is linear and fixed effects are used, lagged values of the dependent variable are employed as an explanatory variable, independent variables are not strictly exogenous and are correlated with their past values and the error term, the errors are heteroskedastic and autocorrelated (Roodman, 2009). The regressions were performed using the options robust and two-step. The validity of the results is associated with the non-rejection of the null hypothesis of Arellano and Bond's test for autocorrelation of the order 2 in error term and the non-rejection of the null hypothesis of Hansen's test that instruments are valid (non-correlated with the error term).

The next section presents the results of long-run growth estimates.

6- Exchange Rate Misalignments and Growth

The estimates for long-run growth equations of Models 1-6 are reported in Appendix D (Tables 3.D 1 – 3.D 8). The estimated coefficients for the variables LRER and the measures of exchange rate misalignments are summarized in Table 3. 1, below. The output suggests that all coefficients are statistically significant (at 10% of critical values) and negative, meaning that a more depreciated (appreciated) real exchange rate boosts (harms) long-run growth.

Table 3. 1 - Parameters estimated for LRER and Exchange Rate Misalignments (equation 5.1)

Model/ Variable	(1)	(2)	(3)	(4)	(5)	(6)	Avg.	Effect of devaluations (10%) on Growth 5-year (yearly)
LRER	-0.21	-0.16	-0.18	-0.23	-0.30	-0.15	-0.20	2% (0.14%)
Mis_1	-0.19	-0.14	-0.14	-0.24	-0.30	-0.14	-0.19	1.9% (0.13%)
Mis_2	-0.22	-0.15	-0.14	-0.26	-0.29	-0.14	-0.20	2% (0.14%)
Mis_3	-0.12	-0.09	-0.09	-0.16	-0.25	-0.15	-0.14	1.4% (0.06%)
Mis_4	-0.21	-0.14	-0.14	-0.25	-0.30	-0.14	-0.19	1.9% (0.13%)
Mis_5	-0.16	-0.13	-0.11	-0.24	-0.32	-0.21	-0.19	1.9% (0.13%)
Mis_6	-0.13	-0.12	-0.12	-0.22	-0.32	-0.27	-0.19	1.9% (0.13%)
Mis_7	-0.13	-0.12	-0.12	-0.21	-0.29	-0.26	-0.18	1.8% (0.12%)

Source: Estimates of Appendix D (Tables 3.D 1 – 3.D 8); only the parameters statistically significant are presented.

The parameters of the variables for exchange rate misalignments differ somewhat according to the fundamentals and growth equations' specification. The parameters are robust and tell the same story. Making the national currency weaker in relation to dollar (devaluations) fosters long-run growth, but an overvalued exchange rate hampers growth. On average, the parameters are: -0.20 (LRER), -0.19 (Mis_1), -0.20 (Mis_2), -0.14 (Mis_3), -0.19 (Mis_4), -0.19 (Mis_5), -0.19 (Mis_6), -0.18 (Mis_7). These results suggest that devaluations of exchange rate around 10% increase the growth of *per capita* income in 2%, 1.9%, 2%, 1.4%, 1.9%, 1.9%, 1.9%, 1.9% and 1.8% over a five-year period and 0.14%, 0.13%, 0.14%, 0.06%, 0.13%, 0.13%, 0.13% and 0.12% in terms of average annual growth rate, respectively.

6.1- Exchange Rate Misalignments, Income Level and Growth

Despite the evidence that the real exchange rate is associated with long-run growth, the literature points out that such an effect disappears from a certain level of *per capita* incomes. Development policies, based on exchange rates, offer a catching-up mechanism for emerging countries. Nevertheless, as income grows, the Balassa-Samuelson effect acts, leading to higher wages and prices, which reduces exports' competitiveness and its influence on growth. The estimates of Rodrik (2008) suggest that the influence of the exchange rate on growth is valid until countries with a *per capita* income of $19,635. The empirics of Rodrik (2008) also point out that such an effect is stronger for developing countries (those with smaller *per capita* income than $6,000). The results of Viera and MacDonald (2012) go in the same direction, showing that the effects of exchange rate on growth are more substantial for developing and emerging countries.

In order to test the relation between exchange rate effect on growth and income level, three empirical strategies were employed seeking for robust results.

Following Rodrik (2008), the first strategy is to introduce a further variable represented by the *per capita* income multiplied by the exchange rate misalignment measure into the most parsimonious growth equation specification (Model 1). The results are reported in Table 3.D 9 (appendix D). The parameters estimated for the exchange rate are statistically significant in all regressions, except when such variable is Mis_6. All parameters are negative, suggesting that devaluations (overvaluations) of exchange rate are positively (negatively) associated with growth. The parameters' magnitude enlarged due to the collinearity induced by the introduction of the interaction between income level and exchange rate misalignment. This variable is statistically significant (at 1% of a critical level) only in growth regressions using the variables Mis_1 and Mis_3 as the measures of exchange rate misalignments. The parameter of YN x Mis_1 is 0.000006, whilst it is -0.33 for Mis_1. The effects of the exchange rate vanish when the *per capita* income reaches U$S 5,500. The parameter of YN x Mis_2 is 0.00009, whilst it is -0.28 for Mis_1. The effects of the exchange rate disappear when the *per capita* income reaches U$S 3,111. Such a result is very strong and imposes severe restrictions for an exchange rate policy for development. However, as seen, this result is not robust as it is not supported by the growth regressions using other measures of exchange rate misalignment and, as it will be seen, it is not fully supported by other strategies.

The second strategy is performing growth regressions for countries grouped by income level. Rodrik (2008) employed the cutline of a *per capita* income of U$S 6,000 to define developing countries. This strategy tests if the exchange rate misalignment is statistically significant to explain countries' growth within a range of values of *per capita* incomes, providing a parameter for these countries. The regressions performed using Rodrik's cutline are presented in Table 3.D 10 (appendix D). Only the parameters estimated for LRER, Mis_2 and Mis_4 are statistically significant; at 5% and 10% (for the last two variables). The parameters' magnitude is somewhat greater than the estimates for full sample of countries; -0.28, -0.23 and -0.24 for LRER, Mis_2 and Mis_4 against -0.21, -0.22 and -0.21 (Table 3.1), respectively.

Other values for the cutline of the *per capita* income are used - non-peremptorily defined, leading to different results. When the value of 25% percentile of *per capita* income (U$S 3,346) is employed as cutline, no measure of exchange rate misalignment is statistically significant to explain the long-run growth, see Table 3.D 11 in appendix D. When values of 50% (U$S 9,365) and 75% (U$S 24,725) percentiles of *per capita* income are employed as cutline, the results changed widely. The regressions performed provided results more robust once various measures of exchange rate misalignments have shown statistically significant. In the first set of regressions – Table 3.D 12 in appendix D, all measures of exchange rate misalignments are statistically significant at least at 10% of critical values, except for Mis_6 and Mis_7. Still, the estimated parameters are systematically smaller than the estimated for Model 1 in Table 1; -0.07 (LRER), -0.10 (Mis_1), -0.15 (Mis_2), -0.11 (Mis_3), -0.13 (Mis_4), -0.17 (Mis_5). In turn, Table 3.D 13 (in appendix D) presents the estimates using the cutline of *per capita* income of U$S 24,725. All measures of exchange rate misalignments are statistically significant at least at 10% of critical values, except for Mis_5 and Mis_7. Although significant to explain growth, once again, the parameters are systematically smaller than the estimated for Model 1 in Table 1; -0.10 (LRER), -0.08 (Mis_1), -0.10 (Mis_2), -0.14 (Mis_3), -0.17 (Mis_4), -0.15 (Mis_5).

The third strategy is performing growth regressions introducing a dummy variable for the countries accordingly to the cutline of a *per capita* income – U$S 6,000, the 25%, 50%, and 75% percentiles of the distribution, interacted with the exchange rate misalignment measure. This strategy tests whether the effects of exchange rate misalignments are stronger for countries within a range of values of *per capita* incomes, providing an additional parameter for these countries.

Table 3.D 14 (appendix D) presents the growth regressions employing the interaction between a dummy for countries with *per capita* income until U$S 6,000 and the exchange rate misalignment (dummy6000 x Mis). All estimated parameters for the exchange rate misalignment variable are statistically significant (except Mis_3 and Mis_5) and negative. However, only the interactions between the dummy and LRER, Mis_6 and Mis_7 are statistically significant at 10% of critical values. The estimated parameters for LRER and dummy6000 x LRER are -0.27 and 0.07, leading to a net effect of exchange rate movements around that estimated in Table 3.1 (-0.20). In turn, the estimated parameters of Mis_6 and Mis_7 are both -0.10, while it is -0.20 for both interactions. Such a result means that controlling the wage costs, as a fundamental of exchange rate misalignment, devaluations of exchange rate around 10% - induced by cuts in wage costs, increase *per capita* income growth by 3% (0.24% in annual terms).

Table 3.D 15 (appendix D) presents the growth regressions employing the interaction between a dummy for countries with *per capita* income until U$S 3,346 and the exchange rate misalignment (dummy3346 x Mis). The results provided little evidence that the effects of exchange rate misalignment are different for these countries. Although all estimated parameters for exchange rate misalignment measures are statistically significant and negative, only the estimated parameter of dummy3346 x Mis_6 is statistically significant (at 10% of critical values). The same applies for the growth regressions using the cutline of *per capita* income equals U$S 9,634 (Table 3.D 16), since no interacting dummy was statistically significant.

The regressions using the interaction between the dummy for countries with *per capita* income until U$S 24,725 and the exchange rate misalignment are reported in Table 3.D 17. The results provide little evidence in favor of a different effect of exchange rate movements on these countries' growth. Only the estimated parameter for LRER is statistically significant and negative. In analyzing the standard deviation of the parameters estimated for exchange rate misalignment measures and its interaction with the dummy24,725, it can be noticed that it has enlarged in relation to the previous estimates. This suggests potential collinearity between such variables, undermining the power of statistical inference. In order to overcome this potential problem, a new specification was performed considering only the interacting variable and dropping the measure of exchange rate misalignment.[28] The output is presented in Table 3.D 18. The results have changed widely and suggest that the effects of exchange rate misalignments are stronger for countries within an income *per capita* until U$S 24,725. All estimated parameters for the interacting dummy are statistically significant, at least at 5% of critical values and negative. Interestingly, the magnitude of parameters increased in all regressions in relation to the estimates of Table 1; -0.37 (LRER), -0.28 (Mis_1), -0.29 (Mis_2), -0.23 (Mis_3), -0.32 (Mis_4), -0.20 (Mis_5), -0.19 (Mis_6) and -0.21 (Mis_7). On average, devaluations of exchange rate around 10% increase the growth of countries with *per capita* income until U$S 24,725 in 2,3% over a 5-year period (0.18% annually).

6.2- Exchange Rate Misalignments and Growth: Africa, Latin America, and Asia

The export-led growth literature suggests that the exchange rate played an important role in economic performance of Africa, Latin America, and Asia countries (Sachs, 1985, Cavallo et all, 1990, Dollar, 1992, Rodrik, 2008). Asian economies are among those with more rapid growth in the world over the period 1995-2018. On average, its growth rate of income *per capita* was 0.14% over the period – 33% larger than the average for the rest of the world. Whilst African and Latin American countries performed poorly, 0.08% and 0.09%, respectively. This is suggestive that the Asian economies are catching up with the wealthiest countries, and African and Latin American economies are falling behind. The orientation of Asian economies helps to explain such different economic performances (Sachs, 1985, Cavallo et all, 1990, Dollar, 1992, Eichengreen, 2008).

Economies outward-oriented grow more rapidly, given that exports are the primary growth source. Nonetheless, the effects of the exchange rate go further than expanding exports. By affecting real wage, it is associated with the profitability of tradable/non-tradable sectors. Devaluations of exchange rate reduce real wage, increase export competitiveness, increase profitability (saving), and investment in tradable sectors– industry. Overvaluations, in turn, increase real wage and favor non-tradable sectors by benefiting consumption to the detriment of saving/investment - services. Although overvaluations of exchange rate can result in periods of growth – mainly in wage-led economies (Bahduri and Marglin, 1989), such exchange rate

[28] This alternative specification was also performed for other *per capita* income cutline. The result did not provide much evidence that the interacting variable is statistically significant.

policy is not bearable as economy's orientation led inwards, which leads to crises in the balance of payment and lower long-run growth rates.

The experience of Asia, Africa, and Latin America concerning exchange rate policies is contrasting. The estimated values for exchange rate misalignments (Table 3.1 B in appendix B) indicate that Asia and Africa pursued, on average, devalued exchange rate over the period 1995-2018. Meanwhile, Latin American countries pursued an overvalued exchange rate - mainly because of the use of exchange rate as a nominal anchor over the 1990s and the improvement in terms of trade over the 2000s (due to higher commodity prices). To illustrate that, the mean of Mis_1 (Model 1) is -0.07, -0.08 and 0.05, respectively for Asian, African, and Latin American countries, whereas the mean of Mis_7 (Model 7) is -0.14, -0.18 and 0.01 – such pattern also applies to the other measures of exchange rate misalignments calculated of Table 1B in appendix B.

In order to test the validity of export-led explanation for the trajectory of these countries, a new set of regressions (Model 1 of growth equation) was performed using the countries of Latin America, Africa, and Asia as a sample. Furthermore, aiming at testing whether the exchange rate policy helps to explain the Asian distinguished growth, a further regression was performed considering the same sample of countries and a dummy for Asian countries that interacted with the measures of exchange rate misalignment (LRER, Mis_1 and Mis_7).[29]

The output of regressions is presented in Table 3.D 19. Column 1 of Table 3.D 19 displays the estimated parameter for the LRER, which is statistically significant at 5% and equals -0.09. When the interacted dummy for Asian countries and LRER is also considered (Column 2), the parameter of LRER becomes non-statistically significant and the interaction - significant at 5%, equals -0.04. Columns 3 and 4 present the same estimates using the variable Mis_1 instead LRER. Considered without the interaction, the estimated parameter for Mis_1 (column 3) is not significant, which remains non-significant in combination with its interaction with the dummy for Asian countries (column 4), which is significant at 5% and equal -0.32. At last, columns 5 and 6 present the estimates using the variable Mis_7 that is significant at 5% and equals -0.10, when it is considered without the interacted term. Nevertheless, both parameters (for Mis_7 and its interaction) are not significant when considered jointly.

Even using a different sample with fewer countries, the estimates for Latin America, Africa and Asia confirmed the influence of exchange rate misalignment on growth. Such result

[29] In order to make easier the estimating of growth equations, it was chosen only three measures of exchange rate misalignments: LRER, Mis_1 and Mis_7.

indicates the robustness of previous regressions using full sample. More than that, a careful analysis of the results says that a devaluation of exchange rate around 10% - disregarding the Balassa-Samuelson effect, promotes the growth of Latin America, Africa and Asia, on average, in 0.9%. Such effect is especially valid for Asian economies. However, when the Balassa-Samuelson effect is considered, the exchange rate's influence on these countries' growth vanishes, remaining only for Asian countries. Curiously, when the positive pressures of labor costs on the exchange rate are considered (overvaluation), the exchange rate becomes significant to explain the economic performance, suggesting that a devaluation of exchange rate around 10% foster the growth of Latin America, Africa and Asia, on average, in 1%.

A possible interpretation of these findings is that a devalued exchange rate acts as a facilitating condition for growth (Eichengreen, 2008). Pursuing exchange rate devaluations potentializes the fundamentals of long-run growth such as human capital, saving/capital accumulation, institutions and technological innovation, but it does not substitute the importance of these elements in the development process (Eichengreen, 2008). The poor growth of African economies, even pursuing a devalued exchange rate such as Asian countries, illustrates it. A policy of exchange rate devaluations does not fill the lack of good institutions, a friendly environment for business, human capital, fiscal discipline, low inflation and technological progress, etc. (Eichengreen, 2008).

7- Exchange Rate and Growth: The Washington Consensus' view

The Washington Consensus represents an opposing view to the export-led growth literature on the role played by the exchange rate at the economic development (Schröder, 2013). Any misalignment of exchange rate from its equilibrium is harmful to growth (Williamson, 1990). Pursuing exchange rate overvaluations may result in a balance of payments crises, which is negatively associated with growth (Berg, 2010). Meanwhile, devaluations of the exchange rate raise inflationary pressures that harms investments and growth (Williamson, 1990). Within this perspective, the appropriated exchange rate to induce growth is that one at equilibrium situation (Schröder, 2013). Developing countries should keep the exchange rate close to its equilibrium values avoiding excessive misalignments to grow faster (Schröder, 2013).

Schröder (2013) came up with a strategy to test the Washington Consensus view:

$$y_{ti}=\alpha+\beta Y_{bi}+\beta_1 \,|mis_{t-1,i}|\, + \beta_2 controls+f_t+f_i+ u_{it} \quad (19)$$

where the standard measure of exchange rate misalignment - with negative values for devaluations and positive for overvaluations, is replaced by its absolute values represented by $|mis_{t-1,i}|$ in growth equation (19). Negative values for β_1 confirm the Washington Consensus' view, according to which any kind of exchange rate misalignment hurts growth. The estimates were performed following the same strategy discussed in section 5 and are reported in Tables 3.E 1- 3.E 7 (appendix E). The findings do not provide empirical support for the Washington Consensus' view, once no measure of exchange rate misalignment in absolute values has shown statistical significance. However, there is no consensus in empirical literature as Schröder (2013) found some empirical evidence in favor of the Washington Consensus' view.

8- Robustness Check I

This section provides a robustness check for the previous regressions. The same strategy discussed in section 5 to estimate equation (18) applies in current estimates. However, following Schröder (2013), the measure of exchange rate misalignment is split up into two new variables:

$$y_{ti}=\alpha+\beta Y_{bi}+\beta_1\, dev_{t-1,i} + \beta_2\, over_{t-1,i} + \beta_3 controls+f_t+f_i+ u_{it} \qquad (20)$$

where *dev* represents a dummy for negative values of the exchange rate misalignment (1 for negative values and 0 otherwise) multiplied by the measure of exchange rate misalignment, and *over* represents a dummy for positive values of the exchange rate misalignment (1 for positive values and 0 otherwise) multiplied by the measure of exchange rate misalignment. Negative values for the estimated parameters β_1 and β_2 indicate the robustness of previous results insofar as it confirms that devaluations (overvaluations) are positively (negatively) associated with growth.

The output of regressions is reported in Tables 3.F 1-3.F 7 (appendix F). Table 3.2 summarizes the estimated coefficients statistically significant for variables *dev* and *over*.

Table 3. 2 - Parameters estimated for $devt_{-1,i}$ and $over_{t-1,i}$ (equation 20)

Model/ Variable	(1)	(2)	(3)	(4)	(5)	(6)	Avg.	Effect of devaluations/overvaluations (10%) on Growth 5-year (yearly)
dev_1			-0.23			-0.16	-0.19	1.9% (0.13%)
dev_2			-0.27		-0.23	-0.21	-0.23	2.3% (0.18%)
dev_3			-0.14			-0.22	-0.18	1.8% (0.12%)
dev_4		-0.15	-0.27		-0.22	-0.29	-0.23	2.3% (0.18%)
dev_5	-0.40			-0.36	-0.22	-0.23	-0.30	3.0% (0.24%)
dev_6	-0.22	-0.14	-0.16	-0.25	-0.43	-0.23	-0.23	2.3% (0.18%)
dev_7	-0.25	-0.14	-0.16	-0.24	-0.27	-0.25	-0.21	2.1% (0.15%)
$over_1$	-0.30			-0.26	-0.49	-0.13	-0.29	-2.9% (-0.23%)
$over_2$				-0.25	-0.40	-0.10	-0.25	-2.5% (-0.20%)
$over_3$	-0.25				-0.16		-0.20	-2.0% (-0.14%)
$over_4$					-0.40		-0.40	-4.0% (-0.31%)
$over_5$					-0.49	-0.14	-0.31	-3.1% (-0.25%)
$over_6$	-0.13	-0.18	-0.11			-0.23	-0.16	-1.6% (-0.09%)
$over_7$	-0.12	-0.17	-0.11		-0.17	-0.22	-0.15	-1.5% (-0.08%)

Source: Estimates of Appendix F (Tables 3.F 1-3.F 7); only the parameters statistically significant are presented.

On average, the estimated parameters for the variable *dev* are: -0.19 (dev_1), -0.23 (dev_2), -0.18 (dev_3), -0.23 (dev_4), -0.30 (dev_5), -0.23 (dev_6) and -0.21 (dev_7), which suggests that devaluations of exchange rate around 10% increase the growth of *per capita* income in 1.9%, 2.3%, 2.8%, 2.3%, 3.0%, 2.3% and 2.1% over a five years period and 0.13%, 0.18%, 0.12%, 0.18%, 0.24%, 0.18% and 0.15% in terms of average annual growth rate, respectively. In turn, the estimated parameter for the variable *over* are, on average: -0.29 ($over_1$), -0.25 ($over_2$), -0.20 ($over_3$), -0.40 ($over_4$), -0.31 ($over_5$), -0.16 ($over_6$) and -0.25 ($over_7$), which suggests that overvaluations of exchange rate around 10% reduce the growth of *per capita* income in 2.9%, 2.5%. 2.0%, 4.0%, 3.1%, 1.6% and 1.5% over a five-year period and 0.23%, 0.20%, 0.14%, 0.31%, 0.25%, 0.09% and 0.08% in terms of average annual growth rate, respectively.

Estimates of equation 20 confirmed the previous results according to which exchange rate misalignments matter for growth. Devaluations are good for growth. Notwithstanding, as already obtained, the parameters vary across the different specifications and exchange rate misalignment measures. The results also revealed that devaluations and overvaluations have non-symmetric effects on growth. The results employing the variables Mis_1-Mis_5 as measures of exchange rate misalignment (without controlling for the labor cost as a fundamental) mean that overvaluations hurt more growth than devaluations promote. In contrast, the regressions using the variables Mis_6 and Mis_7 as measures of exchange rate misalignment (controlling for the labor cost) revealed that devaluations promote more growth than overvaluations hurt.

In addition, two further specifications were run considering the variables *dev* and *over* separately into Model 01 of growth equations. More than a robustness check, these new estimates answer two questions; namely, devaluations of exchange rates are a necessary condition for growth? Or avoiding overvaluations of exchanges rate is sufficient condition in promoting growth? The estimates – presented in Tables 3.F 8 and 3.F 9 in appendix F go in the same direction that previous results and suggest that the answer for both questions is positive. Devaluations *per si* is a sufficient condition for growth, and avoiding overvaluations is beneficial for growth. The estimated parameter for *dev* is, on average, 0.23, indicating that devaluations of exchange rate around 10% increases *per capita* income by 2.3% over a five-year period and 0.18% annually. In turn, the estimated parameter for *dev* is, on average, 0.21, indicating that overvaluations around 10% reduce *per capita* income by 2.1% over a five-year period and 0.15% annually.

Finally, facing the previous findings that suggest the exchange rate helps explain the more rapid growth of Asian countries compared with Latin America and Africa, Tables 3.F 10 and 3.F 11 present regressions performed to explain these countries' economic performance using the variables *dev* and *over*.[30] It aims to test if the more rapid growth of Asian countries is associated with devaluations or avoiding an overvalued exchange rate.[31] The results are mixed and partially support the previous findings. When the exchange rate measures are represented by Mis_1 (Table 3. F10), both variables *dev* and *over* are not statistically significant when considered singly (columns 1 and 3). Such a result is especially valid for the variable *over*, once no estimated parameter is significant for it. Nevertheless, when the interaction between a dummy for Asian countries and variable *dev* is considered, its parameter is statistically significant and around -0.20 (columns 2 and 6), suggesting that pursuing a devalued exchange rate was important to Asian countries grow more rapidly than America Latina and Africa.

When the exchange rate measure is represented by Mis_7 (Table 3.F 11) – discounting the effect of labor costs in exchange rate, the estimated parameter for the variable *dev* remains non-significant. Although the parameters estimated for the interaction between a dummy for Asian countries and variable *dev* is significant and around -0.16 (column 2), confirming its importance

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[30] In order to make easier the estimating of growth equations, it was chosen only the following measures of exchange rate misalignments: Mis_1 and Mis_7.

[31] It was also tested if the effects of variables *dev* and *over* are associated with income level (full sample countries). The estimates were performed following the same three strategies of section 6. The results were not so conclusive, mainly those using interacting dummies for countries' income level, so it opted for not presenting it.

to explain Asian growth performance. The results have changed widely when the estimated parameter for *over* is analyzed, its parameter become significant (except for column 5) and negative, indicating that avoiding overvaluations of exchange rate benefits these countries' growth. It should be stressed, however, that the effects of overvaluations in Asian countries are weaker once the parameter of interaction between a dummy for Asian countries and the variable *over* is significant and positive.

9- Robustness Check II

This section provides a further robustness check by employing an alternative measure of exchange rate misalignment calculated by Couharde et al (2017), which is named Mis_{CEPII}. This variable's calculation follows the BEER approach, controlling for the Balassa-Samuelson effect, net-foreign assets and terms of trade as fundamental of exchange rate. This exchange rate misalignment measure is calculated using co-integration techniques for econometric panels, providing an annual variable.[32] Negative values represent an exchange rate devalued with respect to its equilibrium values, and positive values mean an overvalued exchange rate. Viera and MacDonald (2012) and Schröder (2013) performed growth regressions using annual measures of exchange rate misalignment, arguing that this may, potentially, change the growth estimates. A robustness check considering an annual measure of exchange rate misalignment is important.

The same empirical strategy discussed in section 5 to estimate equation (18) applies in current estimates. However, it is used the values of the first year of variable Mis_{CEPII} (1995, 2000, 2005, 2010, and 2015) instead of its five-year average. This expunges the possible simultaneity and provides an additional robustness check. The results - presented in Appendix G in Table 3.G 1, confirmed the previous results that devaluations (overvaluations) influence positively (negatively) growth. All estimated parameters are statistically significant, at least at 10%, and negative: -0.52 (Model 1), -0.17 (Model 2), -0.06 (Model 3), -0.45 (Model 4), -0.09 (Model 5) and -0.19 (Model 6). On average, the estimates suggest that devaluations of the exchange rate by around 10% increase *per capita* income by 2.4% over a five-year period and 0.19% annually.

[32] Appendix G provides a detailed discussion on the calculation of this variable.

10- Testing the non-linear effect of exchange rate on growth

The empirical literature is not consensual on the non-linear effects of exchange rate movements on growth. Some authors found empirical evidence in favor of a non-linear effect of exchange rate movements on economic growth, such as Razin and Collins (1997) and Aguirre and Calderon (2006). In contrast to Rodrik (2008) and Viera and MacDonald (2012), whose findings do not confirm such effect.

In order to test the possible non-linear effect of exchange rate movements on growth, two further specifications were run. Firstly, adding the measures of exchange rate misalignment squared into growth equation (18) (Model 1) and, secondly, replacing the linear values of exchange rate misalignment by its squared values:

$$y_{ti}=\alpha+\beta Y_{bi}+\beta_1 mis_{t-1,i}+\ \beta_2 mis_{t-1,i}^2+\beta_3 controls+f_t+f_i+u_{it} \quad (21)$$

$$y_{ti}=\alpha+\beta Y_{bi}+\beta_1 mis_{t-1,i}^2+\beta_2 controls+f_t+f_i+u_{it} \quad (22)$$

The outputs are reported in Tables 3.H 1 and 3.H 2 in appendix H. The estimates of equation (21) indicate that the parameter β_1 is statistically significant in all regressions at least at 5% (except when LRER is employed) and negative; -0.15 (Mis_2), -0.12 (Mis_3), -0.13 (Mis_4), -0.16 (Mis_6), -0.18 (Mis_7). The estimated parameter β_2 is not statistically significant in all regressions of 3.H 1. The estimates of equation (22) provided few evidences, and non-robust, in favor of non-linear effects of exchange rate on growth. The parameter β_1 is statistically significant at 10% and negative in the estimates using Mis_2, Mis_4 and Mis_6 as measure of exchange rate misalignments.

Concluding Remarks

Taking into account the relevance of the exchange rate to explain the long-run growth in literature, this paper proposed to assess, empirically, the effects from exchange rate movements for a set of one hundred and fifty-one countries over the period 1995-2018. Various fundamentals of exchange rate were considered in estimates to construct exchange rate measures employed in growth regressions. The most usual variables in literature were introduced into the regressions – the Balassa-Samuelson effect, net foreign assets, and terms of trade. The findings have pointed that the Balassa-Samuelson effect overlaps the remaining fundamentals. However, introducing labor costs in regressions indicated that *ceteris paribus* increasing (reducing) makes the goods more expensive (cheap). In other words, increasing the labor costs appreciate the real exchange rate, whilst cutting the labor costs depreciates the real exchange rate.

A set of regressions was performed using various exchange rate measures, different specifications and countries. The findings are robust in showing that devaluations (overvaluations) of exchange rate boost (hurt) growth. On average, devaluations of the exchange rate by 10% increase long-run growth roughly by 2% over a five-year period or 0.14% annually. Furthermore, additional regressions did not provide evidence that any kind of exchange rate misalignment is harmful to growth - as Washington Consensus claims, or that the effects of exchange rate on growth follow a non-linear pattern.

The exchange rate effects seem to be non-monotonic as they are associated with countries' income levels. However, this finding is associated with the *per capita* income cut line used to define a developing country, the measure of exchange rate misalignment, and empirical strategy to account for it. Growth regressions grouping countries in ranges of *per capita* income provide evidence that devaluations of exchange rate do not explain the growth of countries with *per capita* income lower than U$S 3,346 and little evidence that it does for countries with *per capita* lower than U$S 6,000. Those results have changed widely in regressions for countries with *per capita* income lower than U$S 9,365 and U$S 24,725. Although the estimated parameters are lower than those of regressions employing the full sample of countries, the results indicate the exchange rate helps explain these countries' growth performance. Growth regressions with interacting dummies for countries with *per capita* income lower than U$S 3,346, U$S 6,000 U$S 9,634 provide poor evidence that the effects of exchange rate movements are stronger for these countries. However, it does not apply to countries with *per capita* lower than U$S 24,725, once all variables of the interacting dummy were statistically significant and negative, indicating that the effects of exchange rate movements are stronger for these countries.

The findings have delivered evidence that the pursuing of devalued exchange rate helps explain the more rapid growth of Asian economies compared with the poor growth of Latin America and Africa. Devaluing the exchange rate has contributed to the catching up of Asian countries while keeping the exchange rate overvalued has reduced the long-run growth of Latin America. However, even with devalued national currencies, African countries have grown poorly. This suggests that a devalued exchange rate acts more as a facilitating condition than a sufficient condition for growth (Eichengreen, 2008). A policy of exchange rate devaluations does not substitute good institutions, human capital, macroeconomic environment, and technological progress, but it potentializes these fundamentals' importance in the development process (Eichengreen, 2008). Moreover, estimates are suggestive that policies that reduce (increase) wage costs may increase (decrease) long-run growth by making national goods cheaper (more expensive).

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Appendix A – Empirical Literature and Empirical Approaches to Estimating Equilibrium Exchange Rates

Table 3.A 1 - Summary of cross-country empirical literature

Paper	Exchange rate measure	Dependent variables	Sample	Method	Results
Cottani et all (1990)	Firstly, it is computed a measure of Misalignment and a measure of exchange instability, respectively, represented by deviations of PPP value using the mean of the three years with the highest exchange devalued average for the whole sample period and the variance of real exchange rate. Secondly, it is computed the effects of terms of trade, degree of openness, net capital inflows, domestic credit and a dummy for time in order to assess its effects on economic performance	Real GDP growth rate, exports, import, investment, agriculture and incremental capital-output ratio	24 less developed countries over the period 1960-1983	Cross sectional regressions	Higher exchange volatility and misalignments of real exchange rates hurt the growth of all dependent variables, except for the incremental capital-output ratio
Dollar (1992)	Misalignment index that measures the extent to which the real exchange rate is distorted away from its hypothetical free-trade level, this index represents the trade orientation of the economy (outwards or inwards)	Real GDP per capita growth rate	95 less developed countries over the period 1976-1985	Cross sectional regressions	Higher exchange volatility hurts the growth and the outward-orientation (trade liberalization, devaluations and stability) is positively associated with higher growth rates
Razin and Collins (1997)	Real exchange misalignments for developed and developing countries estimated separately specified as 5 years moving average considering the GDP per capita growth, money growth in excess of output growth, terms of trade, capital inflows and export minus imports as the fundamentals	Real GDP per capita growth rate	93 countries over the period 1975-1992 divided into 20 developed countries and 73 developing countries	Panel data setting (FE and RE)	There exists a non-linear relationship between real exchange rate and growth; only high over-valuations are associated with slower economic growth, and moderated to high (but not too high) under-valuations are associated with a higher economic growth rate
Easterly (2001)	Dollar (1992)'s measure converted into PPP	Real GDP per capita growth rate	Developing countries over the period 1980-1998; decades average	Seemingly unrelated regressions	Devaluations are associated with higher growth rates
Acemoglu et al (2003)	Dollar (1992)'s measure	Standard deviation of the growth rate per capita output, worst output drop and average of growth rate	1970-1997 and the main of respective decade	Cross-sectional regressions (OLS and 2SLS) and panel setting (FE and RE)	Weak institutions (extractive institutions inherited from colonial times) leads to an overvalued exchange rate (distortionary macroeconomic policies; high inflation and budget deficit) and, hence, to high volatility of growth rate per capita output, the real exchange overvaluation is used as a method of income redistribution in favor of elites and a self-perpetuating way this elite in the power

Aguirre and Calderón (2005)	Real exchange misalignments estimated in a cointegrating vector panel setting (heterogeneous panel) and for each country separately (DOLS – dynamic ordinary least square) considering the net foreign assets, labor productivity, terms of trade, government spending as the fundamentals	Real GDP per capita growth rate	60 countries over the period 1965-2003 (5-year and 10-years averages)	Panel data setting (GMM dynamic models)	There exists a negative relationship between exchange misalignment and growth; overvaluation and undervaluation adversely affect the growth with different intensities. This relationship is non-linear: i- the higher overvaluation minor the growth; ii- moderate exchange undervaluations are associated with positive growth
Hausmann, Pritchett and Rodrik (2005)	Real exchange rate (not defined in details)	Rapid acceleration in economic growth: an increase in per-capita growth of 2 percentage points or more; the increase in growth has to be sustained for at least eight years and the post-acceleration growth rate has to be at least 3.5 percent per year; the post-acceleration output exceeds the pre-episode peak level of income	All countries of PWT 6.0, excluding the countries with a population less than 1 million and with fewer than 20 data points in PWT. The 83 episodes of growth accelerations are concentrated in the period between 1957 and 1992	Cross-sectional regressions	Growth accelerations require more investment, more exports and a more competitive exchange rate
Galindo, Izquierdo and Montero (2007)	Bilateral real exchange rate (national currency – dollar)	Industrial employment decision of firms	9 Latin American (Argentina, Bolivia, Brazil, Chile, Colombia, Uruguay, Costa Rica, Mexico and Peru) countries over the 1990s, but for different periods according to the availability of the database	Panel data setting (FE and GMM dynamic models)	Real exchange devaluations positively affect industrial employment, especially for industries with higher export orientation. However, for industries with a significant amount of foreign currency-denominated liabilities, the effects of real exchange devaluations are negative
Johnson, Ostry and	Real exchange misalignments estimated in a cross-sectional estimate considering only the Balassa-Samuelson effect	Hausmann, Pritchett and Rodrik (2005)'s definition	sub-Saharan African Countries	Graphic analysis and basic statistics	Avoiding real exchange rate overvaluation is essential to escape from poverty and the historical trap of weak institutions as far as it

Subramanian (2007)					increases the manufacturing exports, as it is the case of east Asia
Gala (2008)	Real exchange misalignments estimated in a panel setting (FE) considering only the Balassa-Samuelson effect	Real GDP per capita growth rate	58 developing countries over the period 1960-1999; five-year average	Panel data setting (FE, RE and GMM dynamic models)	Exchange overvaluations (devaluations) hurt (boost) the economic growth
Rodrik (2008)	Real exchange misalignments estimated in a panel setting (FE) considering only the Balassa-Samuelson effect	Real GDP per capita growth rate	184 countries over the period 1950-2004; five-year average	Panel data setting (FE, RE and GMM dynamic models)	Exchange overvaluation hurts growth, and undervaluation helps economic growth (this relationship is linear). This result is especially valid for developing countries
Levy-Yeyati and Sturzenegger (2009)	Two variables created by the authors to represent the fear of appreciation or the mercantilist interventions and captures the idea that the monetary authority acts in order to avoid the appreciation of national currency: i- the annual average of the absolute value of monthly interventions, that is, the average absolute change in net international reserves relative to the monetary base in the previous month and ii- the annual change of the ratio between the foreign assets and broad money	Real GDP growth	179 countries over the period 1974-2004	Panel data setting (FE)	The fear of appreciation or the interventions from the monetary authority to avoid the appreciation of national currency boosts the growth
Bahmani-Oskooee and Hajilee (2010)	Real effective exchange rate (International Monetary Fund)	Gross capital formation in real terms	50 countries over the period 1975-2006	Error correction model following Pesaran et al (2001)	The short-run effects of devaluation are significant and positive for 43 countries; the long-run effects are significant and positive only for 10 countries
Berg and Miao (2010)	Two measures of exchange misalignment: (i) that one estimated in a panel setting (FE) considering only the Balassa-Samuelson effect and (ii) the other one that considers terms of trade, government consumption, investment and openness	Real GDP growth rate	184 countries (Rodrik (2008) sample) over the period 1950-2004; five-year average	Panel data setting (FE, RE)	Exchange overvaluation hurts growth and undervaluation helps economic growth – this relationship is linear, and, in empirical terms, the measures of exchange rate affect equally the growth
Rapetti, Skott, and Razmi (2011)	Real exchange misalignments estimated in a panel setting (FE) considering only the Balassa-Samuelson effect	Real GDP growth rate	181 countries over the period 1950-2004; five-year average	Panel data setting (FE, RE and GMM dynamic models)	Exchange undervaluation is stronger correlated and more robust with economic growth in developing countries, but it depends on the GDP per capita cut-off that defines the developing country
Berg, Ostry and Zettelmeyer (2012)	Log of the sum of one and the depreciation in the parallel exchange rate	The time period between a growth acceleration and a deceleration of GDP per capita obtained combining both	140 countries	Microeconometric regressions with time-varying covariates	The length of growth periods is negatively associated with external shocks and macroeconomic volatility, while it is positively associated with good political institutions, exports of manufacturing goods and income distribution. In turn, the avoidance of exchange

		statistical structural break tests and economic criteria			rate overvaluation is favorable for duration of growth periods
Razmi, Rapetti and Skott (2012)	Real exchange misalignments estimated in a panel setting (FE) considering only the Balassa-Samuelson effect; it is excluded from the sample extreme values of the undervaluation index. Plus, the real exchange misalignment is calculated as the coefficient of variation of RER within each 5-year period	Investment growth $(I_t/I_{t-1})^{0.2}$-1	153 countries over the period 1960-2004; five-year average	Panel data setting (FE, RE and GMM dynamic models)	Exchange undervaluations increase the investment, especially for low-income countries
Glüzmann, Levy-Yeyati and Sturzenegger (2012)	Real exchange misalignments estimated in a panel setting (FE) considering only the Balassa-Samuelson effect	Real GDP per capita growth rate, consumption, savings, investment, exports and imports; the observations are filtered outside a 4-standard deviation interval around the mean of all dependent variables and the log of exchange misalignment	Countries of Penn Worlds Table divided into developed, developing and emerging (following Rodrik, 2008) over the period 1950-2007; one-year to five-year average	Panel data setting (FE and RE)	An undervalued exchange rate fosters the growth, investment and savings
Vieira and MacDonald (2012)	Seven different specifications in a panel setting (FE and panel cointegration); (i) Balassa-Samuelson; (ii) Balassa-Samuelson and net foreign assets; (iii) Balassa-Samuelson, net foreign assets and terms of trade; (iv) net foreign assets and terms of trade; (v) Balassa-Samuelson, net foreign assets, terms of trade and government consumption; (vi) net foreign assets and government consumption; and (vii) net foreign assets, terms of trade and government consumption	Real GDP growth rate	90 countries over the period 1980-2004; five-year average	Panel data setting (GMM dynamic models) and Panel Cointegration	A more depreciated exchange rate boosts the economic growth rate
Schröder (2013)	Real exchange rate misalignment estimated in a single equation setting to each country (non-stationary econometrics - DOLS) considering the following fundamentals: investment, terms of trade, net foreign assets and trade balance	Real GDP per capita growth rate (Solow-Swan growth derivation)	63 developing countries over the period 1970-2007	Panel data setting (GMM dynamic models)	Undervaluations hurt growth. Exchange rate in equilibrium position is better to foster growth (Washington consensus); this is not a sufficient condition to grow; this is a facilitating condition
Missio, Jayme Jr., Britto and Oreiro (2015)	Real exchange misalignments estimated in a panel setting (FE) considering only the Balassa-Samuelson effect	Real GDP per capita growth rate	Two sample of countries (developed and	Panel data setting (pooled, FE, RE, GLS, FEGLS,	An undervalued real exchange rate leads to a higher growth rate, this result presented a non-linear pattern (convex). The results of quantile

			developing countries) over the period 1980-2008	GMM dynamic models and quantile regressions)	regression (controlling for the level of income) showed that the non-linear relationship holds for developing countries of average income
Dao, Minoiu and Ostry (2017)	PPP exchange rate	Investment at firm level	30,000 firms of 66 countries (developed and developing) over the period 2000-2011	Panel setting (difference-in-difference)	Depreciations boost profits, investment, and sales of firms that are more financially-constrained and have higher labor shares (depreciations boost internal financing opportunities by reducing real wages, thereby spurring investment). The relationship between exchange rate devaluations and investment is stronger for countries less financially developed countries as far as the firms in these countries need more internal savings to finance their investments
Lanau (2017)	Real exchange rate (IMF IFS)	Sectoral output growth	Input-output tables (33 sectors) for 61 countries over the period 1995-2011	Panel setting (difference-in-difference)	Sectors that export relatively more grow relatively faster in response to a depreciation; sectors where import penetration in final demand is higher also grow relatively faster in response to a depreciation
Avdjiev, Bruno, Koch and Shin (2018)	Bilateral real exchange rate	Real investment at cross-country and firms levels	(1) Country-level: quarterly data for 34 countries over the period 2001-2016 (2) Firm-level: annual data for 32 countries over the period 2000-2015	SPVAR (country-level) and panel setting (firm-level)	Real exchange devaluations have real macroeconomic effects that go in the opposite direction to the standard trade channel. An exchange devaluation boosts the exports (trade channel), whereas the finance channel hampers the investment. The latter effect is stronger than the first one
Brito, Magud and Sosa (2018)	The growth rate of the real exchange index (PPP) and a measure of exchange misalignment calculated as the difference between the index at each point in time and its country-specific historical median, as a percentage of its median, for the period 1980-2016 (both variables vary across countries and not across firms)	Investment at firm level	40,412 firms from 71 countries over the period 1995-2016; non-overlapping five-year average	Panel data setting (FE with robust standard errors clustered by country)	The degree of economic complexity determines the effects of exchange movements in investment. In more complex economies, devaluations increase investment, and, in less complex economies, devaluations decrease investment

Gabriel and Missio (2018)	Real exchange misalignments estimated in a panel setting (FE) considering only the Balassa-Samuelson effect	The output of aggregate sectors (manufacturing, primary and services) as share to GDP % and index of economic complexity	118 countries over the period 1990-2011	Panel data setting (GLS, PCSE and GMM dynamic models)	Real exchange undervaluations affect the manufacturing of developed and developing countries positively

Table 3.A 2 - Summary of empirical approaches to estimating equilibrium exchange rates (Driver and Westaway, 2004)

	UIP	PPP	BS	Monetary Models	CHEERs	ITMEERs	BEERs	FEERs	DEERs	APEERs	PEERs	NATREX	SVARs	DSGE
Name	Uncovered Interest Parity	Purchasing Power Parity	Balassa-Samuelson	Monetary and Portfolio Balance Models	Capital Enhanced Equilibrium Exchange Rates	Intermediate Term Model based equilibrium Exchange Rate	Behavioral Equilibrium Exchange Rates	Fundament al Equilibrium Exchange Rate	Desired Equilibrium Exchange Rates	Atheoretical Permanent Equilibrium Exchange Rates	Permanent Equilibrium Exchange Rates	Natural Real Exchange Rates	Structural Vector Auto Regression	Dynamic Stochastic General Equilibrium Models
Theoretical Assumption	The expected change in the exchange rate determined by interest differentials	Constant Equilibrium Exchange Rate	PPP for tradable goods. Productivity differentials between traded and non-traded goods	PPP in long run (or short run) plus demand for money	PPP plus nominal UIP without risk premia	Nominal UIP including a risk premia plus expected future movements in real exchange rates determined by fundamentals	Real UIP with a risk premia and/or expected future movements in real exchange rates determined by fundamentals	Real exchange rate compatible with both internal and external balance. Flow not full stock equilibrium	As with FEERs, but the definition of external balance based on *optimal* policy	None	As BEERs	As with FEERs, but with the assumption of portfolio balance (so domestic real interest rate is equal to the world rate)	Real exchange rate affected by supply and demand (but not nominal) shocks in the long run	Models designed to explore movements in real and/or nominal exchange rates in response to shocks
Time Horizon	Short run	Long run	Long run	Short run	Short run (forecast)	Short run (forecast)	Short run (forecast)	Medium run	Medium run	Medium run	Medium/ Long-run	Short-run	Short/ Long-run	Short/ Long-run
Statistical Assumption	Stationary (of change)	Stationary	Non-Stationary	Non-Stationary	Stationary, with emphasis on speed of convergence	None	Non-Stationary	Non-Stationary	Non-Stationary	Non-Stationary (extract permanent component)	Non-Stationary (extract permanent component)	Non-Stationary	As with theoretical	As with theoretical
Dependent Variable	Expected change in the real or nominal	Real or nominal	Real	Nominal	Nominal	Future change in the Nominal	Real	Real Effective	Real Effective	Real Effective	Real	Real	Change in Real	Change relative to long-run state
Estimation Method	Direct	Test for stationarity	Direct	Direct	Direct	Direct	Direct	Underlying Balance	Underlying Balance	Direct	Direct	Direct	Direct	Simulation

Source: Driver and Westaway (2004)

Appendix B – Estimates of Exchange Rate Misalignments

Table 3.B 1 - Estimates for Exchange Rate Misalignment

Variables	Model 1: mis_1	Model 2: mis_2	Model 3: mis_3	Model 4: mis_4	Model 5: mis_5	Model 6: mis_6	Model 7: mis_7
Hausman (FE X RE)	RE	FE	FE	FE	FE	RE	RE
LPIBCAPITA	0.19***	0.11**	0.19***	0.10*	0.20***		
	(0.03)	(0.05)	(0.03)	(0.05)	(0.06)		
LTOT		-0.02				-0.21	-0.21
		(0.17)				(0.18)	(0.20)
LASSET			-0.01			-0.009	-0.01
			(0.01)			(0.01)	(0.01)
LGOV				-0.04		-0.10*	
				(0.04)		(0.05)	
LW					0.16	0.29***	0.24**
					(0.12)	(0.11)	(0.11)
Obs.	876	840	680	840	673	510	510
Groups	148	142	141	142	114	109	109

Notes: (1) The logarithm of Real Exchange Rate (RER) is the dependent variable; (2) FE and RE refer to Random and Fixed Effect estimation; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) estimates performed with fixed effects for time and robust variance-covariance matrix for heteroscedasticity; (5) Robust Standard Errors between parentheses; (6) L = variable in logarithm

Appendix C – Database

Table 3.C 1 - Variables – Definition, Source and Observations

Variable	Definition	Source	Obs.
LRER	Bilateral exchange rate (Price level ratio of PPP conversion factor to market exchange rate: $RER_{t,i} = PPP_{t,i} / XRAT_{t,i}$. Negative (positive) values indicate that real exchange rate is undervalued (overvalued).	World Bank	878
LPIBCAPITA	Real GDP per capita (PPP)	World Bank	877
LTOT	Ratio of export to import prices	Penn World Table 9.1	852
LASSET	Net foreign assets as % of GDP	World Bank	799
LGOV	Government consumption as % of GDP	Penn World Table 9.1	852
LW	Wage-share as % of GDP	Penn World Table 9.1	684
GROWTHPIBCAPITA	Log difference of Real GDP per capita (PPP)	World Bank	729
Initial income	Real GDP per capita (PPP) level in 1990, 1995, 2000, 2005, 2010 and 2015	World Bank	869
LEDUC	Average number of schooling of the population above 15 years in 1990, 1995, 2000, 2005, 2010 and 2015	Barro and Lee (2000)	726
Institutions	Constraint in Chief Executive (XCONST). This variable pertains to the extent of institutionalized constraints on the decision-making powers of chief executive; scale from one (worst institutions) to seven (better institutions).	Polity IV Project	780
LSAVING	1 minus the consumption share of GDP	Penn World Table 9.1	842
LOPENNESS	Sum of exports and imports of goods as % of GDP	Penn World Table 9.1	852
INFL	Consumer prices %	World Bank	842
Mis_1	Measure of RER misalignment using LPIBCAPITA (Model 1)		876
Mis_2	Measure of RER misalignment using LPIBCAPITA and LTOT (Model 2)		840
Mis_3	Measure of RER misalignment using LPIBCAPITA and LASSET (Model 3)		680
Mis_4	Measure of RER misalignment using LPIBCAPITA and LGOV (Model 4)		840
Mis_5	Measure of RER misalignment using LPIBCAPITA and LW (Model 5)		673
Mis_6	Measure of RER misalignment using LTOT, LASSET, LGOV and LW (Model 6)		510
Mis_7	Measure of RER misalignment using LTOT, LASSET and LW (Model 7)		510
Mis_{CEPII}	Measure of RER misalignment calculated by CEPII (http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=34) employing the multilateral real exchange rate and real GDP per capita, terms of trade and net foreign	CEPII	828

assets as fundamentals; yearly database in 1990, 1995, 2000, 2005, 2010 and 2015 (beginning year of each 5-years period)

Notes: (1) L = variable in logarithm; (2) Negative (positive) values of exchange rate misalignment measures indicate that the real exchange rate is undervalued (overvalued) relative to the equilibrium level

Table 3.C 2 - List of Countries – Complete Sample

Country	Country	Country	Country	Country	Country
Angola	Chile	Ghana	Korea	Norway	Slovak Republic
Albania	China	Guinea-Bissau	Kuwait	Nepal	Slovenia
United Arab Emirates	Cote d'Ivoire	Equatorial Guinea	Lao PDR	New Zealand	Sweden
Armenia	Cameroon	Greece	Lebanon	Oman	Eswatini
Antigua and Barbuda	Colombia	Grenada	Sri Lanka	Pakistan	Seychelles
Australia	Comoros	Guatemala	Lesotho	Panama	Chad
Austria	Cabo Verde	Guyana	Lithuania	Peru	Togo
Burundi	Costa Rica	Hong Kong	Luxembourg	Philippines	Thailand
Belgium	Cyprus	Honduras	Latvia	Papua New Guinea	Tajikistan
Benin	Czech Republic	Croatia	Morocco	Poland	Turkmenistan
Burkina Faso	Germany	Haiti	Moldova	Portugal	Tonga
Bangladesh	Dominica	Hungary	Madagascar	Paraguay	Trinidad and Tobago
Bulgaria	Denmark	Indonesia	Maldives	Qatar	Tunisia
Bahrain	Dominican Republic	India	Mexico	Romania	Turkey
Bosnia and Herzegovina	Algeria	Ireland	North Macedonia	Russia	Tanzania
Belarus	Ecuador	Iceland	Mali	Rwanda	Uganda
Belize	Egypt	Israel	Malta	Saudi Arabia	Ukraine
Bolivia	Spain	Italy	Mongolia	Sudan	Uruguay
Brazil	Estonia	Jamaica	Mauritania	Senegal	United States
Barbados	Ethiopia	Japan	Mauritius	Singapore	Vietnam
Brunei Darussalam	Finland	Kazakhstan	Malaysia	Solomon Island	Samoa
Bhutan	Fiji	Kenya	Namibia	Sierra Leone	Yemen
Central African Republic	France	Kyrgyz Republic	Niger	El Salvador	South Africa
Canada	Gabon	Cambodia	Nigeria	Serbia	
Switzerland	United Kingdom	Kiribati	Netherlands	Sao Tome and Principe	

Appendix D - Exchange Rate Misalignment and Growth

Table 3.D 1 - Real Exchange Rate (LRER) and Growth

	(1)	(2)	(3)	(4)	(5)	(6)
y_{t-1}	0.18*	0.15	0.16*	0.26***	-0.07	0.19**
	(0.10)	(0.10)	(0.08)	(0.09)	(0.06)	(0.07)
Initial Income	0.09**	0.02	0.05	0.07*	0.03	-0.008
	(0.03)	(0.04)	(0.03)	(0.03)	(0.04)	(0.03)
LRER	-0.21***	-0.16***	-0.18***	-0.23***	-0.30***	-0.15***
	(0.05)	(0.04)	(0.05)	(0.05)	(0.05)	(0.04)
LEduc	-0.08	0.06	0.01	0.04	0.14	0.17***
	(0.09)	(0.07)	(0.06)	(0.08)	(0.09)	(0.05)
Institutions	0.006***	0.004	0.004	0.002	0.0009	0.001*
	(0.002)	(0.003)	(0.003)	(0.004)	(0.005)	(0.001)
LSAVING		0.02				-0.01
		(0.05)				(0.03)
LGOV			-0.09			-0.05
			(0.06)			(0.04)
LOPENNESS				-0.07		-0.03
				(0.11)		(0.08)
INFL					-0.01***	-0.007*
					(0.003)	(0.004)
AR (2)	0.47	0.28	0.40	0.12	0.38	0.18
Hansen	0.30	0.25	0.33	0.16	0.26	0.12
Hansen-Diff	0.74	0.69	0.91	0.32	0.42	0.29
Groups	111	109	109	109	111	109
Instruments	25	37	37	33	32	84

Notes: (1) The dependent variable is GROWTHPIBCAPITA; (2) estimates using robust two-step System GMM with Time Dummies; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) Robust Standard Errors between parentheses; (5) L = variable in logarithm

Table 3.D 2 - Exchange Misalignment (Mis1) and Growth

	(1)	(2)	(3)	(4)	(5)	(6)
y_{t-1}	0.10	0.11	0.10	0.19	-0.06	0.17**
	(0.10)	(0.10)	(0.09)	(0.12)	(0.06)	(0.07)
Initial Income	0.06*	-0.01	-0.02	0.02	-0.02	-0.04
	(0.03)	(0.03)	(0.01)	(0.03)	(0.03)	(0.02)
Mis_1	-0.19***	-0.14***	-0.14***	-0.24***	-0.30***	-0.14***
	(0.05)	(0.05)	(0.04)	(0.07)	(0.06)	(0.04)
LEduc	-0.11	0.07	0.14***	0.03	0.14	0.19***
	(0.08)	(0.06)	(0.04)	(0.07)	(0.10)	(0.05)
Institutions	0.006	0.004	0.002**	0.003	0.002	0.0009
	(0.002)	(0.003)	(0.001)	(0.004)	(0.006)	(0.001)
LSAVING		0.006				0.0009
		(0.05)				(0.04)
LGOV			-0.08			-0.05
			(0.05)			(0.04)
LOPENNESS				-0.05		-0.03
				(0.10)		(0.08)
INFL					-0.01***	-0.007*
					(0.004)	(0.004)
AR (2)	0.45	0.26	0.23	0.17	0.56	0.11
Hansen	0.84	0.39	0.28	0.14	0.34	0.11
Hansen-Diff	0.96	0.71	0.69	0.15	0.48	0.16
Groups	111	109	109	109	111	109
Instruments	25	37	53	29	32	83

Notes: (1) The dependent variable is GROWTHPIBCAPITA; (2) estimates using robust two-step System GMM with Time Dummies; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) Robust Standard Errors between parentheses; (5) L = variable in logarithm

Table 3.D 3 - Exchange Misalignment (Mis2) and Growth

	(1)	(2)	(3)	(4)	(5)	(6)
y_{t-1}	0.11	0.12	0.10	0.21*	-0.07	0.17**
	(0.10)	(0.10)	(0.09)	(0.12)	(0.06)	(0.07)
Initial Income	0.07**	0.006	-0.009	0.05	-0.008	-0.02
	(0.03)	(0.03)	(0.01)	(0.03)	(0.04)	(0.02)
Mis_2	-0.22***	-0.15***	-0.14***	-0.26***	-0.29***	-0.14***
	(0.04)	(0.04)	(0.03)	(0.07)	(0.05)	(0.04)
LEduc	-0.08	0.06	0.14***	0.02	0.16	0.19***
	(0.08)	(0.06)	(0.04)	(0.07)	(0.10)	(0.05)
Institutions	0.006**	0.004	0.002**	0.003	0.001	0.001
	(0.002)	(0.003)	(0.001)	(0.004)	(0.005)	(0.001)
LSAVING		0.003				0.001
		(0.05)				(0.04)
LGOV			-0.07			-0.05
			(0.05)			(0.04)
LOPENNESS				-0.05		-0.02
				(0.11)		(0.08)
INFL					-0.01***	-0.007*
					(0.004)	(0.003)
AR (2)	0.42	0.28	0.22	0.24	0.41	0.12
Hansen	0.66	0.36	0.29	0.13	0.29	0.11
Hansen-Diff	0.86	0.72	0.65	0.17	0.38	0.15
Groups	109	109	109	109	109	109
Instruments	25	37	53	29	32	83

Notes: (1) The dependent variable is GROWTHPIBCAPITA; (2) estimates using robust two-step System GMM with Time Dummies; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) Robust Standard Errors between parentheses; (5) L = variable in logarithm

Table 3.D 4 - Exchange Misalignment (Mis3) and Growth

	(1)	(2)	(3)	(4)	(5)	(6)
y_{t-1}	0.32**	0.27**	0.27**	0.22	-0.06	0.31***
	(0.13)	(0.12)	(0.14)	(0.16)	(0.09)	(0.08)
Initial Income	0.001	-0.009	-0.01	-0.01	-0.06*	-0.04**
	(0.03)	(0.02)	(0.01)	(0.03)	(0.03)	(0.01)
Mis_3	-0.12*	-0.09**	-0.09**	-0.16*	-0.25***	-0.15***
	(0.06)	(0.04)	(0.03)	(0.08)	(0.05)	(0.04)
LEduc	0.04	0.08	0.10*	0.10	0.21***	0.13***
	(0.10)	(0.06)	(0.05)	(0.10)	(0.06)	(0.04)
Institutions	0.006***	0.002	0.002**	0.003	0.004	0.001
	(0.001)	(0.003)	(0.001)	(0.003)	(0.004)	(0.001)
LSAVING		0.03				0.04
		(0.04)				(0.03)
LGOV			-0.06*			-0.04
			(0.03)			(0.03)
LOPENNESS				0.01		0.08
				(0.13)		(0.08)
INFL					-0.01***	-0.005*
					(0.003)	(0.003)
AR (2)	0.86	0.36	0.41	0.66	0.16	0.84
Hansen	0.60	0.32	0.42	0.11	0.54	0.58
Hansen-Diff	0.57	0.58	0.67	0.20	0.82	0.61
Groups	106	104	104	104	106	104
Instruments	25	40	62	30	32	91

Notes: (1) The dependent variable is GROWTHPIBCAPITA; (2) estimates using robust two-step System GMM with Time Dummies; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) Robust Standard Errors between parentheses; (5) L = variable in logarithm

Table 3.D 5 - Exchange Misalignment (Mis4) and Growth

	(1)	(2)	(3)	(4)	(5)	(6)
y_{t-1}	0.11	0.11	0.09	0.18	-0.08	0.16**
	(0.10)	(0.10)	(0.09)	(0.11)	(0.06)	(0.07)
Initial Income	0.07**	0.005	-0.006	0.05	-0.007	-0.02
	(0.03)	(0.03)	(0.01)	(0.03)	(0.04)	(0.02)
Mis_4	-0.21***	-0.14***	-0.14***	-0.25***	-0.30***	-0.14***
	(0.04)	(0.04)	(0.03)	(0.07)	(0.05)	(0.04)
LEduc	-0.08	0.07	0.14***	0.03	0.17*	0.19***
	(0.08)	(0.06)	(0.04)	(0.07)	(0.09)	(0.05)
Institutions	0.005**	0.004	0.002**	0.003	0.001	0.001
	(0.002)	(0.003)	(0.001)	(0.004)	(0.004)	(0.001)
LSAVING		0.006				0.002
		(0.05)				(0.04)
LGOV			-0.06			-0.05
			(0.05)			(0.04)
LOPENNESS				-0.06		-0.02
				(0.11)		(0.08)
INFL					-0.01***	-0.007*
					(0.004)	(0.003)
AR (2)	0.36	0.24	0.20	0.20	0.36	0.11
Hansen	0.59	0.34	0.28	0.11	0.32	0.11
Hansen-Diff	0.81	0.71	0.65	0.19	0.42	0.16
Groups	109	109	109	109	109	109
Instruments	25	37	53	29	32	83

Notes: (1) The dependent variable is GROWTHPIBCAPITA; (2) estimates using robust two-step System GMM with Time Dummies; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) Robust Standard Errors between parentheses; (5) L = variable in logarithm

Table 3.D 6 - Exchange Misalignment (Mis5) and Growth

	(1)	(2)	(3)	(4)	(5)	(6)
y_{t-1}	-0.11	0.06	0.12	-0.03	-0.06	0.17**
	(0.13)	(0.10)	(0.08)	(0.15)	(0.07)	(0.06)
Initial Income	0.04	-0.01	-0.06*	0.01	-0.02	-0.04
	(0.03)	(0.02)	(0.03)	(0.04)	(0.03)	(0.03)
Mis_5	-0.16**	-0.13***	-0.11**	-0.24*	-0.32***	-0.21***
	(0.07)	(0.04)	(0.05)	(0.12)	(0.05)	(0.04)
LEduc	-0.004	0.06	0.23***	0.14	0.10	0.17***
	(0.12)	(0.05)	(0.07)	(0.11)	(0.10)	(0.05)
Institutions	-0.0001	0.005	0.001	-0.01**	0.003	0.00004
	(0.005)	(0.003)	(0.001)	(0.004)	(0.007)	(0.001)
LSAVING		-0.01				0.04
		(0.04)				(0.06)
LGOV			-0.18***			-0.14
			(0.06)			(0.06)
LOPENNESS				-0.01		0.12
				(0.12)		(0.08)
INFL					-0.01***	-0.005
					(0.004)	(0.003)
AR (2)	**0.00**	0.56	0.33	**0.00**	0.83	0.14
Hansen	0.78	0.38	0.108	0.15	0.35	0.17
Hansen-Diff	0.82	0.75	0.34	0.19	0.31	0.87
Groups	95	95	95	95	95	95
Instruments	25	37	53	32	32	82

Notes: (1) The dependent variable is GROWTHPIBCAPITA; (2) estimates using robust two-step System GMM with Time Dummies; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) Robust Standard Errors between parentheses; (5) L = variable in logarithm

Table 3.D 7 - Exchange Misalignment (Mis6) and Growth

	(1)	(2)	(3)	(4)	(5)	(6)[a]
y_{t-1}	0.03	0.18	0.17*	0.13	-0.10	0.09
	(0.18)	(0.13)	(0.10)	(0.10)	(0.06)	(0.11)
Initial Income	0.04	0.01	-0.004	0.04	0.01	-0.008
	(0.06)	(0.02)	(0.02)	(0.02)	(0.04)	(0.04)
Mis_6	-0.13*	-0.12***	-0.12***	-0.22***	-0.32***	-0.27***
	(0.06)	(0.04)	(0.03)	(0.06)	(0.06)	(0.07)
LEduc	0.05	0.09	0.16**	0.12**	0.17**	0.18**
	(0.17)	(0.07)	(0.06)	(0.06)	(0.07)	(0.07)
Institutions	0.005	0.002	0.0009	-0.0003	0.007	0.0005
	(0.004)	(0.004)	(0.0009)	(0.001)	(0.005)	(0.002)
LSAVING		0.01				0.12
		(0.03)				(0.07)
LGOV			-0.11*			-0.16**
			(0.06)			(0.08)
LOPENNESS				0.10		0.27**
				(0.07)		(0.11)
INFL					-0.01***	-0.004
					(0.004)	(0.003)
AR (2)	0.43	0.85	0.73	0.19	0.14	0.81
Hansen	0.72	0.48	0.38	0.34	0.56	0.29
Hansen-Diff	0.80	0.81	0.47	0.76	0.48	0.92
Groups	90	90	90	90	30	90
Instruments	25	40	62	54	32	50

Notes: (1) The dependent variable is GROWTHPIBCAPITA; (2) estimates using robust two-step System GMM with Time Dummies; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) Robust Standard Errors between parentheses; (5) L = variable in logarithm; [a] The instruments are collapsed

Table 3.D 8 - Exchange Misalignment (Mis7) and Growth

	(1)	(2)	(3)	(4)	(5)	(6)[a]
y_{t-1}	0.02	0.19	0.17*	0.14	-0.07	0.12
	(0.20)	(0.13)	(0.09)	(0.11)	(0.07)	(0.11)
Initial Income	0.04	0.01	-0.004	0.04	0.008	-0.01
	(0.05)	(0.02)	(0.02)	(0.03)	(0.04)	(0.03)
Mis_7	-0.13*	-0.12***	-0.12***	-0.21***	-0.29***	-0.26***
	(0.07)	(0.04)	(0.03)	(0.06)	(0.06)	(0.07)
LEduc	0.06	0.09	0.15**	0.11*	0.16**	0.17**
	(0.16)	(0.06)	(0.06)	(0.06)	(0.07)	(0.07)
Institutions	0.005	0.002	0.0008	-0.0004	0.007	0.0004
	(0.004)	(0.004)	(0.0009)	(0.001)	(0.005)	(0.002)
LSAVING		0.012				0.12*
		(0.03)				(0.07)
LGOV			-0.12*			-0.18**
			(0.06)			(0.07)
LOPENNESS				0.09		0.28**
				(0.07)		(0.11)
INFL					-0.01***	-0.003
					(0.003)	(0.003)
AR (2)	0.39	0.88	0.71	0.16	0.11	0.76
Hansen	0.77	0.48	0.37	0.30	0.57	0.23
Hansen-Diff	0.81	0.79	0.42	0.65	0.50	0.88
Groups	90	90	90	90	90	90
Instruments	25	40	62	54	32	50

Notes: (1) The dependent variable is GROWTHPIBCAPITA; (2) estimates using robust two-step System GMM with Time Dummies; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) Robust Standard Errors between parentheses; (5) L = variable in logarithm; [a] The instruments are collapsed

Table 3.D 9 - Exchange Misalignment, Income Level and Growth

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
y_{t-1}	0.16	0.11	0.16*	0.14	0.18*	-0.06	0.19*	0.16
	(0.11)	(0.08)	(0.09)	(0.10)	(0.09)	(0.12)	(0.10)	(0.17)
Initial Income	0.09**	0.02	0.04	0.02	0.04	0.01	-0.01	0.02
	(0.04)	(0.04)	(0.04)	(0.03)	(0.04)	(0.04)	(0.01)	(0.05)
LRER	-0.24***							
	(0.06)							
LRERYN	2.39e-6							
	(3.6e-6)							
Mis_1		-0.33***						
		(0.08)						
Mis_1YN		8.6e-6***						
		(2.7e-6)						
Mis_2			-0.29**					
			(0.11)					
Mis_2YN			4.3e-06					
			(5.3e-6)					
Mis_3				-0.28***				
				(0.09)				
Mis_3YN				9.6e-6***				
				(3.2e-6)				
Mis_4					-0.27**			
					(0.11)			
Mis_4YN					3.9e-6			
					(5.1e-6)			
Mis_5						-0.26**		
						(0.11)		
Mis_5YN						4.3e-6		
						(2.3e-6)		
Mis_6							-0.09	
							(0.06)	
Mis_6YN							-9.4e-6	
							(1.6e-6)	
Mis_7								-0.20**
								(0.10)
Mis_7YN								2.9e-6
								(4.0e-6)
LEduc	-0.12	-0.07	-0.02	-0.05	-0.01	0.01	0.19***	0.10
	(0.09)	(0.10)	(0.09)	(0.10)	(0.09)	(0.10)	(0.05)	(0.15)
Institutions	0.007***	0.005***	0.005***	0.005***	0.005***	-0.003	0.0005	0.003
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.004)	(0.0008)	(0.005)
AR (2)	0.69	0.22	0.28	0.79	0.25	**0.00**	0.34	0.54
Hansen	0.21	0.47	0.43	0.51	0.38	0.37	0.24	0.13
Hansen-Diff	0.84	0.81	0.71	0.43	0.67	0.53	0.83	0.11
Groups	111	111	109	106	109	95	90	90
Instruments	31	31	31	31	31	31	71	31

Notes: (1) The dependent variable is GROWTHPIBCAPITA; (2) estimates using robust two-step System GMM with Time Dummies; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) Robust Standard Errors between parentheses; (5) L = variable in logarithm; (6) LRERYN = LRER X YN, MisYN = Mis X YN

Table 3.D 10 - Exchange Misalignment and Growth: Developing Countries (LPIBCAPITA<US$ 6,000 – Rodrik's cutline income level)

	(1)[a]	(2)[a]	(3)[a]	(4)[a]	(5)[a]	(6)[a]	(7)[a]	(8)[a]
y_{t-1}	-0.52***	-0.53**	-0.49	0.20	-0.37	0.01	0.45	0.34
	(0.19)	(0.21)	(0.29)	(0.53)	(0.27)	(0.42)	(0.33)	(0.36)
Initial Income	0.01	0.03	0.04	0.03	0.03	0.04	0.04	0.05
	(0.08)	(0.07)	(0.09)	(0.09)	(0.08)	(0.21)	(0.04)	(0.05)
LRER	-0.28**							
	(0.11)							
Mis_1		-0.14						
		(0.09)						
Mis_2			-0.23*					
			(0.14)					
Mis_3				-0.12				
				(0.14)				
Mis_4					-0.24*			
					(0.14)			
Mis_5						-0.12		
						(0.11)		
Mis_6							-0.08	
							(0.08)	
Mis_7								-0.10
								(0.08)
LEduc	0.13	0.15*	0.14**	-0.10	0.14**	0.04	0.001	0.006
	(0.08)	(0.08)	(0.06)	(0.18)	(0.06)	(0.5)	(0.07)	(0.08)
Institutions	0.006***	0.005***	0.005***	0.003	0.004***	0.001	0.001	0.0008
	(0.002)	(0.001)	(0.001)	(0.003)	(0.001)	(0.002)	(0.001)	(0.001)
AR (2)	0.16	0.28	0.13	0.11	0.13	0.30	0.30	0.28
Hansen	0.57	0.65	0.77	0.39	0.78	0.16	0.48	0.45
Hansen-Diff	0.71	0.87	0.81	0.79	0.84	0.13	0.63	0.55
Groups	40	40	38	38	38	27	25	25
Instruments	20	20	21	23	21	23	23	23

Notes: (1) The dependent variable is GROWTHPIBCAPITA; (2) estimates using robust two-step System GMM with Time Dummies; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) Robust Standard Errors between parentheses; (5) L = variable in logarithm; [a] The instruments are collapsed

Table 3.D 11 - Exchange Misalignment and Growth: Developing Countries (LPIBCAPITA<US$ 3,346 – 25% percentile)

	(1)[a]	(2)[a]	(3)[a]	(4)[a]	(5)[a]	(6)[a]	(7)[a]	(8)[a]
y_{t-1}	-0.18 (0.30)	-0.08 (0.22)	-0.62 (0.75)	-0.48 (0.52)	-0.67 (0.80)	0.28 (0.23)	0.28 (0.53)	0.26 (0.58)
Initial Income	0.10 (0.13)	0.17 (0.10)	0.12 (0.18)	0.17 (0.19)	0.12 (0.18)	0.14 (0.30)	0.07 (0.15)	0.08 (0.18)
LRER	-0.10 (0.19)							
Mis_1		-0.002 (0.10)						
Mis_2			0.07 (0.16)					
Mis_3				0.10 (0.27)				
Mis_4					0.01 (0.13)			
Mis_5						0.07 (0.14)		
Mis_6							0.06 (0.36)	
Mis_7								0.05 (0.48)
LEduc	0.12* (0.06)	0.12 (0.11)	0.24** (0.10)	0.15 (0.34)	0.28** (0.11)	0.09 (0.12)	0.09 (0.11)	0.09 (0.11)
Institutions	0.003* (0.001)	0.002 (0.001)	0.003** (0.001)	0.003 (0.004)	0.004** (0.001)	0.0003 (0.001)	0.0005 (0.001)	0.0003 (0.001)
AR (2)	0.31	0.66	0.92	0.96	0.98	0.63	0.84	0.64
Hansen	0.90	0.75	0.78	0.38	0.76	0.98	0.89	0.92
Hansen-Diff	0.93	0.87	0.75	0.60	0.72	1.00	1.00	1.00
Groups	27	27	26	26	26	**23**	**23**	**23**
Instruments	20	20	21	23	21	**17**	**16**	**16**

Notes: (1) The dependent variable is GROWTHPIBCAPITA; (2) estimates using robust two-step System GMM with Time Dummies; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) Robust Standard Errors between parentheses; (5) L = variable in logarithm; [a] The instruments are collapsed

Table 3.D 12 - Exchange Misalignment and Growth: Developing Countries (LPIBCAPITA<US$ 9,364 – 50% percentile)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)[a]	(8)[a]
y_{t-1}	0.33***	0.22*	-0.06	0.22	0.27	0.29*	0.25	0.16
	(0.12)	(0.12)	(0.12)	(0.15)	(0.21)	(0.15)	(0.25)	(0.22)
Initial Income	0.01	0.04	0.02	0.006	0.03	0.03	0.06	0.07
	(0.02)	(0.03)	(0.02)	(0.04)	(0.05)	(0.03)	(0.05)	(0.05)
LRER	-0.07**							
	(0.03)							
Mis_1		-0.10*						
		(0.05)						
Mis_2			-0.15***					
			(0.05)					
Mis_3				-0.11*				
				(0.07)				
Mis_4					-0.13*			
					(0.07)			
Mis_5						-0.17**		
						(0.08)		
Mis_6							-0.20	
							(0.15)	
Mis_7								-0.22
								(0.15)
LEduc	0.05	0.01	0.08	0.06	0.04	-0.05	-0.03	-0.04
	(0.04)	(0.06)	(0.06)	(0.07)	(0.10)	(0.09)	(0.10)	(0.12)
Institutions	0.003*	0.002	0.003*	0.004***	0.003**	0.001	0.002	0.001
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
AR (2)	0.17	0.11	0.10	0.11	0.11	0.41	0.20	0.22
Hansen	0.49	0.33	0.33	0.51	0.37	0.54	0.43	0.45
Hansen-Diff	0.74	0.77	0.90	0.86	0.86	0.91	0.63	0.66
Groups	53	53	51	46	35	39	37	37
Instruments	51	44	38	51	51	37	23	23

Notes: (1) The dependent variable is GROWTHPIBCAPITA; (2) estimates using robust two-step System GMM with Time Dummies; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) Robust Standard Errors between parentheses; (5) L = variable in logarithm; [a] The instruments are collapsed

Table 3.D 13 - Exchange Misalignment and Growth: Developing Countries (LPIBCAPITA<US$ 24,725 – 75% percentile)

	(1)	(2)	(3)	(4)	(5)	(6)[a]	(7)	(8)
y_{t-1}	0.30***	0.30***	0.30***	0.33**	0.16	0.25*	0.26*	0.19*
	(0.09)	(0.09)	(0.10)	(0.16)	(0.16)	(0.14)	(0.15)	(0.11)
Initial Income	0.02	0.008	0.01	-0.001	0.04	0.02	0.04*	0.01
	(0.02)	(0.02)	(0.02)	(0.04)	(0.04)	(0.03)	(0.02)	(0.02)
LRER	-0.10**							
	(0.04)							
Mis_1		-0.08**						
		(0.04)						
Mis_2			-0.10**					
			(0.04)					
Mis_3				-0.14*				
				(0.07)				
Mis_4					-0.17***			
					(0.06)			
Mis_5						-0.12		
						(0.10)		
Mis_6							-0.15***	
							(0.05)	
Mis_7								-0.08
								(0.05)
LEduc	0.07*	0.09*	0.09**	0.07	0.05	-0.003	0.05	0.13***
	(0.04)	(0.04)	(0.04)	(0.08)	(0.08)	(0.09)	(0.07)	(0.04)
Institutions	0.001	0.001	0.0008	0.004***	0.002	0.0005	0.0004	0.00003
	(0.001)	(0.001)	(0.001)	(0.001)	(0.003)	(0.002)	(0.001)	(0.001)
AR (2)	0.75	0.70	0.49	0.42	0.48	0.35	0.31	0.15
Hansen	0.32	0.32	0.39	0.25	0.18	0.21	0.26	0.63
Hansen-Diff	0.45	0.47	0.52	0.75	0.68	0.63	0.56	0.95
Groups	83	83	81	77	81	68	62	62
Instruments	61	62	62	37	41	37	55	55

Notes: (1) The dependent variable is GROWTHPIBCAPITA; (2) estimates using robust two-step System GMM with Time Dummies; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) Robust Standard Errors between parentheses; (5) L = variable in logarithm; [a] The instruments are collapsed

Table 3.D 14 - Exchange Misalignment and Growth: Developing Countries (interacting dummies for LPIBCAPITA<US$ 6,000)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
y_{t-1}	0.06	0.07	0.07	0.34***	0.07	-0.09	0.13	0.14
	(0.09)	(0.10)	(0.09)	(0.11)	(0.09)	(0.09)	(0.13)	(0.17)
Initial	0.09**	0.01	0.03	-0.01	0.09	0.01	0.09**	-0.20*
Income	(0.04)	(0.03)	(0.03)	(0.09)	(0.08)	(0.03)	(0.04)	(0.11)
LRER	-0.27***							
	(0.06)							
$LRER_{\_6000}$	0.07*							
	(0.03)							
Mis_1		-0.19***						
		(0.06)						
Mis_{1_6000}		0.07						
		(0.10)						
Mis_2			-0.20***					
			(0.06)					
Mis_{2_6000}			0.08					
			(0.08)					
Mis_3				-0.10				
				(0.06)				
Mis_{3_6000}				-0.01				
				(0.09)				
Mis_4					-0.19***			
					(0.06)			
Mis_{4_6000}					0.09			
					(0.08)			
Mis_5						-0.14		
						(0.09)		
Mis_{5_6000}						0.08		
						(0.10)		
Mis_6							-0.10***	
							(0.03)	
Mis_{6_6000}							-0.20*	
							(0.11)	
Mis_7								-0.10***
								(0.03)
Mis_{7_6000}								-0.20*
								(0.11)
LEduc	-0.04	-0.005	-0.005	0.02	-0.0037	0.04	-0.06	-0.04
	(0.07)	(0.09)	(0.08)	(0.08)	(0.07)	(0.07)	(0.15)	(0.16)
Institutions	0.003	0.005***	0.005***	0.005***	0.005***	0.0009	0.004*	0.004*
	(0.003)	(0.09)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
AR (2)	0.29	0.46	0.34	0.68	0.30	**0.00**	0.85	0.84
Hansen	0.17	0.34	0.44	0.52	0.39	0.35	0.54	0.43
Hansen-Diff	0.67	0.51	0.78	0.38	0.74	0.87	0.33	0.23
Groups	111	111	109	106	109	95	90	90
Instruments	29	34	34	34	34	34	34	34

Notes: (1) The dependent variable is GROWTHPIBCAPITA; (2) estimates using robust two-step System GMM with Time Dummies; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) Robust Standard Errors between parentheses; (5) L = variable in logarithm; (6) $Mis_{\_6000}$ = Mis X dummies for countries with YN = U$S 6,000

Table 3.D 15 - Exchange Misalignment and Growth: Developing Countries (interacting dummies for LPIBCAPITA<US$ 3,346)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
y_{t-1}	0.12	0.15*	0.12	0.45***	0.10	-0.09	0.35**	0.24**
	(0.09)	(0.09)	(0.10)	(0.13)	(0.10)	(0.12)	(0.18)	(0.10)
Initial Income	0.11***	0.03	0.04	-0.003	0.04	0.04	0.05	0.07
	(0.03)	(0.03)	(0.03)	(0.04)	(0.03)	(0.03)	(0.04)	(0.08)
LRER	-0.25***							
	(0.05)							
$LRER_{\_3346}$	0.05							
	(0.03)							
Mis_1		-0.18***						
		(0.05)						
Mis_{1_3346}		0.04						
		(0.07)						
Mis_2			-0.19***					
			(0.05)					
Mis_{2_3346}			0.11					
			(0.08)					
Mis_3				-0.17***				
				(0.06)				
Mis_{3_3346}				0.03				
				(0.10)				
Mis_4					-0.18***			
					(0.05)			
Mis_{4_3346}					0.15*			
					(0.08)			
Mis_5						-0.16**		
						(0.06)		
Mis_{5_3346}						0.16***		
						(0.06)		
Mis_6							-0.24***	
							(0.08)	
Mis_{6_3346}							0.21*	
							(0.11)	
Mis_7								-0.18***
								(0.05)
Mis_{7_3346}								0.07
								(0.08)
LEduc	-0.09	-0.05	0.000007	0.08	0.009	0.01	0.06	0.11
	(0.08)	(0.07)	(0.07)	(0.10)	(0.07)	(0.10)	(0.15)	(0.08)
Institutions	0.004**	0.006***	0.005**	0.005***	0.004	-0.002	0.0003	0.00001
	(0.001)	(0.001)	(0.002)	(0.001)	(0.003)	(0.004)	(0.001)	(0.001)
AR (2)	0.35	0.49	0.37	0.85	0.29	**0.00**	0.26	0.18
Hansen	0.22	0.50	0.32	0.38	0.28	0.72	0.19	0.21
Hansen-Diff	0.55	0.92	0.91	0.55	0.86	0.90	0.74	0.53
Groups	111	111	109	106	109	95	90	90
Instruments	29	34	34	34	34	34	47	57

Notes: (1) The dependent variable is GROWTHPIBCAPITA; (2) estimates using robust two-step System GMM with Time Dummies; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) Robust Standard Errors between parentheses; (5) L = variable in logarithm; $Mis_{\_3346}$ = Mis X dummies for countries with YN = U$S 3,346

Table 3.D 16 - Exchange Misalignment and Growth: Developing Countries (interacting dummies for LPIBCAPITA<US$ 9,634)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
y_{t-1}	0.11	0.13	0.12	0.33***	0.13	-0.04	0.03	0.07
	(0.10)	(0.12)	(0.11)	(0.11)	(0.11)	(0.10)	(0.14)	(0.15)
Initial	0.08*	0.02	0.03	0.006	0.03	0.04	0.09*	0.10*
Income	(0.04)	(0.04)	(0.04)	(0.03)	(0.04)	(0.03)	(0.05)	(0.06)
LRER	-0.17***							
	(0.05)							
$LRER_{\_9634}$	0.003							
	(0.05)							
Mis_1		-0.16***						
		(0.05)						
Mis_{1_9634}		0.03						
		(0.09)						
Mis_2			-0.17***					
			(0.04)					
Mis_{2_9634}			0.04					
			(0.09)					
Mis_3				-0.10				
				(0.07)				
Mis_{3_9634}				-0.04				
				(0.10)				
Mis_4					-0.18***			
					(0.04)			
Mis_{4_9634}					0.06			
					(0.09)			
Mis_5						-0.22***		
						(0.05)		
Mis_{5_9634}						0.15**		
						(0.06)		
Mis_6							-0.20***	
							(0.06)	
Mis_{6_9634}							0.01	
							(0.09)	
Mis_7								-0.20***
								(0.07)
Mis_{7_9634}								-0.02
								(0.11)
LEduc	-0.02	-0.03	0.0007	0.000009	0.000009	-0.003	-0.03	-0.05
	(0.08)	(0.11)	(0.08)	(0.10)	(0.08)	(0.08)	(0.14)	(0.15)
Institutions	0.004	0.006**	0.005*	0.005***	0.004	-0.002	0.003	0.003
	(0.002)	(0.002)	(0.003)	(0.001)	(0.003)	(0.003)	(0.003)	(0.002)
AR (2)	0.17	0.39	0.25	0.80	0.20	**0.00**	0.54	0.67
Hansen	**0.02**	0.14	0.15	0.56	0.13	0.32	0.41	0.30
Hansen-Diff	0.74	0.52	0.77	0.65	0.78	0.67	0.39	0.33
Groups	111	111	109	106	109	95	90	90
Instruments	29	34	34	34	34	34	34	34

Notes: (1) The dependent variable is GROWTHPIBCAPITA; (2) estimates using robust two-step System GMM with Time Dummies; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) Robust Standard Errors between parentheses; (5) L = variable in logarithm; (6) $Mis_{\_9634}$ = Mis X dummies for countries with YN = U$S 9,634

Table 3.D 17 - Exchange Misalignment and Growth: Developing Countries (interacting dummies for LPIBCAPITA<US$ 24,725)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
y_{t-1}	0.13	0.12	0.16	0.26**	0.16**	-0.05	0.05	0.05
	(0.09)	(0.08)	(0.09)	(0.10)	(0.07)	(0.12)	(0.17)	(0.15)
Initial Income	0.10***	0.05	0.04	0.01	0.07**	0.02	0.06	0.07
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)	(0.05)
LRER	-0.33**							
	(0.14)							
$LRER_{\_24725}$	0.09							
	(0.13)							
Mis_1		0.04						
		(0.09)						
Mis_{1_24725}		-0.35***						
		(0.12)						
Mis_2			-0.08					
			(0.09)					
Mis_{2_24725}			-0.15					
			(0.15)					
Mis_3				0.04				
				(0.08)				
Mis_{3_24725}				-0.28**				
				(0.12)				
Mis_4					-0.07			
					(0.08)			
Mis_{4_24725}					-0.20			
					(0.13)			
Mis_5						-0.09		
						(0.16)		
Mis_{5_24725}						-0.13		
						(0.22)		
Mis_6							-0.06	
							(0.09)	
Mis_{6_24725}							-0.12	
							(0.10)	
Mis_7								-0.07
								(0.11)
Mis_{7_24725}								-0.12
								(0.12)
LEduc	-0.07	-0.15*	-0.04	-0.05	-0.08	0.004	-0.01	-0.03
	(0.08)	(0.08)	(0.10)	(0.09)	(0.08)	(0.10)	(0.14)	(0.13)
Institutions	0.004	0.005***	0.006***	0.005**	0.004**	-0.003	0.004	0.003
	(0.003)	(0.001)	(0.001)	(0.002)	(0.002)	(0.004)	(0.005)	(0.005)
AR (2)	0.32	0.22	0.35	0.96	0.15	**0.00**	0.47	0.62
Hansen	0.18	0.87	0.26	0.66	0.44	0.54	0.59	0.71
Hansen-Diff	0.78	0.97	0.29	0.50	0.56	0.51	0.88	0.87
Groups	111	111	109	106	109	95	90	90
Instruments	24	31	31	31	31	31	30	30

Notes: (1) The dependent variable is GROWTHPIBCAPITA; (2) estimates using robust two-step System GMM with Time Dummies; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) Robust Standard Errors between parentheses; (5) L = variable in logarithm; (6) $Mis_{\_24725}$ = Mis X dummies for countries with YN = U$S 24,725

Table 3.D 18 - Exchange Misalignment and Growth: Developing Countries (interacting dummies for LPIBCAPITA<US$ 24,725)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
y_{t-1}	-0.0027	0.10	0.16*	0.29***	0.08	-0.10	0.14	0.15
	(0.09)	(0.09)	(0.09)	(0.10)	(0.09)	(0.14)	(0.15)	(0.15)
Initial	0.11***	0.06*	0.07**	0.01	0.06	0.03	0.06	-0.21**
Income	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.05)	(0.08)
$LRER_{\_24725}$	-0.37***							
	(0.07)							
Mis_{1_24725}		-0.28***						
		(0.08)						
Mis_{2_24725}			-0.29***					
			(0.07)					
Mis_{3_24725}				-0.23**				
				(0.10)				
Mis_{4_24725}					-0.32***			
					(0.09)			
Mis_{5_24725}						-0.20*		
						(0.10)		
Mis_{6_24725}							-0.19**	
							(0.08)	
Mis_{7_24725}								-0.21**
								(0.08)
LEduc	0.009	-0.15*	-0.14*	-0.01	-0.06	0.0001	-0.07	-0.10
	(0.09)	(0.08)	(0.08)	(0.10)	(0.09)	(0.11)	(0.14)	(0.14)
Institutions	0.005***	0.005***	0.005***	0.005***	0.004	-0.0009	0.006	0.005
	(0.001)	(0.002)	(0.002)	(0.001)	(0.003)	(0.005)	(0.006)	(0.004)
AR (2)	0.96	0.20	0.16	0.95	0.12	**0.00**	0.52	0.53
Hansen	0.62	0.83	0.51	0.54	0.49	0.81	0.66	0.75
Hansen-Diff	0.81	0.98	0.71	0.48	0.77	0.91	0.61	0.71
Groups	111	111	109	106	109	105	90	90
Instruments	20	25	25	25	23	25	25	25

Notes: (1) The dependent variable is GROWTHPIBCAPITA; (2) estimates using robust two-step System GMM with Time Dummies; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) Robust Standard Errors between parentheses; (5) L = variable in logarithm; (6) $Mis_{\_24725}$ = Mis X dummies for countries with YN = U$S 24,725

Table 3.D 19 - Exchange Misalignment and Growth: Latin America (LA), Africa (AF), and Asia (AS)

	(1)	(2)	(3)	(4)[a]	(5)[a]	(6)[a]
y_{t-1}	0.32*	0.38***	0.27	0.18	0.46***	0.39***
	(0.17)	(0.07)	(0.18)	(0.12)	(0.09)	(0.10)
Initial Income	-0.01	-0.03**	-0.04	-0.04*	-0.01	-0.02
	(0.03)	(0.01)	(0.03)	(0.02)	(0.02)	(0.02)
LRER	-0.09**	0.02				
	(0.04)	(0.04)				
$LRER_{AS}$		-0.04**				
		(0.02)				
Mis_1			-0.06	0.05		
			(0.05)	(0.10)		
Mis_{1AS}				-0.32**		
				(0.16)		
Mis_7					-0.10**	-0.04
					(0.05)	(0.05)
Mis_{7AS}						-0.10
						(0.12)
LEduc	0.17*	0.09**	0.22**	0.17***	0.18***	0.17**
	(0.09)	(0.03)	(0.10)	(0.06)	(0.06)	(0.06)
Institutions	0.001	0.001	0.0001	0.004*	0.0003	0.0004
	(0.003)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)
AR (2)	0.34	0.19	0.43	0.66	0.27	0.22
Hansen	0.31	0.29	0.33	0.24	0.62	0.66
Hansen-Diff	0.33	0.84	0.28	0.20	0.97	0.88
Groups	71	71	71	71	31	35
Instruments	34	62	35	33	54	54

Notes: (1) The dependent variable is GROWTHPIBCAPITA; (2) estimates using robust two-step System GMM with Time Dummies; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) Robust Standard Errors between parentheses; (5) L = variable in logarithm; (6) The sample has only countries from Latin America, Africa and Asia; [a] The instruments are collapsed; $LRER_{AS}$ = LRER X dummies for Asian countries, Mis_{AS} = Mis X dummies for Asian countries

Appendix E- Exchange Rate Misalignment and Growth: The Washington Consensus'

Table 3.E 1 - Exchange Misalignment (|Mis1|) and Growth

	(1)	(2)	(3)	(4)	(5)	(6)
y_{t-1}	0.04	-0.13	0.15	0.06	0.02	0.28**
	(0.21)	(0.16)	(0.13)	(0.13)	(0.08)	(0.11)
Initial Income	0.02	-0.01	0.003	-0.02	-0.07***	-0.08***
	(0.03)	(0.06)	(0.03)	(0.02)	(0.02)	(0.09)
$\lvert Mis_1 \rvert$	-0.18	-0.08	-0.12	-0.04	0.10*	-0.03
	(0.20)	(0.18)	(0.20)	(0.16)	(0.06)	(0.09)
LEduc	-0.11	0.05	0.01	0.06	0.23***	0.25***
	(0.11)	(0.12)	(0.09)	(0.11)	(0.05)	(0.07)
Institutions	0.006***	0.006***	0.008***	0.002	0.003	0.0007
	(0.001)	(0.004)	(0.07)	(0.005)	(0.002)	(0.002)
LSAVING		0.03				0.07
		(0.08)				(0.05)
LGOV			-0.27***			-0.15**
			(0.07)			(0.06)
LOPENNESS				0.06		-0.17
				(0.08)		(0.12)
INFL					-0.001	-0.001
					(0.002)	(0.006)
AR (2)	0.11	0.11	0.56	**0.02**	0.15	0.17
Hansen	0.12	0.16	0.52	**0.01**	0.10	0.12
Hansen-Diff	0.15	0.11	0.59	**0.05**	0.32	0.17
Groups	111	109	109	109	111	109
Instruments	22	25	25	25	52	50

Notes: (1) The dependent variable is GROWTHPIBCAPITA; (2) estimates using robust two-step System GMM with Time Dummies; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) Robust Standard Errors between parentheses; (5) L = variable in logarithm

Table 3.E 2 - Exchange Misalignment (|Mis2|) and Growth

	(1)	(2)	(3)	(4)	(5)	(6)
y_{t-1}	0.08	-0.05	0.19	0.09	0.03	0.31**
	(0.23)	(0.16)	(0.12)	(0.13)	(0.08)	(0.14)
Initial Income	0.004	-0.02	0.001	-0.03	-0.07***	-0.08***
	(0.04)	(0.06)	(0.02)	(0.02)	(0.05)	(0.02)
$\|Mis_2\|$	-0.15	-0.13	-0.05	-0.03	0.07	-0.14
	(0.15)	(0.14)	(0.11)	(0.11)	(0.05)	(0.13)
LEduc	-0.05	0.06	0.02	0.06	0.23***	0.21**
	(0.14)	(0.10)	(0.07)	(0.09)	(0.04)	(0.10)
Institutions	0.005	0.007	0.008***	0.003	0.003	0.001
	(0.003)	(0.002)	(0.001)	(0.005)	(0.002)	(0.002)
LSAVING		0.04				0.11**
		(0.07)				(0.05)
LGOV			-0.26***			-0.26***
			(0.06)			(0.06)
LOPENNESS				0.06		-0.15
				(0.09)		(0.15)
INFL					-0.002	-0.002
					(0.002)	(0.007)
AR (2)	0.12	0.20	0.64	**0.06**	0.12	0.33
Hansen	**0.05**	0.12	0.50	**0.008**	**0.07**	0.22
Hansen-Diff	0.13	0.21	0.54	**0.02**	0.82	0.24
Groups	109	109	109	109	109	109
Instruments	23	25	25	29	52	37

Notes: (1) The dependent variable is GROWTHPIBCAPITA; (2) estimates using robust two-step System GMM with Time Dummies; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) Robust Standard Errors between parentheses; (5) L = variable in logarithm

Table 3.E 3 - Exchange Misalignment (|Mis3|) and Growth

	(1)	(2)	(3)	(4)	(5)	(6)[a]
y_{t-1}	0.35***	0.33***	0.28**	0.03	0.28***	0.09
	(0.12)	(0.07)	(0.12)	(0.20)	(0.09)	(0.11)
Initial Income	-0.03*	-0.04**	-0.03*	-0.03	-0.05**	-0.12***
	(0.02)	(0.02)	(0.02)	(0.03)	(0.02)	(0.04)
$\|Mis_3\|$	0.03	0.02	0.16	0.13	-0.03	0.004
	(0.12)	(0.05)	(0.11)	(0.15)	(0.07)	(0.08)
LEduc	0.10*	0.09**	0.08*	0.17	0.17***	0.26***
	(0.06)	(0.04)	(0.05)	(0.11)	(0.02)	(0.09)
Institutions	0.001	0.001	0.002**	0.003	0.001	0.002
	(0.001)	(0.001)	(0.001)	(0.003)	(0.001)	(0.002)
LSAVING		0.04				0.09
		(0.03)				(0.08)
LGOV			-0.05			-0.07
			(0.04)			(0.09)
LOPENNESS				-0.10		-0.07
				(0.14)		(0.11)
INFL					-0.001	-0.007
					(0.003)	(0.004)
AR (2)	0.17	0.16	0.23	0.50	0.24	0.38
Hansen	0.15	0.41	0.20	0.21	0.15	0.19
Hansen-Diff	0.63	0.63	0.47	0.28	0.50	0.34
Groups	106	106	104	104	106	104
Instruments	49	77	62	30	64	56

Notes: (1) The dependent variable is GROWTHPIBCAPITA; (2) estimates using robust two-step System GMM with Time Dummies; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) Robust Standard Errors between parentheses; (5) L = variable in logarithm; [a] The instruments are collapsed

Table 3.E 4 - Exchange Misalignment (|Mis4|) and Growth

	(1)	(2)	(3)	(4)	(5)	(6)
y_{t-1}	-0.09	-0.04	0.08	-0.02	0.11	0.30**
	(0.17)	(0.17)	(0.09)	(0.14)	(0.08)	(0.14)
Initial Income	-0.01	-0.02	-0.04***	-0.0001	-0.07***	-0.07***
	(0.05)	(0.06)	(0.01)	(0.04)	(0.02)	(0.02)
$\|Mis_4\|$	-0.26	-0.13	0.10	-0.18	-0.05	-0.13
	(0.22)	(0.13)	(0.09)	(0.15)	(0.08)	(0.11)
LEduc	-0.04	0.06	0.15***	-0.16	0.24***	0.20**
	(0.13)	(0.11)	(0.04)	(0.15)	(0.05)	(0.10)
Institutions	0.007***	0.006**	0.003**	0.009***	0.003	0.001
	(0.001)	(0.003)	(0.001)	(0.001)	(0.002)	(0.002)
LSAVING		0.05				0.12**
		(0.08)				(0.04)
LGOV			-0.11*			-0.25***
			(0.05)			(0.05)
LOPENNESS				0.21		-0.15
				(0.20)		(0.16)
INFL					-0.003	-0.002
					(0.002)	(0.006)
AR (2)	0.10	0.21	0.14	0.10	0.11	0.27
Hansen	0.15	0.11	0.18	0.25	**0.07**	0.22
Hansen-Diff	0.12	0.19	0.86	0.28	0.81	0.25
Groups	109	109	109	109	109	109
Instruments	19	25	54	21	55	37

Notes: (1) The dependent variable is GROWTHPIBCAPITA; (2) estimates using robust two-step System GMM with Time Dummies; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) Robust Standard Errors between parentheses; (5) L = variable in logarithm

Table 3.E 5 - Exchange Misalignment (|Mis5|) and Growth

	(1)	(2)	(3)	(4)	(5)	(6)
y_{t-1}	-0.07	-0.09	0.001	-0.15	0.07	0.23***
	(0.15)	(0.12)	(0.09)	(0.16)	(0.08)	(0.07)
Initial Income	0.03	0.02	-0.05**	-0.02	-0.09***	0.13***
	(0.03)	(0.06)	(0.02)	(0.03)	(0.02)	(0.03)
$\|Mis_5\|$	0.17	-0.17	0.11	-0.05	-0.01	-0.12
	(0.14)	(0.16)	(0.07)	(0.18)	(0.10)	(0.09)
LEduc	-0.12	0.01	0.24***	0.07	0.36***	0.37***
	(0.14)	(0.12)	(0.06)	(0.14)	(0.07)	(0.08)
Institutions	-0.006	0.009*	0.002**	-0.005	-0.0009	0.001
	(0.008)	(0.005)	(0.001)	(0.008)	(0.003)	(0.002)
LSAVING		-0.07				0.11
		(0.08)				(0.08)
LGOV			-0.26***			-0.23***
			(0.09)			(0.08)
LOPENNESS				0.10		0.05
				(0.07)		(0.10)
INFL					-0.003	-0.0009
					(0.003)	(0.003)
AR (2)	**0.00**	0.41	0.42	**0.00**	**0.00**	0.38
Hansen	0.61	0.38	0.14	**0.04**	**0.02**	0.11
Hansen-Diff	0.48	0.68	0.99	0.16	0.33	0.57
Groups	95	95	95	95	95	95
Instruments	19	30	49	21	54	97

Notes: (1) The dependent variable is GROWTHPIBCAPITA; (2) estimates using robust two-step System GMM with Time Dummies; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) Robust Standard Errors between parentheses; (5) L = variable in logarithm

Table 3.E 6 - Exchange Misalignment (|Mis6|) and Growth

	(1)	(2)	(3)	(4)	(5)	(6)[a]
y_{t-1}	0.14	0.26	0.19	0.17**	0.12	0.26***
	(0.09)	(0.19)	(0.12)	(0.07)	(0.14)	(0.10)
Initial Income	-0.04**	-0.03	-0.04**	-0.02	-0.07**	-0.09***
	(0.01)	(0.02)	(0.02)	(0.01)	(0.03)	(0.08)
$\|Mis_6\|$	-0.12**	-0.03	0.02	-0.07	-0.04	-0.03
	(0.06)	(0.12)	(0.06)	(0.06)	(0.08)	(0.03)
LEduc	0.23***	0.10	0.18***	0.19***	0.31***	0.23***
	(0.06)	(0.07)	(0.06)	(0.06)	(0.09)	(0.07)
Institutions	0.0006	0.003	0.0005	0.0004	0.0005	0.0008
	(0.001)	(0.003)	(0.001)	(0.001)	(0.001)	(0.002)
LSAVING		0.03				0.12*
		(0.04)				(0.07)
LGOV			-0.15**			-0.19**
			(0.06)			(0.07)
LOPENNESS				-0.13*		0.10
				(0.07)		(0.12)
INFL					-0.006***	-0.004
					(0.002)	(0.004)
AR (2)	0.14	0.97	0.28	0.18	0.26	0.49
Hansen	0.28	0.19	0.37	0.34	0.31	0.13
Hansen-Diff	0.87	0.38	0.83	0.74	0.53	0.60
Groups	90	90	90	90	90	90
Instruments	50	40	62	62	45	55

Notes: (1) The dependent variable is GROWTHPIBCAPITA; (2) estimates using robust two-step System GMM with Time Dummies; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) Robust Standard Errors between parentheses; (5) L = variable in logarithm; [a] The instruments are collapsed

Table 3.E 7 - Exchange Misalignment (|Mis7|) and Growth

	(1)	(2)	(3)	(4)	(5)	(6)
y_{t-1}	0.11	0.25	0.19*	0.17**	0.13	0.36***
	(0.19)	(0.19)	(0.11)	(0.08)	(0.14)	(0.08)
Initial Income	-0.0005	-0.04	-0.05**	-0.02	-0.07**	-0.08***
	(0.03)	(0.02)	(0.02)	(0.01)	(0.03)	(0.02)
$\|Mis_7\|$	0.001	-0.03	0.02	-0.07	-0.04	-0.02
	(0.10)	(0.12)	(0.05)	(0.05)	(0.08)	(0.03)
LEduc	0.03	0.11	0.17***	0.19***	0.31***	0.15**
	(0.13)	(0.07)	(0.06)	(0.06)	(0.09)	(0.06)
Institutions	0.001	0.003	0.0007	0.0004	0.0004	0.0001
	(0.004)	(0.003)	(0.001)	(0.001)	(0.001)	(0.0001)
LSAVING		0.03				0.14***
		(0.04)				(0.04)
LGOV			-0.15**			-0.14**
			(0.06)			(0.06)
LOPENNESS				-0.13*		0.10
				(0.07)		(0.06)
INFL					-0.006***	-0.0002
					(0.002)	(0.0003)
AR (2)	0.25	0.98	0.33	0.16	0.21	0.11
Hansen	0.16	0.19	0.36	0.35	0.31	0.30
Hansen-Diff	0.98	0.32	0.83	0.73	0.49	0.81
Groups	90	90	90	90	90	90
Instruments	28	40	62	62	45	89

Notes: (1) The dependent variable is GROWTHPIBCAPITA; (2) estimates using robust two-step System GMM with Time Dummies; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) Robust Standard Errors between parentheses; (5) L = variable in logarithm

Appendix F - Robustness Check I

Table 3.F 1 - Devaluations, Overvaluations of Exchange rate (Mis1) and Growth

	(1)	(2)	(3)	(4)	(5)	(6)
y_{t-1}	0.07	0.001	0.09	0.06	-0.04	0.21***
	(0.14)	(0.10)	(0.08)	(0.10)	(0.06)	(0.07)
Initial Income	0.01	-0.03	-0.03**	0.001	-0.006	-0.05***
	(0.03)	(0.02)	(0.01)	(0.03)	(0.03)	(0.02)
Dev_1	0.14	-0.17	-0.23***	-0.004	-0.18	-0.16**
	(0.19)	(0.12)	(0.08)	(0.13)	(0.14)	(0.06)
$Over_1$	-0.30**	-0.07	0.003	-0.26**	-0.49***	-0.13**
	(0.14)	(0.12)	(0.09)	(0.12)	(0.16)	(0.06)
LEduc	-0.05	0.15**	0.15***	-0.01	0.13	0.19***
	(0.09)	(0.06)	(0.05)	(0.07)	(0.09)	(0.04)
Institutions	0.006***	0.003	0.002**	0.005	0.001	0.001
	(0.001)	(0.002)	(0.001)	(0.003)	(0.006)	(0.001)
LSAVING		0.02				0.03
		(0.04)				(0.03)
LGOV			-0.07			-0.02
			(0.04)			(0.04)
LOPENNESS				0.09		-0.004
				(0.07)		(0.07)
INFL					-0.01***	-0.007***
					(0.003)	(0.002)
AR (2)	0.28	0.17	0.18	0.17	0.71	0.11
Hansen	0.36	0.15	0.47	0.16	0.35	0.14
Hansen-Diff	0.23	0.94	0.88	0.51	0.42	0.31
Groups	111	109	109	109	111	109
Instruments	28	44	59	34	33	91

Notes: (1) The dependent variable is GROWTHPIBCAPITA; (2) estimates using robust two-step System GMM with Time Dummies; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) Robust Standard Errors between parentheses; (5) L = variable in logarithm; (6) $Dev_1 = Mis_1$ X Dummy for devaluations; $Over_1 = Mis_1$ X Dummy for overvaluations

Table 3.F 2 - Devaluations, Overvaluations of Exchange rate (Mis2) and Growth

	(1)	(2)	(3)	(4)	(5)	(6)
y_{t-1}	-0.007	0.08	0.06	0.09	-0.07	0.20***
	(0.12)	(0.11)	(0.07)	(0.10)	(0.06)	(0.07)
Initial Income	-0.01	-0.01	-0.01	0.006	0.008	-0.04**
	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.02)
Dev_2	-0.04	-0.15	-0.27***	-0.03	-0.23*	-0.21***
	(0.13)	(0.09)	(0.08)	(0.11)	(0.11)	(0.07)
$Over_2$	-0.13	-0.05	-0.003	-0.25**	-0.40***	-0.10*
	(0.12)	(0.09)	(0.07)	(0.10)	(0.12)	(0.06)
LEduc	0.07	0.07	0.13**	-0.01	0.14	0.19***
	(0.06)	(0.05)	(0.05)	(0.07)	(0.09)	(0.04)
Institutions	0.005	0.003	0.002**	0.006**	0.001	0.001
	(0.003)	(0.003)	(0.001)	(0.002)	(0.004)	(0.001)
LSAVING		0.01				0.03
		(0.04)				(0.04)
LGOV			-0.07			-0.02
			(0.04)			(0.04)
LOPENNESS				0.13**		0.005
				(0.06)		(0.08)
INFL					-0.01***	-0.007***
					(0.003)	(0.002)
AR (2)	0.24	0.14	0.17	0.33	0.46	0.13
Hansen	0.12	0.10	0.43	0.13	0.28	0.16
Hansen-Diff	0.10	0.18	0.91	0.28	0.28	0.34
Groups	109	109	109	109	109	109
Instruments	32	43	59	34	33	91

Notes: (1) The dependent variable is GROWTHPIBCAPITA; (2) estimates using robust two-step System GMM with Time Dummies; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) Robust Standard Errors between parentheses; (5) L = variable in logarithm; (6) Dev_2 = Mis_2 X Dummy for devaluations; $Over_2$ = Mis_2 X Dummy for overvaluations

Table 3.F 3 - Devaluations, Overvaluations of Exchange rate (Mis3) and Growth

	(1)	(2)	(3)	(4)	(5)	(6)
y_{t-1}	0.42***	0.35	0.29**	0.33***	0.27***	0.26***
	(0.16)	(0.08)	(0.13)	(0.07)	(0.06)	(0.07)
Initial Income	-0.002	-0.02	-0.02	-0.01	-0.05***	-0.05***
	(0.03)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)
Dev_3	0.01	-0.06	-0.14*	-0.04	-0.01	-0.22***
	(0.14)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)
$Over_3$	-0.25*	-0.03	-0.05	-0.12	-0.16**	-0.10
	(0.14)	(0.07)	(0.09)	(0.07)	(0.06)	(0.07)
LEduc	0.05	0.08	0.10	0.08*	0.17***	0.14***
	(0.10)	(0.05)	(0.06)	(0.04)	(0.05)	(0.04)
Institutions	0.003	0.001	0.002**	0.002*	0.001	0.001
	(0.003)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
LSAVING		0.005				0.05
		(0.03)				(0.03)
LGOV			-0.05*			-0.05
			(0.03)			(0.04)
LOPENNESS				0.03		0.09
				(0.04)		(0.08)
INFL					-0.004*	-0.005***
					(0.002)	(0.001)
AR (2)	0.45	0.17	0.38	0.23	0.77	0.95
Hansen	0.23	0.38	0.42	0.24	0.15	0.54
Hansen-Diff	0.22	0.95	0.55	0.66	0.53	0.50
Groups	106	104	104	104	106	104
Instruments	28	85	68	86	86	97

Notes: (1) The dependent variable is GROWTHPIBCAPITA; (2) estimates using robust two-step System GMM with Time Dummies; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) Robust Standard Errors between parentheses; (5) L = variable in logarithm; (6) Dev_3 = Mis_3 X Dummy for devaluations; $Over_3$ = Mis_3 X Dummy for overvaluations

Table 3.F 4 - Devaluations, Overvaluations of Exchange rate (Mis4) and Growth

	(1)	(2)	(3)	(4)	(5)	(6)
y_{t-1}	0.005	0.08	0.06	0.09	-0.08	0.10
	(0.12)	(0.11)	(0.08)	(0.11)	(0.06)	(0.07)
Initial Income	-0.01	-0.01	-0.01	0.01	0.01	-0.06***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.02)
Dev_4	-0.04	-0.15*	-0.27***	0.02	-0.22*	-0.29***
	(0.12)	(0.09)	(0.08)	(0.11)	(0.11)	(0.09)
$Over_4$	-0.13	-0.04	-0.01	-0.28	-0.40***	0.002
	(0.11)	(0.08)	(0.07)	(0.11)	(0.11)	(0.10)
LEduc	0.08	0.07	0.12**	0.001	0.15*	0.26***
	(0.06)	(0.05)	(0.05)	(0.09)	(0.09)	(0.02)
Institutions	0.004	0.003	0.002**	0.004	0.001	0.0001
	(0.004)	(0.003)	(0.001)	(0.005)	(0.004)	(0.001)
LSAVING		0.01				0.02
		(0.04)				(0.04)
LGOV			-0.07			-0.11*
			(0.05)			(0.06)
LOPENNESS				0.08		-0.01
				(0.08)		(0.10)
INFL					-0.01***	-0.008***
					(0.003)	(0.003)
AR (2)	0.18	0.10	0.14	0.15	0.45	0.15
Hansen	0.10	0.12	0.41	0.11	0.29	0.18
Hansen-Diff	0.10	0.22	0.90	0.25	0.31	0.13
Groups	109	109	109	109	109	109
Instruments	32	43	59	38	33	91

Notes: (1) The dependent variable is GROWTHPIBCAPITA; (2) estimates using robust two-step System GMM with Time Dummies; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) Robust Standard Errors between parentheses; (5) L = variable in logarithm; (6) Dev_4 = Mis_4 X Dummy for devaluations; $Over_4$ = Mis_4 X Dummy for overvaluations

Table 3.F 5 - Devaluations, Overvaluations of Exchange rate (Mis5) and Growth

	(1)	(2)	(3)	(4)	(5)	(6)
y_{t-1}	0.16	0.01	0.11	0.01	-0.05	0.19***
	(0.19)	(0.10)	(0.09)	(0.17)	(0.06)	(0.06)
Initial Income	0.07	-0.01	0.001	-0.004	-0.005	-0.06**
	(0.04)	(0.03)	(0.005)	(0.04)	(0.03)	(0.02)
Dev_5	-0.40***	-0.12	-0.09	-0.36**	-0.22*	-0.23***
	(0.10)	(0.10)	(0.08)	(0.15)	(0.12)	(0.06)
$Over_5$	-0.32	-0.07	0.04	-0.007	-0.49***	-0.14**
	(0.20)	(0.12)	(0.12)	(0.16)	(0.18)	(0.07)
LEduc	0.07	0.09*	0.18**	0.09	0.10	0.19***
	(0.04)	(0.05)	(0.08)	(0.15)	(0.10)	(0.05)
Institutions	0.002	0.003	0.001	-0.007	0.001	0.00001
	(0.003)	(0.003)	(0.005)	(0.008)	(0.005)	(0.001)
LSAVING		-0.02				0.06
		(0.05)				(0.05)
LGOV			-0.22**			-0.15**
			(0.10)			(0.06)
LOPENNESS				0.12		0.14*
				(0.08)		(0.07)
INFL					-0.01**	-0.006**
					(0.004)	(0.002)
AR (2)	0.11	0.16	0.24	0.003	0.65	0.11
Hansen	0.11	0.13	**0.00**	0.06	0.32	0.15
Hansen-Diff	0.44	0.32	0.88	0.10	0.29	0.72
Groups	95	95	95	95	95	95
Instruments	30	43	49	33	33	89

Notes: (1) The dependent variable is GROWTHPIBCAPITA; (2) estimates using robust two-step System GMM with Time Dummies; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) Robust Standard Errors between parentheses; (5) L = variable in logarithm; (6) Dev_5 = Mis_5 X Dummy for devaluations; $Over_5$ = Mis_5 X Dummy for overvaluations

Table 3.F 6 - Devaluations, Overvaluations of Exchange rate (Mis6) and Growth

	(1)	(2)	(3)	(4)	(5)	(6)[a]
y_{t-1}	0.001	0.31*	0.15	0.16	-0.10	0.10
	(0.18)	(0.16)	(0.10)	(0.12)	(0.07)	(0.13)
Initial Income	0.07	0.01	0.008	0.05	0.01	-0.01
	(0.05)	(0.02)	(0.02)	(0.04)	(0.04)	(0.03)
Dev_6	-0.22**	-0.14**	-0.16**	-0.25***	-0.43***	-0.23**
	(0.09)	(0.06)	(0.06)	(0.09)	(0.14)	(0.11)
$Over_6$	-0.13**	-0.18***	-0.11**	-0.16	-0.16	-0.23**
	(0.05)	(0.06)	(0.04)	(0.10)	(0.11)	(0.09)
LEduc	0.05	0.13**	0.14**	0.08	0.16*	0.19***
	(0.17)	(0.06)	(0.06)	(0.09)	(0.09)	(0.07)
Institutions	0.0001	0.00004	0.0007	-0.0001	0.01	-0.0005
	(0.003)	(0.001)	(0.0009)	(0.003)	(0.007)	(0.002)
LSAVING		0.02				0.12
		(0.03)				(0.07)
LGOV			-0.08			-0.18**
			(0.06)			(0.07)
LOPENNESS				0.12		0.24*
				(0.09)		(0.12)
INFL					-0.01***	-0.002
					(0.003)	(0.003)
AR (2)	0.23	0.37	0.71	0.13	0.17	0.35
Hansen	0.78	0.32	0.35	0.11	0.34	0.30
Hansen-Diff	0.77	0.78	0.35	0.92	0.26	0.93
Groups	90	90	90	90	90	90
Instruments	31	67	68	50	33	54

Notes: (1) The dependent variable is GROWTHPIBCAPITA; (2) estimates using robust two-step System GMM with Time Dummies; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) Robust Standard Errors between parentheses; (5) L = variable in logarithm; (6) Dev_6 = Mis_6 X Dummy for devaluations; $Over_6$ = Mis_6 X Dummy for overvaluations; (7) [a] The instruments are collapsed

Table 3.F 7 - Devaluations, Overvaluations of Exchange rate (Mis7) and Growth

	(1)	(2)	(3)	(4)	(5)	(6)[a]
y_{t-1}	-0.0003	0.24	0.15	0.13	0.03	0.12
	(0.15)	(0.15)	(0.10)	(0.10)	(0.11)	(0.14)
Initial Income	0.08	0.02	0.0007	0.04	0.01	-0.01
	(0.05)	(0.02)	(0.0009)	(0.03)	(0.05)	(0.03)
Dev_7	-0.25***	-0.14*	-0.16**	-0.24***	-0.27***	-0.25**
	(0.08)	(0.08)	(0.06)	(0.08)	(0.10)	(0.10)
$Over_7$	-0.12**	-0.17***	-0.11**	-0.10	-0.17*	-0.22**
	(0.05)	(0.06)	(0.05)	(0.07)	(0.09)	(0.11)
LEduc	0.01	0.09	0.13**	0.08	0.16	0.17**
	(0.16)	(0.07)	(0.06)	(0.07)	(0.12)	(0.08)
Institutions	0.0001	0.002	0.0007	0.00007	0.003	-0.0001
	(0.003)	(0.002)	(0.06)	(0.001)	(0.005)	(0.002)
LSAVING		0.02				0.13*
		(0.04)				(0.07)
LGOV			-0.08			-0.20**
			(0.06)			(0.07)
LOPENNESS				0.09		0.27**
				(0.07)		(0.12)
INFL					-0.01***	-0.002
					(0.003)	(0.003)
AR (2)	0.33	0.86	0.75	0.17	0.24	0.65
Hansen	0.84	0.51	0.30	0.24	0.19	0.25
Hansen-Diff	0.83	0.70	0.26	0.98	0.76	0.87
Groups	90	90	90	90	90	90
Instruments	31	46	68	59	43	54

Notes: (1) The dependent variable is GROWTHPIBCAPITA; (2) estimates using robust two-step System GMM with Time Dummies; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) Robust Standard Errors between parentheses; (5) L = variable in logarithm; (6) $Dev_7 = Mis_7$ X Dummy for devaluations; $Over_7 = Mis_7$ X Dummy for overvaluations; (7) [a] The instruments are collapsed

Table 3.F 8 - Exchange Rate Devaluations and growth

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
y_{t-1}	-0.01 (0.07)	-0.05 (0.08)	0.09 (0.08)	-0.04 (0.08)	0.20** (0.09)	0.20* (0.11)	0.19* (0.11)
Initial Income	-0.01 (0.03)	-0.02 (0.03)	-0.03 (0.03)	-0.01 (0.03)	-0.01 (0.01)	-0.02 (0.02)	-0.02 (0.02)
Dev_1	-0.29*** (0.09)						
Dev_2		-0.28*** (0.09)					
Dev_3			-0.22* (0.12)				
Dev_4				-0.28*** (0.09)			
Dev_5					-0.21** (0.10)		
Dev_6						-0.12 (0.07)	
Dev_7							-0.12* (0.07)
LEduc	0.24*** (0.06)	0.28*** (0.07)	0.21*** (0.06)	0.27*** (0.07)	0.12* (0.06)	0.17** (0.07)	0.17** (0.08)
Institutions	0.004*** (0.001)	0.005*** (0.001)	0.003** (0.001)	0.004*** (0.001)	0.004 (0.004)	0.0004 (0.0007)	0.0004 (0.0007)
AR (2)	0.30	0.33	0.80	0.29	0.29	0.24	0.24
Hansen	0.15	0.16	0.17	0.17	**0.01**	0.15	0.13
Hansen-Diff	0.94	0.85	0.59	0.91	0.32	0.32	0.18
Groups	111	109	106	109	95	90	90
Instruments	43	43	44	43	32	62	62

Notes: (1) The dependent variable is GROWTHPIBCAPITA; (2) estimates using robust two-step System GMM with Time Dummies; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) Robust Standard Errors between parentheses; (5) L = variable in logarithm; Dev = Mis X Dummy for devaluations; (7) [a] The instruments are collapsed

Table 3.F 9 - Exchange Rate Overvaluations and growth

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
y_{t-1}	-0.02	-0.02	0.23	-0.01	-0.05	0.13	0.13
	(0.11)	(0.10)	(0.18)	(0.10)	(0.17)	(0.22)	(0.20)
Initial Income	0.05	0.02	0.06	0.02	0.05	0.07	0.08
	(0.04)	(0.04)	(0.06)	(0.04)	(0.03)	(0.06)	(0.06)
$Over_1$	-0.26***						
	(0.10)						
$Over_2$		-0.18**					
		(0.07)					
$Over_3$			-0.22*				
			(0.12)				
$Over_4$				-0.18***			
				(0.07)			
$Over_5$					-0.44		
					(0.29)		
$Over_6$						-0.24**	
						(0.09)	
$Over_7$							-0.23***
							(0.08)
LEduc	-0.17	-0.009	-0.04	-0.005	-0.21	-0.11	-0.13
	(0.14)	(0.10)	(0.16)	(0.10)	(0.24)	(0.23)	(0.23)
Institutions	0.006***	0.004	0.003	0.004	0.002	0.004	0.004
	(0.001)	(0.003)	(0.004)	(0.003)	(0.007)	(0.003)	(0.003)
AR (2)	0.23	0.12	0.42	0.13	**0.03**	0.82	0.87
Hansen	0.42	0.12	0.39	0.12	**0.01**	0.47	0.50
Hansen-Diff	0.30	0.07	0.48	0.07	0.09	0.80	0.82
Groups	111	109	106	109	95	90	90
Instruments	20	26	22	26	24	19	19

Notes: (1) The dependent variable is GROWTHPIBCAPITA; (2) estimates using robust two-step System GMM with Time Dummies; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) Robust Standard Errors between parentheses; (5) L = variable in logarithm; Over = Mis X Dummy for overvaluations

Table 3.F 10 - Devaluations and Overvaluations of Exchange Rate (Mis1) and Growth: Latin America (LA), Africa (AF), Asia (AS)

	(1)	(2)	(3)	(4)	(5)	(6)[a]
y_{t-1}	0.42***	0.37***	0.45***	0.44***	0.41***	0.20*
	(0.08)	(0.08)	(0.07)	(0.08)	(0.08)	(0.10)
Initial Income	-0.04***	-0.02**	-0.02	-0.02	-0.03**	-0.05**
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
Dev_1	-0.07	0.03			-0.10*	0.02
	(0.05)	(0.06)			(0.05)	(0.09)
Dev_{1_AS}		-0.20*				-0.19**
		(0.11)				(0.09)
$Over_1$			0.03	-0.04	0.05	-0.11
			(0.08)	(0.13)	(0.11)	(0.20)
$Over_{1\_AS}$				0.11		0.23
				(0.17)		(0.20)
LEDUC	0.14***	0.08**	0.07	0.07*	0.12**	0.24**
	(0.05)	(0.04)	(0.04)	(0.04)	(0.04)	(0.07)
Institutions	0.002	0.001	0.001	0.001	0.001	0.003**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
AR (2)	0.35	0.23	0.17	0.21	0.27	0.69
Hansen	0.37	0.37	0.14	0.27	0.32	0.27
Hansen-Diff	0.37	0.53	0.46	0.56	0.68	0.45
Groups	71	71	71	71	71	71
Instruments	55	63	54	62	60	48

Notes: (1) The dependent variable is GROWTHPIBCAPITA; (2) estimates using robust two-step System GMM with Time Dummies; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) Robust Standard Errors between parentheses; (5) L = variable in logarithm; [a] The instruments are collapsed; Dev = Mis X Dummy for devaluations , Over = Mis X Dummy for overvaluations

Table 3.F 11 - Devaluations and Overvaluations of Exchange Rate (Mis7) and Growth: Latin America (LA), Africa (AF), Asia (AS)

	(1)[a]	(2)	(3)[a]	(4)[a]	(5)[a]	(6)[a]
y_{t-1}	0.42***	0.39***	0.44***	0.37***	0.38***	0.37***
	(0.09)	(0.10)	(0.11)	(0.09)	(0.09)	(0.10)
Initial Income	-0.02	-0.04	-0.01	-0.02	-0.009	-0.02
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Dev_7	-0.04	-0.01			-0.07	0.03
	(0.06)	(0.08)			(0.08)	(0.08)
Dev_{7_AS}		-0.16**				-0.06
		(0.08)				(0.11)
$Over_7$			-0.44**	-0.41**	-0.12	-0.34***
			(0.21)	(0.16)	(0.09)	(0.12)
$Over_{7\_AS}$				0.28*		0.23*
				(0.15)		(0.12)
LEDUC	0.17***	0.16**	0.20***	0.21***	0.16***	0.19***
	(0.05)	(0.07)	(0.07)	(0.07)	(0.05)	(0.06)
Institutions	0.0007	0.0004	0.001	0.002*	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
AR (2)	0.23	0.18	0.98	0.75	0.64	0.97
Hansen	0.68	0.61	0.43	0.58	0.51	0.30
Hansen-Diff	0.98	0.91	0.92	0.89	0.78	0.64
Groups	54	54	54	54	54	54
Instruments	33	43	31	38	38	48

Notes: (1) The dependent variable is GROWTHPIBCAPITA; (2) estimates using robust two-step System GMM with Time Dummies; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) Robust Standard Errors between parentheses; (5) L = variable in logarithm; [a] The instruments are collapsed; Dev_{AS} = Mis X Dummy for devaluations X Dummy for Asia, $Over_{AS}$ = Mis X Dummy for overvaluations X Dummy for Asia

Appendix G - Robustness Check II

The measure of exchange misalignment employed in growth regressions to provide an additional robustness check for the previous estimates is that one calculated by Couharde et al (2017) (available at http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=340). Couharde et al (2017) calculate the exchange misalignment for the country *i* at year *t* $mis_{i,t}$ as the difference between the real effective exchange rate $reer_{i,t}$ and the equilibrium real exchange rate $erer_{i,t}$:

$$mis_{i,t} = reer_{i,t} - erer_{i,t} \quad (1g)$$

both variables are denoted in logarithm form. A negative (positive) $mis_{i,t}$ indicates an undervaluation (overvaluation) of the domestic currency. In the case that the real effective exchange rate is undervalued (overvalued), it is expected that the real effective exchange rate appreciates (depreciates) toward its long-run equilibrium (Couhard et al, 2017).

In order to calculate it, the nominal effective exchange rate $neer_{i,t}$ is defined as the currency value of country *i* facing a weighted average of foreign currencies (Couhard et al, 2017):

$$neer_{i,t} = \prod_{j=1}^{N} ner_{ij,t}^{W_{ij,t}} \quad (2g)$$

where $ner_{ij,t}$ represents the index of the nominal exchange rate of the currency of country *i* and the currency of its trade partner *j* in year *t*, *N* is the number of trading partners and $W_{ij,t}$ is the trading weight of the partner *j*. The real effective exchange rate[33] is calculated as the weighted average of real bilateral exchange rates against each *N* trading partner *j* (Couhard et al, 2017):

$$reer_{i,t} = \prod_{j=1}^{N} rer_{ij,t}^{W_{ij,t}} \quad (3g)$$

where $rer_{i,t}$ is an index of the real exchange rate rer of country *i* in relation to the trading partner *j* in year *t* considering the index prices of countries *i* and *j* $P_{i,t}$ and $P_{j,t}$ CPI:

$$rer_{ij,t} = \frac{ner_{ij,t} \text{ x } P_{i,t}}{P_{j,t}} \quad (4g)$$

The construction of an effective real exchange rate requires determining a trade-weight matrix, that is, imports and exports weight to each trading partner. The weight of each partner $W_{ij,t}$ is calculated as the weighted average of exports $X_{i,t}$ and imports $M_{i,t}$ weight:

$$W_{ij,t} = \left(\frac{M_{i,t}}{M_{i,t}+X_{i,t}}\right) * W_{ij,t}^{M} + \left(\frac{X_{i,t}}{M_{i,t}+X_{i,t}}\right) * W_{ij,t}^{X} \quad (5g)$$

[33] A real (nominal) appreciation of the domestic currency is recorded as an increase in the real (nominal) effective exchange rate index.

where $W_{ij,t}^{M}$ and $W_{ij,t}^{X}$ stand respectively for the weight of imports and exports of country *j*:

$$W_{ij,t}^{M} = \frac{M_{i,t}^{j}}{M_{i,t}} \tag{6g}$$

$$W_{ij,t}^{X} = \frac{X_{i,t}^{j}}{X_{i,t}} \tag{7g}$$

where $M_{i,t}^{j}$ is the imports from country *i* into the country *j* and $X_{i,t}^{j}$ is the exports flows of country *i* from the country *j*. The exchange misalignment of Couhard et al (2017) is calculated using two weighting schemes for 186 trading partners for the period 1973-2018. First, the time-invariant scheme is compounded by two weighting methodologies (i) 2008-2012 (*erer_fw_2008_2012*) and (ii) 1973-2016 (*erer_fw_1973_2016*). Second, the time-variant scheme is grounded on non-overlapping five-year average weights (*erer_v5y*) for the periods 1973-1979, 1980-1984, 1985-1989, 1990-1994, 1995-1999, 2000-2004, 2005-2009, 2010-2017. The correspondent code for each exchange misalignment variable is *mis_fw_2008_2012*, *mis_fw_1973_2016* and *mis_v5y*.

Couharde et al (2017) adopt the BEER approach to estimate the equilibrium real exchange rate. Three variables are considered as the fundamentals of the real effective exchange rate: the income per capita (in logarithm) in order to capture the BSH effect *BS*, the net foreign asset position *nf* (in the percentage of GDP) and the trade of terms *tot* (in logarithm). The equilibrium real exchange rate is estimated in a panel data setting, deriving it from the fitted value of real effective exchange rate given by the estimation:

$$\mathrm{reer}_{i,t} = \mu_i + b_1 \mathrm{BS}_{i,t} + b_2 \mathrm{nf}_{i,t} + b_3 \mathrm{tot}_{i,t} + e_{i,t} \tag{8g}$$

where μ_i is the cross-country fixed effects and $e_{i,t}$ is an independent and identically distributed error. The signal of the three parameters is expected to be positive.

The BSH effect means that the real exchange rate of economies more developed, with higher levels of productivity, have the tendency to be appreciated as the higher productivity spreads out from traded sectors to non-traded sectors, which increases the wages and the inflation (Couhard et al, 2017).

Lane and Milanesi-Ferreti (2002) connects the real exchange rate and net-foreign asset through an economy's trade balance. The authors argue that, in long-run equilibrium, a positive (negative) net-foreign asset (does not) allow for a country runs trade deficits, which requires a more appreciated real exchange rate.

The terms of trade are positively associated with the real exchange rate (Coudert et al, 2008). In the case of commodity-exports economies (developing countries), the terms of trade are the major determining of real exchange rate (Cashin et al 2004). Considering a small open economy that produces a non-tradable good and a tradable good (primary commodity; mineral and agricultural), Cashin (2004) links the terms of trade and real exchange rate. The authors suppose that the export sectors use only labor to produce their goods under competitive market and constant return to scale. Besides, it further assumes that (i) domestic consumers provide labor inelastically and consume the tradable and the non-tradable final (imported good which is not produced domestically) goods, (ii) foreign firms use the primary commodities produced exclusively abroad as input to produce the final tradable good. Thus, the *rer* is defined by Cashin (2004) as:

$$\mathrm{rer} = \left(\frac{a_x}{a_I^*}\frac{a_n^*}{a_n}\frac{P_X^*}{P_I^*}\right)^{\gamma} \tag{9g}$$

where $\frac{a_x}{a_I^*}$ and $\frac{a_n^*}{a_n}$ represent respectively the productivity differential between export and import sectors and the productivity differential between the domestic and foreign non-tradable sectors, the term $\frac{P_X^*}{P_I^*}$ stands for the terms of trade (the ratio between the price of a (the) primary commodity and the intermediate foreign good) and γ is the share of non-tradable goods in the basket of consumption. As the wages are equal across all sectors, the rise of terms of trade increases the wages of export sectors propagating this effect toward the rest of the economy (non-tradable sectors), appreciating the real exchange rate. Negative values of exchange misalignment calculated by Couharde et al (2017) indicate that national currency is undervalued, and positive values indicate that national currency is overvalued. Besides, the three measures of real effective exchange rate and exchange misalignment are available to the period between 1973-2018 on a yearly basis. The growth regressions employing it will be presented next.

Table 3.G 1 - Exchange Misalignment (MisCEPII) and Growth

	(1)	(2)	(3)	(4)	(5)	(6)
y_{t-1}	0.08	0.29***	0.14	-0.17	0.14	0.26***
	(0.16)	(0.07)	(0.10)	(0.14)	(0.09)	(0.08)
Initial Income	-0.08*	-0.02*	-0.04**	-0.10**	-0.08***	-0.08
	(0.04)	(0.01)	(0.02)	(0.04)	(0.01)	(0.02)
Mis_{CEPII}	-0.52***	-0.17**	-0.06**	-0.45***	-0.09*	-0.19***
	(0.13)	(0.08)	(0.03)	(0.14)	(0.05)	(0.07)
LEduc	0.34**	0.11***	0.14**	0.47***	0.23***	0.23***
	(0.13)	(0.03)	(0.06)	(0.12)	(0.05)	(0.06)
Institutions	0.0007	0.003**	0.001	0.001	0.002	0.003***
	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)
LSAVING		-0.05				-0.004
		(0.03)				(0.04)
LGOV			-0.10*			-0.15***
			(0.05)			(0.04)
LOPENNESS				-0.11		0.10
				(0.17)		(0.07)
INFL					-0.002	-0.002
					(0.002)	(0.003)
AR (2)	0.17	0.10	0.11	0.12	0.17	0.25
Hansen	0.15	0.11	0.12	0.14	0.15	0.10
Hansen-Diff	0.53	0.82	0.80	0.63	0.86	0.86
Groups	111	109	109	109	108	109
Instruments	29	51	54	29	58	68

Notes: (1) The dependent variable is GROWTHPIBCAPITA; (2) estimates using robust two-step System GMM with Time Dummies; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) Robust Standard Errors between parentheses; (5) L = variable in logarithm

Appendix H - The non-linear effect of exchange rate on growth

Table 3.H 1 - Exchange Misalignment (linear and non-linear) and Growth

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
y_{t-1}	0.16	0.03	0.05	0.39***	0.06	-0.06	-0.005	0.01
	(0.10)	(0.09)	(0.09)	(0.11)	(0.09)	(0.11)	(0.18)	(0.15)
Initial Income	-0.03	-0.005	0.01	-0.001	0.01	0.03	0.05	0.07
	(0.03)	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)	(0.05)	(0.05)
LRER	-0.07							
	(0.06)							
$LRER^2$	0.002							
	(0.03)							
Mis_1		-0.13**						
		(0.06)						
Mis_1^2		-0.14						
		(0.12)						
Mis_2			-0.15***					
			(0.05)					
Mis_2^2			-0.07					
			(0.09)					
Mis_3				-0.12**				
				(0.06)				
Mis_3^2				-0.10				
				(0.08)				
Mis_4					-0.13***			
					(0.05)			
Mis_4^2					-0.08			
					(0.09)			
Mis_5						-0.18**		
						(0.06)		
Mis_5^2						0.004		
						(0.08)		
Mis_6							-0.16***	
							(0.05)	
Mis_6^2							-0.01	
							(0.05)	
Mis_7								-0.18***
								(0.05)
Mis_7^2								0.02
								(0.05)
LEduc	0.14*	0.01	0.01	0.07	0.003	-0.01	0.07	0.01
	(0.07)	(0.07)	(0.07)	(0.09)	(0.07)	(0.11)	(0.16)	(0.14)
Institutions	0.006***	0.007***	0.006***	0.004***	0.006***	-0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.003)	(0.003)	(0.003)
AR (2)	0.50	0.49	0.44	0.61	0.38	**0.00**	0.91	0.89
Hansen	**0.00**	0.55	0.40	0.57	0.32	0.83	0.67	0.79
Hansen-Diff	0.29	0.49	0.38	0.50	0.29	0.82	0.62	0.75
Groups	111	111	109	106	109	95	90	90
Instruments	39	31	31	31	31	31	31	31

Notes: (1) The dependent variable is GROWTHPIBCAPITA; (2) estimates using robust two-step System GMM with Time Dummies; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) Robust Standard Errors between parentheses; (5) L = variable in logarithm; (6) LRERYN = LRER X YN, MisYN = Mis X YN

Table 3.H 2 - Exchange Misalignment (non-linear) and Growth

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
y_{t-1}	0.28**	-0.005	0.08	0.23*	0.08	0.0005	0.16*	0.14
	(0.13)	(0.14)	(0.14)	(0.13)	(0.14)	(0.15)	(0.08)	(0.16)
Initial Income	-0.03	-0.06	-0.01	-0.02	-0.01	-0.01	-0.04*	-0.05
	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)	(0.07)	(0.02)
$LRER^2$	0.04***							
	(0.01)							
Mis_1^2		0.03						
		(0.12)						
Mis_2^2			-0.14*					
			(0.08)					
Mis_3^2				0.06				
				(0.09)				
Mis_4^2					-0.15*			
					(0.08)			
Mis_5^2						-0.01		
						(0.14)		
Mis_6^2							-0.14*	
							(0.07)	
Mis_7^2								-0.14
								(0.07)
LEduc	0.12	0.17*	0.005	0.07	0.006	0.03	0.23***	0.26***
	(0.08)	(0.10)	(0.08)	(0.06)	(0.08)	(0.13)	(0.06)	(0.10)
Institutions	0.004	0.006***	0.006***	0.004*	0.006***	0.001	0.0006	0.0008
	(0.003)	(0.002)	(0.001)	(0.002)	(0.001)	(0.005)	(0.001)	(0.001)
AR (2)	0.21	0.33	0.15	0.49	0.16	**0.00**	0.11	0.16
Hansen	**0.00**	**0.01**	0.14	0.26	0.13	0.14	0.36	0.28
Hansen-Diff	0.09	0.67	0.08	0.23	0.08	0.12	0.89	0.38
Groups	111	111	26	29	26	95	90	90
Instruments	33	29	109	106	109	25	47	41

Notes: (1) The dependent variable is GROWTHPIBCAPITA; (2) estimates using robust two-step System GMM with Time Dummies; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) Robust Standard Errors between parentheses; (5) L = variable in logarithm; (6) LRERYN = LRER X YN, MisYN = Mis X YN

FOURTH ESSAY - Exchange Rate and Structural Change: a study using aggregated and sectoral data

Abstract

This article tests the association between exchange rate and structural change. A series of regressions were performed in a panel setting for various countries and periods, using aggregated and sectorial databases. The estimates using the aggregated database suggest that the exchange rate devaluations favor manufacturing and agriculture sectors to the detriment of services. Regressions also provide evidence that the industrializing effects of exchange rate devaluations are stronger for low-income countries and countries with more complex productive structure. Moreover, regressions indicate that a weak national currency is associated with diversification and the production of more knowledge-intensive goods. In turn, the estimates using the sectorial database point out that devaluations of exchange rates expand manufacturing activities. This effect is associated with sectoral particularities such as outward orientation, the costs associated with imports, financial constraint (conflict distributive), and technological regime.

Keywords: Exchange Rate, Structural-Change, Industrialization, Economic Complexity, Manufacturing Sectors.

1- Introduction

Structural change toward manufacturing sectors is the central element in promoting the long-run growth within classical-kaldorian-structuralism economics. The classical authors of development economics, such as Rosenstein-Rodan, Nurkse, Singer, Lewis, Hirschman, and the Latin American structuralism, claim that industrialization is the central feature of a strategy in overcoming underdevelopment. In Kaldorian terms, the growth of productivity and economy is associated with the pace of industry growth. The faster is the manufacturing growth, the faster is the growth. Development is not an automatic process, as is suggested by Rostow's theory of take-off or a market-led process as claimed by the *laissez-faire* growth theories (Chang, 2002). The catching-up between nations results from deliberated industrialization policies, as the current richer countries have done in the past (Chang, 2002).

From a historical perspective, Asian and Latin American countries' recent experiences illustrate the importance of the state-led policy for industrializing and, hence, catching-up. The faster growth of Asian economies than Latin American economies may be explained by the different development models pursued. Asian economies adopted a nationalism model of development over the 1980s, while Latin American countries implemented a dependent model of development grounded on the Washington Consensus prescriptions (Kohli, 2012). Up until the 1980s, both Latin American countries as the Asians had similar economic features, and the differences pertain to the exchange rate and trade policies (Sachs, 1985). Asian economies adopted exchange rate devaluations to develop an export-led industry (outward-looking); meanwhile, Latin America embraced import-substitution policies (inward-looking) (Sachs, 1985, Cavallo at all, 1990, Dollar, 1992). Despite the importance of trade and exchange rate policies, the South-Korean experience demonstrates the importance of a multidimensional strategy (e.g., credit, state investment, taxes, import protection, and entry restrictions) for a development strategy of industrialization and growth (Chang, 1993).

There is a significant body of empirical literature that documented the influence of exchange rate on long-run growth. The bulk of this literature has shown that exchange rate influences growth; devaluations foster growth, whereas overvaluations hurt it (Razin and Collins, 1997, Easterly, 2001, Acemoglu *et al*, 2003, Hausmann *et al*, 2005, Vieira and MacDonald, 2012, Glüzmann *et al*, 2012). This association is especially valid for developing countries (Gala, 2008, Rapetti *et al*, 2011). The influence on the productive structure is one of the mechanisms suggested by existing literature to explain why the exchange rate affects growth. As a relative price, the exchange rate changes the profitability of tradable and non-tradable sectors (Frenkel and Ros, 2006, Rodrik, 2008, Bhalla, 2012 and Ros, 2013). Devaluations of the exchange rate, by making the export goods cheaper, potentially benefit the sectors exposed to international competition (industry and primary sectors) to the detriment of services (Sachs, 1985).

Manufacturing is the sector with a vast ability to generate innovative activities, increasing returns to scale, and the backward/forward linkages (Tregenna, 2008, Szirmai, 2012). Enhancing the importance of modern sectors within a productive structure is the engine of long-run growth (Kaldor, 1966). Manufacturing sectors play a unique role in promoting the long-run growth, especially for the developing countries, as its productivity growth depends on the access to the technology of developed countries and the promotion of structural change towards modern sectors (Ocampo and Vos, 2008). The exchange rate rises as a tool of development for emerging countries. It makes access to new technologies developed by industrialized countries possible by generating the required funds to finance investment (via expanded profitability induced by the increase in exports). Therefore, an exchange rate policy orientated towards the development allows structural change and industrial diversification (Rodrik, 2008, Gabriel and Missio, 2018).

This article empirically tests the relationship between exchange rate and structural change using an aggregated and a sectorial database.[34] The aggregated database covers different periods and countries. Multiple variables represent structural change: manufacturing, agriculture, and services as shares of GDP and employment, as well the economic complexity index. By controlling other covariates, four measures of exchange are employed: a bilateral real exchange rate, two measures of exchange rate misalignment constructed by authors, and the index calculated by Couharde (2017). Estimates are performed using 5-years averaged database.

The sectoral regressions employ the database of World Input-Output Database provided by Timmer et al. (2015). The sectoral performance is represented by the growth rate of employment and exchange rate misalignment is represented by the index calculated by Couharde (2017). Following the literature, estimates are afforded to account the sectoral particularities by introducing variables denoting sectoral outward orientation, the costs associated with imports, financial constraints, and technological regime.

[34] This paper does not aim to test the empirical validity of manufacturing's importance to foster the long-run growth. There is a vast empirical literature on this topic: Drakopoulous and Theodossiou (1991), Fingleton and McCombie (1998), Leon-Ledesma (2000), Rodrik (2008), Timmer and Vries (2008), Alexiadis and Tsagdis (2010), Szirmai (2012), Szirmai and Verspagen (2015), Su and Yao (2016), Romero and Britto (2017), Gabriel and Ribeiro (2019) among others.

This article consists of ten parts. Section 2 discusses the relationship between structural change and growth. Section 3 provides a discussion about the operative channels through which exchange rate influences structural change. Sections 4, 5, and 6 present the estimates using the aggregated databases. Section 7 presents the basic regressions performed to explain the sectoral performance across the countries, while Sections 8 and 9 expand these estimates to capture sectoral particularities. Section 10 closes the article with the conclusions.

2- Structural Change and Growth for Kaldorian-Structuralists

There exist two controversial approaches within economics on the relationship between structural change and growth (Ocampo *et al*, 2009). A strand of literature states that structural change stems from the income level. Higher-income levels entail changes in sectoral composition; hence that structural change is a consequence instead of growth's cause. In this view, the expansion of the economy and markets reconfigures the structural composition from primary and secondary towards tertiary sectors in terms of contributions to output, employment, and investment (Ocampo *et al*, 2009). It is a natural and automatic process. As income grows, the services become the major sector. Thus, in developed economies (or in high-income economies), the industrial sectors play a timid role in terms of contribution to GDP to the detriment of services. Meanwhile, the poorest economies are essentially dominated by primary sectors with serious constraints to access modern technology and unable to provide increasing returns to scale (Ocampo *et al*, 2009). Therefore, in this approach, the structural change does not matter or simply has a passive role (Ocampo *et al*, 2009).

Other strands within economics see the structural change as the engine of long-run growth. Economic growth is a process characterized by a continuing transformation of the productive structures based upon the creative destruction in the Schumpeterian sense (Ocampo, 2005). Essentially, the manufacturing sectors play a preeminent role for long-run growth because of their higher productivity growth to the extent that they are more dynamic in terms of innovative activities and have increasing returns to scale (Ocampo *et al*, 2009). Manufacturing sectors have a larger potential to induce domestic integration via the backward and forward linkages with other sectors of the economy *a la* Hirschman (1958) in a manner that the manufacturing growth exerts a pulling effect in the economy (Tregenna, 2008). Moreover, the industry requires more capital accumulation than other sectors and presents economies of scale encompassing more embodied and disembodied technological progress (Szirmai, 2012).

Therefore, manufacturing activities are more productive than other sectors, so that a structural change towards industry boosts the long-run growth (Szimai, 2012). The manufacturing sectors are associated with higher savings, faster pace of technological accumulation, and stronger human capital contributions and institutions to growth for middle-income economies (Su and Yao, 2016).

In this regard, the differences in long-run performance are explained by the industrialization degree - the faster the industry's growth, the faster the growth economy (Kaldor, 1966). The ability to promote the structural change to manufacturing is associated with success or failure concerning the long-run growth. Developed countries promoted the industrialization of productive structure towards the more technology-intensive sectors, whereas the developing countries are those trapped within primary sectors.

The formalization of Ros (2015) offers a useful simplification of how industrialization acts to increase the overall productivity growth of an economy. The Kaldorian growth theory, grounded on the circular cumulative causation *a la* Myrdal (1957), places the increasing returns to scale of manufacturing activities at the center of growth explanation (Ros, 2015). The model of Ros (2015) assumes that the growth of aggregated labor productivity p is a weighted sum of industrial productivity growth p_{ind} and non-industrial productivity growth p_{nind}:

$$p = ap_{ind} + bp_{nind} \tag{1}$$

The manufacturing productivity growth is defined following the second law of Kaldor, according to which the productivity of manufacturing depends positively on industrial demand growth q_{ind}:

$$p_{ind} = \alpha_0 + vq_{ind} \tag{2}$$

The constant α_0 is the autonomous rate of capital accumulation per worker. The parameter v is the Verdoorn's coefficient that represents the pace of capital accumulation induced by demand growth and the pace of technical progress incorporated in capital accumulation (Dixon and Thirlwall, 1975) and indicates how productivity is influenced by demand growth.

As industrial labor productivity growth is the difference between the growth rate of output q_{ind} and industrial employees e_{ind}, equation (2) becomes (Ros, 2015):

$$p_{ind} = \frac{\alpha_0}{1-v} + \frac{v}{1-v} e_{ind} \tag{3}$$

The magnitude of Verdoorn's coefficient is supposed to range between zero and one in order to exist a positive relationship between industrial employment growth (demand) and industrial productivity growth, that is, increasing returns to scale (Ros, 2015).

In turn, the non-industrial sectors are unable to generate increasing returns to scale. Therefore, the non-industrial productivity growth p_{nind} is determined residually as the difference between output growth q_{nind} and employment growth e_{nind} (Ros, 2015). It is assumed the existence of a linking between non-industrial and industrial sectors in a manner that the non-industrial output growth depends positively on the industrial output growth:

$$q_{nind} = c_0 + c_1 q_{ind} \quad (4)$$

Ros (2015) defines the non-industrial employment growth as the difference between the labor supply growth *n* and industrial employment growth e_{ind}:

$$e_{nind} = n - e_{ind} \quad (5)$$

Representing the employment growth *e* as the following identity:

$$e = \psi_{ind} e_{ind} + \psi_{nind} e_{nind} \quad (6)$$

where ψ_{ind} and ψ_{nind} are respectively the shares of industrial and non-industrial employment in the overall employment. Assuming that n equals e, and introducing (6) into (5):

$$e_{nind} = \frac{1}{\psi_{nind}} n - \frac{\psi_{ind}}{\psi_{nind}} e_{ind} \quad (5.1)$$

Ros (2015)'s formalization leads to the following determination of productivity growth of non-industrial sectors:

$$p_{nind} = [c_0 + c_1 q_{ind}] - [\frac{1}{\psi_{nind}} n - \frac{\psi_{ind}}{\psi_{nind}} e_{ind}] \quad (7)$$

Introducing (3) and (7) into (1):

$$p = a\left[\frac{\alpha_0}{1-v} + \frac{v}{1-v} e_{ind}\right] + b[(c_0 + c_1 q_{ind}) - (\frac{1}{\psi_{nind}} n - \frac{\psi_{ind}}{\psi_{nind}} e_{ind})] \quad (1.1)$$

Equation (1.1) represents the third Kaldor's law and states that the overall productivity growth depends on manufacturing activities (Ros, 2015). The first term represents the second law of Kaldor, while the second term is the nonindustrial output growth (Ros, 2015). The third term stands for the classical development's mechanism according to which the reallocation of employment from non-industrial to industrial sectors increases productivity (Ros, 2015). To simplify, equation (1.1) shows that the long-run performance - overall labor productivity growth, depends positively (negatively) on industrial production (via output and employment) and on structural change towards manufacturing activities (Ros, 2013).

The Kaldorian literature moved on, discussing other aspects associated with Verdoorn's mechanism. The returns to scale are obtained under a specific technological state-of-the-art, human capital, and institutions, which creates a lock-in point (Setterfield, 1995). The Verdoorn coefficient is endogenous with respect to the previous capital accumulated under a specific technological paradigm (Setterfield, 1995). More than this, the parameters α_0 and v are endogenous to institutional regime connecting historical elements and institutional differences to economic performance (capital accumulation, exchange rate regimes, public policies) (Setterfield and Cornwall, 2003). Ocampo (2005) claims that the parameters α_0 and v are associated with the technological capabilities, the degree of innovativeness, the incentives and economies' institutions.[35] Romero and Britto (2017) argue that the sectoral research intensity and knowledge accumulation are positively associated with Verdoorn's coefficient magnitude. Therefore, the higher the technical innovation faster the productivity growth induced by demand growth (Romero, 2019). Thus, economies with industrial productive structure more technologic-intense have higher Kaldor-Verdoorn coefficient. This makes the circuit of cumulative causation stronger in these economies, leading to higher productivity growth and long-run performance (Romero and Britto 2017, Romero, 2019).

Next section discusses the profitability-development channel through which the exchange rate influences the structural composition within economy.

3- Why does the exchange rate matter for structural change?

A large body of empirical literature in economic field suggest that exchange rate influences growth (e.g., Cottani, 1990, Dollar, 1992, Razin and Collins, 1997, Vieira and MacDonald, 2012, Gala, 2008, Rodrik, 2008, Rapetti et al, 2011, among others). One of the influencing channels of the exchange rate is the firms' profitability. The exchange rate influences the sectoral profitability and promotes a structural change towards the sectors more benefited from exchange rate changes In this respect, the higher profitability, induced by the exchange rate policy, fosters production, employment, and investment (Frenkel and Ros, 2006). Exchange rate policies (by changing export competitiveness) expand or reduce tradable sectors' importance within the productive structure (Rodrik, 2008). Hence, as tradable sectors encompass the manufacturing

[35] Other articles associated the Verdoorn mechanism with other elements. Naastepad (2005), Hein and Tarassow (2010) and Hartwing (2013) associated the Verdoorn's mechanism to the effects of income distribution into demand growth a la Baduhri and Marglin (1990). The income distribution has different effects on productivity growth via Verdoorn's mechanism depending on the demand regime of economy (wage- or profit-led).

sectors, the exchange rate policy may promote a structural change towards sectors with increasing returns to scale (Ros and Skott, 1998, Frenkel and Ros, 2006, Rodrik, 2008). Thus, an influencing channel from the exchange rate to long-run growth is the profitability-development channel (Ros, 2013).

Frenkel and Ros (2006) point three transmission channels through which the exchange rate influences the employment creation. Firstly, the macroeconomic channel according which the exchange rate devaluations increase exports, demand, output, and employment, despite the contractionary effects caused by falls in the real wage. Secondly, devaluations of the exchange rate reduce labor costs, increasing the profit-rate, which encourages the use of more intensive labor. In contrast, overvaluations of exchange rate cut the profit-rate, which forces the firms to seek new manufacturing methods less intensive of labor. At lastly, the development channel links the exchange rate devaluations with industrialization through expanding its exports. This is because the exchange rate establishes the relative prices of tradable and non-tradable goods, acting as a tariff (subside) on imports (exports) (Frenkel and Ros, 2006).

In a similar fashion, Rodrik (2008) states that exchange rate devaluations boost the profitability of tradable sectors, increasing their importance in productive structure. Rodrik (2008) offers two explanations for the causal link between exchange rate devaluations, tradable sectors' profitability and growth. The first explanation is the idea that bad institutions of low-income countries act as a higher tax on tradable sectors, resulting in a misallocation of resources in terms of investment. Accordingly, by increasing profitability, exchange rate devaluations increase investment and efficiency (Rodrik, 2008). The second explanation is that one according which exchange rate devaluations act as a substitute for industrial policy to remedy the market failures of tradable sectors. Thus, taking the economic development as a structural change towards a productive structure more diversified and complex and assuming that market failures are more severe for these sectors, devaluations of exchange rate induce production of new products, boosting the complexity and long-run growth (Rodrik, 2008).

Thus, the exchange rate movements can foster the long-run growth in the Classical-Kaldorian-Structuralist perspective in so far as it affects the industrial employment and output:

$$p = a\left[\frac{\alpha_0}{1-v} + \frac{v}{1-v} e_{ind}(rer)\right] + b[(c_0 + c_1 q_{ind}(rer)) - (\frac{1}{\psi_{nind}} n - \frac{\psi_{ind}}{\psi_{nind}} e_{ind}(rer))] \quad (8)$$

The positive influence on the industrial exports (demand growth) fosters the productivity growth due to increasing returns to scale in manufacturing sectors, while increases in industrial output strengthen the industrial linkages within the industry. Besides, the industrialization promoted by the exchange rate devaluations reallocates workers from non-industrial sectors (low productivity) to industrial sectors (high productivity).

In contrast, the literature indicates that the influence of exchange rate on structural change within manufacturing sectors is not straightforward. There are two opposing channels through which the exchange rate affects the sectoral profit-rate: the costs and the revenues of firms in a manner that its effect is associated with which channel prevails (Campa and Goldber, 2001, Nucci and Pozzolo, 1999, Galindo et all, 2007, Lanau, 2017).

On the costs side, devaluations reduce the labor costs (real wage) because firms raise their mark-ups to benefit from the favorable competitiveness regarding foreign goods (Blecker, 1989). Devaluations have distributive effects between workers and entrepreneurs. *Ceteris paribus*, exchange rate devaluations up the profit-share of GDP to the detriment of wage-share, potentially increasing growth (Blecker, 1989, Bhaduri and Marglin, 1990). However, devaluations can increase the production costs as it makes the imported inputs more expensive. For instance, a larger share of imported inputs, over total costs, strengthens the response of costs to exchange rate devaluations, potentially reducing growth (Nucci and Pozzolo, 1999, Campa and Goldber, 2001, Galindo et all, 2007, Lanau, 2017). The net effects of exchange rate on the firms' costs are associated with what effect prevails. If the first (second) effect prevails, *ceteris paribus*, a policy of devaluations increases (reduces) the importance of these sectors within the productive structure.

On the revenues side, larger the share of revenues that come from exports (domestic market) stronger (weaker) is the response of revenues to exchange rate devaluations (Nucci and Pozzolo, 1999). The effects of the exchange rate on firms' sales volume are associated with the degree that domestic demand or exports determine the firms' revenues. In a wage-led demand regime, the domestic demand prevails, and, then, exchange rate devaluations reduce the firms' revenues (Bhaduri and Marglin, 1990). However, in a profit-led regime of demand, the international demand (exports) prevails, and, then, exchange rate devaluations increase the firms' revenues (Bhaduri and Marglin, 1990). Therefore, the exchange rate effects on the firms' revenues are associated with the firms' demand composition.

Furthermore, the literature points out other influencing channels through which exchange rates affects the sectoral performance. An aspect brought up by Nucci and Pozzolo (1999) is the different effects of exchange rates on firms according to the magnitude of mark-up. Firms with low mark-up suffer a financing constraint to invest as their retained profits are short, making them more dependent on financing sources. As a result, those firms' investment is more sensitive to the exchange rate policy as it can potentially boost its internal funds (Nucci and Pozzolo, 1999). Galindo et al. (2007) introduced a new influencing channel into the picture, the balance sheet effect induced by liability dollarization; devaluations of exchange rate increase firms' financial burden with a significative share of debts in dollar. This creates real effects in firms as it raises the debt service leading to liquidity constraints (Galindo et al, 2007).

In sum, the literature indicates that the sectoral effects of the exchange rate are ambiguous. Changes in the exchange rate may hurt or boost sectoral performance depending on which effect prevails: the positive effect on revenues or the negative effect via costs. Likely, countries with non-developed manufacturing depend strongly on imports of basic inputs and physical capital to carry on a structural change towards manufacturing sectors. Thus, devaluations of the exchange rate can be an adverse effect on manufacturing performance. Therefore, exchange rate capacity to promote industrialization may be associated with the different cross-countries and sectoral characteristics.

The next section discusses empirical strategy, database and estimates using aggregated database followed by the sectorial estimates.

4- Estimates for Aggregated Database

The empirical strategy consists of performing regressions to explain structural changes of 148 countries[36] over 1991 and 2018. The basic estimating equation is:

$$y_{ti}=\alpha+\beta Y_{bi}+\beta_1 mis_{t,i}+ \beta_2 controls+f_t+f_i+ u_{it} \tag{9}$$

where *i* and *t* denote country and time (5-year) index. Estimates were performed with time and country fixed effects, f_t and f_i, respectively. The dependent variable is the logarithm of manufacturing, services and agriculture in terms of share in GDP and employment. Estimates use four measures of exchange rates. The article employs data from World Bank for the real exchange rate (RER):

$$RER_{it}= \ln (PPP_{it}/XRAT_{it}) \tag{10}$$

The variables PPP_{it} and $XRAT_{it}$ are the conversion factor and nominal exchange rate in national currency units per U.S. dollar. Three further measures of exchange rate misalignments are used. The first one accounts for the discount of the Balassa-Samuelson effect from RER using the *per*

[36] The sample is presented in Table 4. A1 in appendix A.

capita GDP as fundamental of the exchange rate. The second measure of exchange rate misalignment is calculated employing the terms of trade (TOT) to capture the effects of exports' price in relation to imports' price, the net foreign asset (ASSET) to capture the external adjustment - as indicated by Viera and MacDonald (2012), and the wage-share of GDP (W) as a proxy for labor costs effects in prices of tradable goods.

Table 4.A 2 in appendix A presents the estimates of exchange rate misalignments. The Hausman test indicated that the random effect model is appropriated for both models. In the first specification, the Balassa-Samuelson effect is valid, and an increase by 1% in *per capita* income appreciates the exchange rate in 0.19%. Only the variable wage-share in GDP is statistically significant at 5% in the second specification; an increase of 1% in wage-share makes the national currency more appreciated by 0.24%. Finally, the exchange rate misalignment was calculated following Rodrik (2008), which produces the mis_1 (Balassa-Samuelson) and mis_2 (TOT, ASSET and W).

The fourth measure of the exchange rate is the index of misalignment provided by Couharde et al (2017). This variable is calculated using co-integration techniques for econometric panels and controlling the Balassa-Samuelson effect, the net-foreign assets and the terms of trade as fundamentals. Couharde et al. (2017) deliver an annual measure instead of a 5-years variable. This is important as Viera and MacDonald (2012) and Schröder (2013) showed that using annual measures of exchange rate misalignment may alter the estimates' results. Such variable is employed in structural change regressions averaged in 5-years.

When the exchange rate misalignments are greater than zero, the currency is higher than the purchasing power parity or than the equilibrium given by fundamentals (more appreciated). However, when it is lower than zero, the currency is lower than the purchasing power parity or than the equilibrium given by fundamentals (more depreciated). This applies to all measures of exchange rate misalignments. A negative signal of β_1 in equation (9) means that exchange devaluations (overvaluations) are positively (negatively) associated with structural change. Whilst a positive signal of β_1 produces the opposite results.

Other variables are controlled, such as terms of trade, government consumption, wage-share (labor costs of tradable sectors) and income level (natural structural change induced by increases in income level). All controllable variables are employed in logarithm form. Table 4.A 3 in appendix A presents all variables. Two different specifications were performed. The difference is that one controls government consumption in addition to other variables, excluding wage-share (model 1), while the other specification controls wage-share, in addition to other variables, excluding government consumption (model 2). This is adopted to avoid collinearity between government consumption and wage-share once both variables are represented as GDP share. The estimates are performed using dynamic panel data models in a System of equations using the levels and differences of independent variables as instruments (Blundell and Bond, 1998). This methodology addresses the issue of endogeneity, as estimates are performed by *Generalized Method of Moments* (GMM) and assures the control of individual unobserved characteristics.[37]

The full results are presented in tables of appendix A. Table 4.A 4 reports the results of regressions using the manufacturing share in GDP as a dependent variable. The models have fitted well once the test for autocorrelation of order 2 in errors and Sargan/Hansen test for validity for instruments did not reject the null hypothesis.[38] The output suggests that all coefficients estimated for exchange rate misalignment measures are statistically significant at 1% of critical values (except for specifications 6 and 7) and negative. Therefore, when the exchange rate is more depreciated (appreciated), it promotes a structural change toward (non-) manufacturing sectors.

The results are robust and go in the same direction (even though the parameters differ according to the fundamentals and the specification of the structural change equation). Making the national currency 10% more depreciated increase the manufacturing share in GDP share by 1.1% (model 1) and 0.6% (model 2) for LRER; by 1.3% (model 1) and 0.9% (model 2) for mis_1; by 2.9% (model 1) and 0.4% (model 2) for mis_2; and by 1.8% for mis_{cepii} (model2) over a five-year period. Regressions also point out that share of the manufacturing in GDP is positively associated with income level (high-income countries have elevated manufacturing share in GDP) and terms of trade. Nevertheless, it does not provide robust evidence that government consumption influences it. Specifications 2 and 4 indicate that increases of 10% in wage-share

37 The System GMM applies for (Roodman, 2009): short and linear panels, lagged values of dependent variables are used as an explanatory variable, independent variables are correlated with their past values and error term, fixed effects, the errors are heteroskedastic and autocorrelated (Roodman, 2009). Regressions are valid in the case that the null hypothesis of Arellano and Bond's test for autocorrelation of order 2 in error and the null hypothesis of Sargan (matrix of variance-covariance non-robust for heteroskedasticity) or Hansen (matrix of variance-covariance robust for heteroskedasticity) test is not disregarded (Roodman, 2009).

38 The Sargan test is sensitive to the presence of heteroskedasticity so that the null hypothesis tends to be rejected (Roodman, 2009). Following Roodman (2009), the robust matrix of variance-covariance robust for heteroskedasticity is used when the Sargan test rejects the null hypothesis. In this case, the Hansen test should be analyzed instead of the Sargan test.

reduce manufacturing share in GDP by 3% and 4%, respectively. Interestingly, the effects of the exchange rate are smaller when wage-share is controlled. Furthermore, specifications 5 and 6 indicate that exchange rate depreciation (cheaper exports) caused by reductions in wage-share benefits manufacturing.

Table 4.A 5 shows the results of regressions using the manufacturing share in employment as a dependent variable. Only the estimated parameters for exchange rate misalignment of columns 1, 3, and 7 are statistically significant at 1% of critical values and negative. A devaluation of 10% in exchange rate increase the manufacturing share in employ by 1.2% for LRER; 1.1% for mis_1; and 2% for mis_{cepii} (all for model 1). Regressions do not provide evidence that manufacturing share in employment may be associated with income level, terms of trade, or government consumption. However, specifications 2 and 6 suggested that wage-share is negatively associated with workers' transfers from non-manufacturing activities to manufacturing activities. An increase of 10% in wage-share reduces in 7.6% and 5.7% of workers' share in manufacturing activities (respectively in columns 2 and 6).

The regressions using the agriculture share in GDP as a dependent variable are reported in Table 4.A 6. The output provides evidence that exchange rate devaluations benefit agriculture. Despite the non-significance of mis_2 and mis_{cepii}, the results suggest that a devaluation of 10% increases agriculture share in GDP by 1.2% (model 1) and 1.15 (model 2) for LRER; 1.3% (model 1) and 1.9% (model 2) for mis_1 over a 5-years period. Regressions do not deliver evidence that agriculture share in employment is associated with terms of trade, government consumption, or wage-share. Notwithstanding, results suggest that the agriculture share in GDP is negatively associated with income level (high-income countries have a smaller agriculture share in GDP).

The estimates using agriculture share in employ are presented in Table 4.A 7. The output reveals little evidence that this variable is influenced by the exchange rate.[39] Only the estimated parameter of LRER in model 1 (column 1) is statistically significant at 1%. A devaluation of 10% increases the agriculture share in employment by 2%. Estimates also suggest that terms of trade, government consumption, or wage-share do not influence agriculture. In contrast, results indicate that increases in income are associated with reductions in agriculture share in employment.

[39] Specifications of columns 3, 4, 7, and 8 did not perform well, even testing various combinations of instruments.

Table 4.A 8 and 4.A 9 report the estimates for the share of services in GDP and in employment, respectively. No measure of exchange rate misalignment was statistically significant, while only the income level is statistically significant and positive. That is, services have more importance within the productive structure of high-income countries (at least in terms of GDP share). Estimates do not provide much evidence that government consumption and wage-share influence both dependent variables. Moreover, results also suggest that improving terms of trade has expansionary effects on the share of services in GDP and employment.

5- Exchange Rate and Economic Complexity

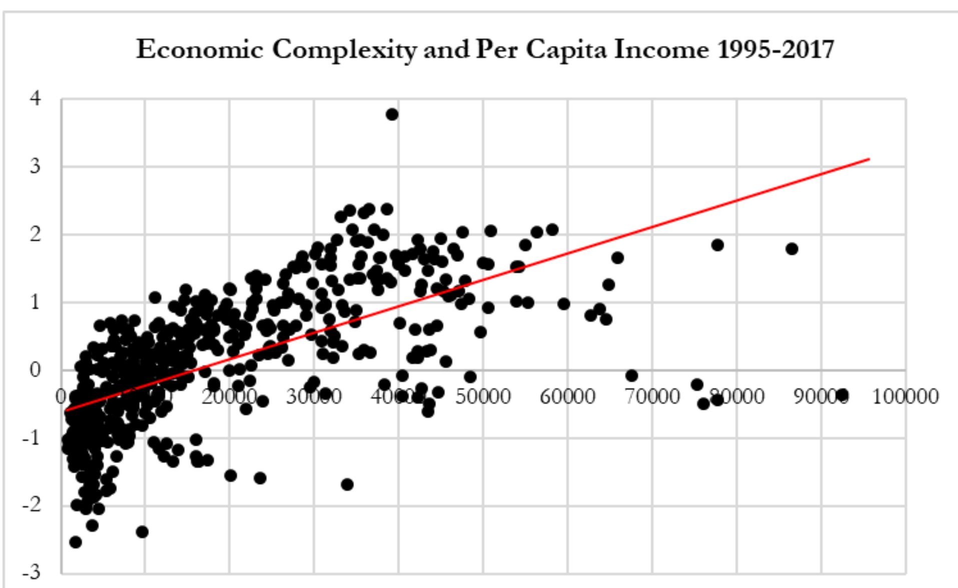
Structural change is a broader process than the growth of industry and modern services; it is about the ability to create new activities and to integrate the domestic sectors (Ocampo and Vos, 2008). It concerns the diversification of productive structure, or the expansion of productive capability beyond the traditional activities (Hausmann and Hidalgo et al., 2011). The literature about economic complexity has moved forward, incorporating deeper aspects of structural change than the simple structural change measures represented by the share of employment or income of manufacturing, agriculture, and services. The recent advances of economic complexity literature improved the understanding of structural change in a broad perspective and provided an expanded ability to quantify the productive structure (Hartmann et al., 2017). Structural change encompasses the multiplicity of useful knowledge embedded in productive structure (Hausmann and Hidalgo et al., 2011). More complex economies produce a diverse mix of more knowledge-intensive goods, while simpler economies produce few products less knowledge-intensive (Hausmann and Hidalgo et al., 2011). Structural change is a process of getting knowledge of how to produce more complex goods (Hausmann and Hidalgo et al., 2011).

Hausman and Hidalgo et all (2011) created an index representing economy's complexity – *economic complexity index* (ECI), or a measure of knowledge embedded in productive structure. Authors argue that the amount of knowledge (or the degree of economic complexity) is expressed in the diversity and the ubiquity of goods produced. Economies that have the knowledge to produce an elevated variety of goods are more diversified and then more complex, whilst the production of more complex goods is possible only in countries with such knowledge. Thus, those products are less ubiquitous (Hausmann and Hidalgo et al., 2011). Economies with this "rare" knowledge embedded in the productive structure are more complex (Hausmann and Hidalgo et al., 2011).

The human capital (the amount of knowledge entrenched in humans) in mainstream growth models represents a driver of long-run growth that explains why some countries grow more than others (Hidalgo, 2015). The economic complexity offers a measure of the diversity of accumulated knowledge and know-how incorporated in the productive structure associated with firms and individuals' ability to link collectively in a network (Hidalgo, 2015). Hartmann et al., (2017) claim that the degree of complexity of productive structure also captures information about institutions. Following the arguments of Engerman and Sokoloff (1997) and Acemoglu and Robinson (2001), Hartmann et al., (2017) argue that post-colonial societies with a productive structure barely diversified and specialized agriculture products have bad institutions (i.e., unequal distribution of knowledge, political power, and income). Meanwhile, societies with a productive structure more diversified and capable of producing sophisticated products have reliable and inclusive institutions (Hartmann et al., 2017). Furthermore, the authors indicated that countries with a productive structure more complex have lower income inequality.

Hausmann and Hidalgo et all (2011) indicate that the economic complexity is a good predictor of cross-country differences in per capita income. Figure 1 illustrates, graphically, the association between economic complexity index (ECI) and per capita income for the sample of countries of previous estimates over the 1995 and 2017.

Graph 4. 1 - Economic Complexity and Per Capita Income (1995-2017)



The correlogram confirms the positive association between economic complexity and per capita income. Felipe et al. (2012) found evidence suggestive that the cross-country differences regarding the share of complex products in exports are positively associated with per capita income. Higher the income higher the share of complex products in exports. Therefore, Figure 1 means more than a simple visual correlation; it indicates a distribution of knowledge and know-how on making sophisticated products among rich and poor countries. The higher-income countries are those with a productive structure more complex, with great productive capability (diversified) and more knowledge embedded in productive structure (less ubiquitous products) and in exports, and good institutions (Hidalgo, 2015).

Structural change is a many-faceted phenomenon that encompasses deep changes in productive structure linked with human capital, exports, income inequality, institutions, and social capabilities (Hartmann et al., 2017). It is likely that the root causes that explain the cross-country differences of the productive structure may be associated with the influence of the type of colonization in current institutions and so on (Hartmann et al., 2017). However, recently many countries have boosted the economic complexity by diversifying and producing more knowledge-intensive goods (as Asian countries). This suggests that the underdevelopment or the poverty trap of low-income countries resulted from the colonial past can be surpassed by policies that boost the economic complexity.

A series of regressions were performed to test the association between economic complexity and the previous measures of exchange rate misalignment. The same empirical strategy of earlier estimates was adopted.[40] Table 4.A 10 reports the results. The regressions provide evidence that a weak national currency is associates with greater economic complexity. The estimated parameters of LRER, mis_1 and mis_2 are statistically significant at 5% and around -0.0001. Interestingly, this parameter is statistically significant only in the specification that controls government spending instead of wage-share. However, the parameter of mis_{cepii} is positive and equal to 0.002 (column 7). The output did not deliver evidence in favor that govern spending influence economic complexity. Meanwhile, the variable wage-share is statistically significant at 1% and around 0.002, in the specification of columns 6 and 8, which suggests that societies with more equalitarian functional income distribution have a productive structure more

[40] An additional lag of measure of the exchange rate was introduced into the estimated equation's right side because this specification fitted better in terms of AR (2) and Sargan/Hansen tests.

complex. Also, the output indicates that the degree of economic complexity is positively associated with income per capita and terms of trade.

6- Exchange Rate, Income Level, Complexity and Structural Change

The promotion of structural change in direction to manufacturing sectors is how low-income countries have escaped from bad institutions in the past and made the catching-up; avoiding exchange rate overvaluations is essential for that (Johnson et al., 2007). However, the adoption of the exchange rate regime for development is not particularly obvious. The adoption of overvalued exchange rate reflects institutional problems from poor countries (Acemoglu et al., 2003). As overvaluations of exchange rate are linked to transfers of resources from rural to urban sectors, political elites capture it to take benefits of exchange rate policy (Acemoglu et al., 2003). In this perspective, societies with reliable and inclusive institutions pursue a weak national currency to promote the sophistication of productive structure, while poor countries with weak institutions pursue strong national currency to benefit the traditional activities.

Rodrik (2008) indicated that the effectiveness of exchange rate devaluations in promoting long-run growth is associated with countries' income levels. The positive effects of a weak national currency in economic growth are stronger for developing countries. The explanation offered by Rodrik (2008) is that developing countries have bad institutions, which difficulties the catching-up. The poor institutions lock down the low-income countries into a poverty trap characterized by the reduced appropriation of private investment returns due to the existence of contractual incompleteness, hold-up problems, corruption, and absence of property rights (Rodrik, 2008). As a result, the defective institutions tax the private returns, inhibiting capital accumulation and technological progress (Rodrik, 2008). The first-best strategy would be improving institutions (Rodrik, 2008). Nevertheless, good institutions are the outcome of a historical and tough process and are inherent to each country's social, cultural, and economic characteristics (Chang, 2002). Devaluations of exchange rates act as the second-best mechanism to compensate the taxation of defective institution and promote structural change and long-run growth within developing countries (Rodrik, 2008).

A series of regressions were run to test the link between the magnitude of the exchange rate's effects in structural change with income-level and economic complexity. The same empirical strategy of earlier estimates was adopted to explain the manufacturing activities in

GDP.[41] For that, an interacted variable between the measures of exchange rate misalignment and income per capita/economic complexity was introduced in estimates.

The regressions introducing the interacted measures of exchange rate misalignment and income per capita in estimates are reported in Table 4.A 11. Once again, the results indicate that devaluating national currency expands the share of manufacturing sectors in GDP, but that such effect is stronger for countries with lower income.[42] Exchange rate devaluations are more important in promoting structural change for low-income countries as far as it offsets its bad institutions, as Rodrik (2008) suggests.

Table 4.A 12 reports the estimates using the interaction between the measures of exchange rate misalignment and the economic complexity index.[43] The results indicate that the expansionary effects of exchange rate devaluations in GDP manufacturing share are stronger for countries with more complex productive structure. Thus, it evidences that good institutions, great productive capability and more knowledge embedded in productive structure potentialize the expansionary effect of devaluations of the exchange rate in the manufacturing share of GDP. Therefore, regressions provide evidence that devaluations of the exchange rate should be adopted *pari passu* with other policies that improve economic complexity in order to potentialize its effects.

Lastly, a set of regressions considering the interacted measures of exchange rate misalignment and income per capita was run to explain the economic complexity. The results are reported in Table 4.A 13 and suggest that making the exchange rate devalued boosts the economic complexity and this effect is stronger for high-income countries.[44]

7- Exchange Rate and Manufacturing Sectors

This section estimates regressions to test the association between exchange rate and structural change at the sectoral level. The empirical strategy consists of performing regressions to explain the employment growth from 19 manufacturing sectors of 41 countries over 2000 and 2014. The basic estimating equation is:

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[41] Regressions employing the manufacturing share of the employment as a dependent variable were performed, but the interacted variable was absolutely not statistically significant. Thus, the regressions were not presented.

[42] This is valid for regressions using LRER, mis_1 and mis_2. Regressions using mis_{cepii} are contrasting and do not provide robust evidence.

[43] The economic complexity index was normalized to be positive in all extension.

[44] This is valid only for LRER, mis_1 and mis_2.

$$emp_{tsi}=\alpha+\beta_1 mis_{t,i}+f_t+f_i+u_{it} \quad (11)$$

where *i*, *s,* and *t* denote country, sector, and the time index. Estimates were performed with time and country-sectors fixed effects, f_t and f_s, respectively. The dependent variable is the growth rate[45] of manufacturing employment and comes from the world input-output database (WIOD) provided by Timmer et al. (2015).[46] The sectors are classified according to the International Standard Industrial Classification of All Economic Activities (ISIC) 4.0.[47] The measure of exchange rate employed in regressions is the index of Couharde et al (2017).

Three further specifications are run considering the variable $mis_{t,i}$ and its interaction with the sectoral share of inputs that comes from abroad (import), the share of sectoral income that comes from exports (export) and net exports[48] (net export):

$$emp_{tsi}=\alpha+\beta_1 mis_{t,i} + \beta_2 (mis_{t,i} \text{ x } import_{tsi})+f_t+f_i+u_{it} \quad (11.1)$$

$$emp_{tsi}=\alpha+\beta_1 mis_{t,i} + \beta_2 (mis_{t,i} \text{ x } export_{tsi})+f_t+f_i+u_{it} \quad (11.2)$$

$$emp_{tsi}=\alpha+\beta_1 mis_{t,i} + \beta_2 (mis_{t,i} \text{ x net } export_{tsi})+f_t+f_i+u_{it} \quad (11.3)$$

The variables import, export and net export are calculated by the authors using the world input-output database (WIOD) 2016 release. Equations (11.1) and (11.2) aim at capturing the heterogeneous effect of exchange rate movements associated with the share of inputs that comes from abroad (import) and the share of sectoral income that comes from exports (export) as Nucci and Pozzolo (1999), Campa and Goldber (2001), Galindo et al. (2007) and Lanau (2017) suggest. Equation (11.3) captures the heterogeneous effect of exchange rate movements associated with the difference between revenue (export) and cost (import) that represent the transmission channels from exchange rate movements into the profit-rate of firms.[49]

The use of Arellano-Bond/GMM estimators is the usual practice in estimating the exchange rate effect on long-run growth to address the endogeneity issues in econometric panels (Vaz and Baer, 2014). The estimates are run using the method of Ordinary Least Square following Vaz and Baer (2014). The argument of the authors is that it is very unlike that a manufacturing sector determines the exchange rate mainly because each sector represents a small

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45 The first difference of dependent variable in logarithm.

46 The sectoral employment was chosen at detriment of output to avoid the issue associated with the non-existence of a sectoral purchasing power parity measure (for the best of our knowledge).

47 The countries and the sectors covered by database are presented in Tables 4.B 1 and 4.B 2 in appendix B.

48 The net export is the difference between export and import. Positive (negative) values indicate that revenues as exports are greater than costs as imports (both in %) and then it is likely that devaluations of exchange rate have positive (negative) effect on production.

49 Table 4.3 B in appendix B presents the variables.

share of the productive structure. Plus, controlling the sectoral heterogeneity indicates that the exchange rate has different effects in distinct sectors, which eliminates the spurious correlation between the boom of commodities and growth of many countries (Vaz and Baer, 2014). Moreover, the use of index of misalignment of Couharde et al (2017) mitigates the effects of productivity growth, terms of trade, and net foreign assets on exchange rate and then avoids the possibility that the non-controlled variables produce vies in sectoral estimates.

The estimates are reported in Table 4.B 4 (appendix B) The results deliver robust evidence that devaluating the exchange rate increase the growth rate of employment in manufacturing sectors - the estimated parameter of mis_{cepii} ranges from 0.12 to 0.17. Thus, a 1% more devalued exchange rate expands manufacturing employment by 0.15%, on average. The regressions did not provide evidence that the interacted variables are statistically significant.

8- The Sectoral Heterogeneous Effects of Exchange Rate

This section provides empirical evidence about the sectoral heterogeneous effects of exchange rate devaluation on employment growth within different countries. Firstly, the empirical strategy consists of introducing a dummy for each country that interacted with the exchange rate to capture the cross-country heterogeneous effect of exchange rate on manufacturing employment. The aim is to estimate the effect of exchange rate movements within a country:

$$emp_{tsi}=\alpha+\beta_1 mis_{t,i}+\beta_2\,(mis_{t,i} \text{ x country})+f_t+f_i+ u_{it} \quad (12)$$

where country is a dummy to countries, the argument is that each country's "macro" characteristics – such as income distribution, national system of innovation, financial system, openness degree etc., produce particular effects of changes in exchange rate. Equation (12) estimates different slopes to each country and captures the cross-country particularities regarding the exchange rate.

Following Vaz and Baer (2014), a further specification is estimated considering the interaction between exchange rate and country dummies and the interaction between exchange rate and country-sector dummies:

$$emp_{tsi}=\alpha+\beta_1 mis_{t,i}+\beta_2\,(mis_{t,i} \text{ x country})+\beta_3\,(mis_{t,i} \text{ x country x sector})+f_t+f_i+ u_{it} \quad (12.1)$$

where sector represents a dummy for 17 manufacturing sectors[50], the *rationale* is that movements of exchange rate affect the performance of manufacturing sectors in different ways, which is associated with the sectorial peculiarities (Vaz and Baer, 2014). Movements of exchange rate produce heterogeneous sectoral dynamics, and equation (12.1) captures it by estimating a slope to each sector within a country.

The robustness of estimates of equation (11.1) is assessed by performing a regression in accordance with Nucci and Pozzolo (1999), Campa and Goldberg (2001), Galindo et al. (2007), and Lanau (2017), according to which the magnitude of exchange rate effect is associated with changes in costs and revenues produced by exchange rate movements:

$$emp_{tsi}=\alpha+\beta_1 mis_{t,i}+ \beta_1 (mis_{t,i} \text{ x country})+\beta_2 (mis_{t,i} \text{ x country x sector x net export}_{tsi})+f_t+f_i+u_{it} \quad (12.2)$$

Sectors with more imported inputs and revenues associated with exports tend to be more affected by exchange rate movements. Equation (12.2) captures this argument by estimating a particular slope to each sector linked to its net export within a country. The empirical strategy is the same as in section 6. The estimates that capture the cross-country and sectoral heterogeneous effects of exchange rate movements were performed by introducing dummies for the following developing countries Brazil, Indonesia, India, Korea, and Mexico.[51]

The complete outputs of regressions are presented in Tables 4.B (5, 7, 9, 11, and 13). Table 4.1 summarizes the regressions of equation (11) that estimates different slopes to each country to capture the cross-countries particularities regarding the movements of exchange rate.

[50]10-12 Food products, beverages, and tobacco products; 13-15 Textiles, wearing apparel and leather products; 16 Wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials; 17 Paper and paper products; 18 Printing and reproduction of recorded media; 19 Coke and refined petroleum products; 20 Chemicals and chemical products; 21 Basic pharmaceutical products and pharmaceutical preparations; 22 Rubber and plastic products; 23 Other non-metallic mineral products; 24 Basic metals; 25 Fabricated metal products, except machinery and equipment; 26 Computer, electronic and optical products; 27 Electrical equipment; 28 Machinery and equipment; 29 Motor vehicles, trailers, and semi-trailers; 30 Other transport equipment.

[51] And in accordance with the availability of data.

Table 4. 1 - Cross-country Heterogeneous Effects

Country	Effect of a 1% of devaluation in the exchange rate
Brazil	0.29%
Indonesia	0.54%
India	-0.16%
Korea	0.19%
Mexico	0.13%

Obs.: calculated by the authors using the output of the estimates presented in Tables B5-B9 (first column).

The results indicate that movements of exchange rate do not have uniform effects across the countries. The estimated parameter of variable $mis_{t,i}$ is statistically significant at 1% in all estimates and around -0.11 and -0.13, indicating that the "common" cross-country effect of an exchange rate devaluation of 1% in the growth of manufacturing employment is around 0.12%. In turn, the parameter of the interacted variable $mis_{t,i}$ x country is statistically significant at 1% in all estimates (except for Mexico). The estimates suggest that devaluations of exchange rate have a positive effect on manufacturing employment of Brazil, Indonesia, Korea, and Mexico; an exchange rate devaluation of 1% increase the growth of manufacturing employment by 0.29%, 0.54%, 0.19% and 0.13%, respectively. In contrast, the estimates point that devaluations of the exchange rate are negatively associated with India's manufacturing employment; an exchange rate devaluation of 1% reduces the growth rate of manufacturing employment by 0.16%.

Regarding the estimates of equations (12.1) and (12.2), the estimated parameter of mis_{cepii} is around -0.12 in all estimates. The parameter of the variable mis_{cepii} interacted with the dummy for countries in estimates of equation (11.1) is -0.33 (Brazil), -1.43 (Indonesia), 0.70 (India), non-significant (Mexico), and 0.32 (Korea). Plus, the estimates of both equations confirmed the heterogeneous effects of exchange rate across country-sectors once most of the sectoral slopes are statistically significant. Although the estimates of equation (11.1) provide evidence suggestive that devaluations increase the growth of manufacturing employment of the majority sectors, regressions also indicated that devaluations might hurt the growth employment of few sectors.[52] This is the case of Brazil, Indonesia, Mexico, and Korea. Conversely, the regressions are contrasting for India as far as estimates indicate that devaluations of exchange rate reduce employment growth of the majority manufacturing sectors and promote it in few sectors.

[52] See the first column of Table B5.1 (Brazil), B6.1 (Indonesia), B7.1 (India), B8.1 (Mexico), B9.1 (Korea) to obtain the total effect of a devaluation of 1% using the estimates of equation (11.1).

Table 4.2 presents the effect of a devaluation of 1% on sectoral employment growth using the estimates of equation (12.1).

Table 4. 2 - Sectoral Effect I of a devaluation of 1%

	Brazil	Indonesia	India	Mexico	Korea
10-12 Food products, beverages and tobacco products	0.22	0.57	0.24	-0.02	0.38
13-15 Textiles, wearing apparel and leather products	0.12	0.35	-0.04	0.15	0.37
16 Wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	0.36	0.82	-0.54	0.23	0.6
17 Paper and paper products	0.26	0.08	0.25	0.09	0.2
18 Printing and reproduction of recorded media	0.08	0.08	0.22	-0.03	0.44
19 Coke and refined petroleum products	1.06	0.48	1.26	-0.18	0.12
20 Chemicals and chemical products	0.9	0.24	-0.23	0.16	0.03
21 Basic pharmaceutical products and pharmaceutical preparations	0.61	0.24	-0.28	0.06	0.22
22 Rubber and plastic products	0.24	-0.01	-1.28	-0.04	0.49
23 Other non-metallic mineral products	0.25	0.71	-0.29	-0.13	0.17
24 Basic metals	0.01	0.58	-0.07	0.13	0.15
25 Fabricated metal products, except machinery and equipment	0.39	0.58	-0.17	0.18	-0.04
26 Computer, electronic and optical products	0.14	0.25	-0.37	0.22	0.08
27 Electrical equipment	0.03	0.25	-0.41	0.42	0.16
28 Machinery and equipment	0.25	1.1	0.18	0.33	0.23
29 Motor vehicles, trailers and semi-trailers	0.41	0.94	0.82	0.08	0.13
30 Other transport equipment	0.3	0.94	0.82	0.33	0.11

A possible explanation for the contrasting result for India relies on the relatively small importance of exports in revenue of manufacturing sectors and the great share of imports in inputs. Table 4.3 presents the average of the share of exports in revenue (x) and the share of imported inputs (m) in intermediate inputs:

Table 4. 3 - Sectoral exports and imports (average of 2000-2014)

	Brazil		Indonesia		India		Mexico		Korea	
	x	*m*	*x*	*m*	*x*	*m*	*x*	*m*	*x*	*m*
10-12 Food products, beverages and tobacco products	0.19	0.05	0.17	0.09	0.06	0.04	0.06	0.15	0.05	0.12
13-15 Textiles, wearing apparel and leather products	0.13	0.11	0.53	0.29	0.24	0.08	0.41	0.32	0.4	0.16
16 Wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	0.28	0.08	0.43	0.1	0.08	0.09	0.08	0.13	0.02	0.22
17 Paper and paper products	0.22	0.1	0.31	0.18	0.04	0.13	0.12	0.26	0.16	0.15
18 Printing and reproduction of recorded media	0.01	0.12	0.02	0.18	0.03	0.14	0.13	0.26	0.02	0.12
19 Coke and refined petroleum products	0.08	0.16	0.36	0.2	0.16	0.51	0.07	0.1	0.35	0.8
20 Chemicals and chemical products	0.12	0.16	0.35	0.29	0.18	0.19	0.15	0.23	0.28	0.21
21 Basic pharmaceutical products and pharmaceutical preparations	0.05	0.11	0.11	0.21	0.06	0.15	0.11	0.21	0.05	0.13
22 Rubber and plastic products	0.08	0.16	0.42	0.27	0.11	0.14	0.27	0.31	0.38	0.19
23 Other non-metallic mineral products	0.1	0.1	0.12	0.19	0.05	0.14	0.15	0.16	0.13	0.28
24 Basic metals	0.29	0.13	0.33	0.22	0.11	0.26	0.29	0.21	0.22	0.34
25 Fabricated metal products, except machinery and equipment	0.06	0.11	0.12	0.25	0.11	0.23	0.42	0.34	0.2	0.2
26 Computer, electronic and optical products	0.16	0.34	0.63	0.31	0.13	0.2	0.9	0.71	0.54	0.26
27 Electrical equipment	0.12	0.14	0.38	0.31	0.1	0.17	0.9	0.53	0.27	0.18
28 Machinery and equipment	0.19	0.16	0.32	0.43	0.11	0.22	0.77	0.45	0.29	0.18
29 Motor vehicles, trailers and semi-trailers	0.17	0.13	0.1	0.29	0.1	0.16	0.57	0.44	0.46	0.15
30 Other transport equipment	0.29	0.26	0.68	0.37	0.3	0.32	0.79	0.44	0.45	0.18
Average	0.15	0.14	0.32	0.25	0.12	0.19	0.36	0.31	0.25	0.23

Note: elaborated by author using the database of world input-output database (WIOD) 2016

Table 4.3 provides evidence suggestive that the manufacturing sectors of India are relatively more aimed for internal market and import more input from abroad than sectors of other countries, on average. In contrast, the manufacturing sectors of the remaining countries are more outwarded oriented and have less cost associated with imports in general. Perhaps, this is a reason why devaluations of the exchange rate hurt the manufacturing sectors of India.

Regarding the estimates of equation (12.2), the parameter of mis_{cepii} interacted with the dummy for countries is -0.14 (Brazil), -0.53 (Indonesia), 0.24 (India), -0.10 (Mexico), and 0.09 (Korea). The total effect of a devaluation of 1% in the exchange rate on sectoral employment growth using the estimates of equation (11.2) are presented in Tables 4.B 6 (Brazil), 4.B 8

(Indonesia), 4.B 10 (India), 4.B 12 (Mexico), 4.B 14 (Korea).[53] As expected, the effect varies over the years depending on the value of net export and is positive for most sectors of Brazil, Indonesia, Mexico, and Korea. Once again, the results indicate a negative effect of devaluations of exchange rate in most sectors of India, indicating the robustness of earlier estimates.

Table 4.4 summarizes the results by presenting the averaged total effect over 2000-2014 of a devaluation of 1% in the exchange rate on sectors using the estimates of equation (11.2).

Table 4. 4 - Sectoral Effect II of a devaluation of 1%

	Brazil	Indonesia	India	Mexico	Korea
10-12 Food products, beverages and tobacco products	0.21	0.65	-0.01	-0.06	0.34
13-15 Textiles, wearing apparel and leather products	0.18	0.30	-0.05	0.05	0.26
16 Wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	0.42	0.66	-0.20	0.21	0.56
17 Paper and paper products	0.25	-0.12	-0.05	0.06	0.20
18 Printing and reproduction of recorded media	0.07	-0.13	-0.05	0.03	0.47
19 Coke and refined petroleum products	1.15	0.42	0.72	0.29	0.18
20 Chemicals and chemical products	0.10	0.25	-0.15	0.08	0.04
21 Basic pharmaceutical products and pharmaceutical preparations	0.61	0.11	-0.61	0.03	0.25
22 Rubber and plastic products	0.23	-0.05	-0.23	0.14	0.54
23 Other non-metallic mineral products	0.12	0.22	-0.11	0.03	0.15
24 Basic metals	0.10	0.19	-0.74	0.03	0.14
25 Fabricated metal products, except machinery and equipment	0.14	0.15	-0.05	0.18	-0.01
26 Computer, electronic and optical products	0.25	0.66	-0.58	0.18	0.05
27 Electrical equipment	0.17	0.50	-0.40	0.36	0.10
28 Machinery and equipment	0.28	0.63	-0.19	-0.22	0.28
29 Motor vehicles, trailers and semi-trailers	0.25	0.48	0.07	0.01	0.14
30 Other transport equipment	0.24	0.73	-0.11	0.51	0.16

It should be noticed that the values of Table 4.4 are similar to those of Table 4.2 in many sectors and countries, suggesting some degree of robustness of results.

A correlogram between the total effect of a devaluation of 1% in exchange rate using the estimates of equation (11.2) and the average of sectoral net export is presented in Graph 4.B 1 (Brazil), Graph 4.B 2 (Indonesia), Graph 4.B 3 (India), Graph 4.B 4 (Mexico) and Graph 4.B 5

[53] The total effect was calculated on a yearly basis for the period 2000-2014 using the yearly values of exports share on revenue and imports on costs with inputs.

(Korea) in appendix B.[54] When the outliers are excluded of the sample (black line), the correlograms of Brazil, Indonesia, India, and Mexico indicate a positive association (at least graphically) between net export and the magnitude of the effect of devaluations of exchange rate on sectoral performance. This indicates that, on average, the effects of devaluations are stronger in sectors more outwarded oriented and with smaller share of imported inputs. Still, this does not apply to Korea because it is not possible to identify any graphical pattern in this case.

9- The Effects of Exchange Rate by Technological Regime and Conflict

The earlier estimates indicated that the effects of changes in the exchange rate are heterogeneous across the sectors. This section goes forward and tests whether the effects of exchange rate movements are associated with the sectoral technological regime and labor costs. The sectors are grouped according to the intensity of technological innovation following the classification of Rueda and Verger (2016).[55] A dummy for sectors under a regime of a fast, or slow, pace of technological innovation interacted with exchange rate is introduced in estimates:

$$emp_{tsi}=\alpha+\beta_1 mis_{t,i} + \beta_2 (mis_{t,i} \text{ x country}) + \beta_3 (mis_{t,i} \text{ x country x fast pace})+f_t+f_i+ u_{it} \quad (13)$$

$$emp_{tsi}=\alpha+\beta_1 mis_{t,i} + \beta_2 (mis_{t,i} \text{ x country}) + \beta_3 (mis_{t,i} \text{ x country x slow pace})+f_t+f_i+ u_{it} \quad (14)$$

Equations (13) and (14) estimate an individual slope to the sectors under a regime of a fast, or slow, pace of technological innovation. The variable country represents a dummy for Brazil, Indonesia, India, Mexico, and Korea. The empirical strategy is the same as in section 6.

The estimates of equations (13) and (14) are reported in Table 4B. 15 (appendix B). The outputs indicate that a devaluation of 1% in exchange rate changes the growth of employment in sectors under fast pace technological innovation regime in 0.25% (Brazil), 0.56% (Indonesia), 0.07% (India), 0.19% (Mexico) and 0.14% (Korea). Whereas it changes the growth of employment in sectors under slow pace technological innovation regime in 0.30% (Brazil), 0.52% (Indonesia), -0.30% (India), 0.02% (Mexico) and 0.26% (Korea).

In other words, regressions indicate that devaluations of exchange rate expand the employment of sectors with a faster pace of innovation in all countries, even at different

[54] The total effect of a devaluation of 1% in exchange rate using the estimates of equation (12.2) was calculated employing the yearly data of the share of exports in revenue (x) and the share of imported inputs (m) in intermediate inputs over the period 2000-2014 and then averaged.

[55] See Table 4.B 2 in appendix. Following the classification of Rueda and Verger (2016), the sectors of high intense technological progress correspond to the sectors of high and medium-high intensity, while the sectors of low intense are those of medium and medium-low intensity.

intensities (this effect is stronger for Brazil and Indonesia). Regressions also indicate that devaluations expand employment of sectors with a slower pace of innovation in all countries, except for India (once again, this effect is stronger for Indonesia and Brazil). It should be stressed that devaluations' positive effect is stronger for the sectors more intense in technological innovation of Indonesia, India, and Mexico, whilst it is stronger for the sectors less intense in technological innovation of Brazil and Korea.

A further channel through which exchange rate may affect the sectoral performance is explored. The *rationale* is that the magnitude of the effects of exchange rate movements is associated with the importance of labor in costs. The argument is in accordance with Nucci and Pozzolo (1999), according to which firms with low mark-up are financially constrained because retained profits are short, which increases the dependence on other financing sources. Sectors more financially constrained are more sensitive to changes in the exchange rate (Nucci and Pozzolo, 1999). Put differently, sectors with greater labor costs depend more on other financing sources to expand activities because their internal funds are scarce,[56] whereas sectors with lower labor costs are less dependent upon other sources of financing as their internal funds tend to be relatively greater. The argument is that devaluations of the exchange rate may offset the reduced retained profits insofar as it increases exports. An active exchange rate policy may alleviate the social conflict between workers and capitalists by boosting exports to generate the required internal funds to expand new activities.

Equation (15) is estimated to test this argument empirically:[57]

$$emp_{tsi}=\alpha+\beta_1 mis_{t,i} + \beta_2 (mis_{t,i} \text{ x wage costs})+f_t+f_i+ u_{it} \qquad (15)$$

Four further specifications are estimated considering the interaction between $mis_{t,i}$ and the share of exports in revenue, imports in costs, both variables, and only the three interactions -Table 4. B 16 (appendix B) reports the estimates. Only the variable $mis_{t,i}$ x wage costs is statistically significant and negative in all estimates. This result suggests that devaluations increase employment growth and such effect is stronger in sectors with higher labor costs (more financially constrained). Equation (15) was re-estimated by taking only the following interactions as an independent variable: $mis_{t,i}$ x wage costs x export, or $mis_{t,i}$ x wage costs x net export in

[56] In Kaleckian terms, the wage-share corresponds to mark-up over the labor costs. Greater (lower) the wage-share smaller (greater) the mark-up.

[57] The interaction between $mis_{t,i}$ and wage costs was constructed using lagged values of wage costs in t-1 to assure that influences occur from wage costs to employment growth.

different specifications.[58] Both parameters are statistically significant and negative, indicating that devaluations of exchange rates are stronger in promoting employment growth in sectors with greater importance of wage in costs, which is especially valid for sectors more outwarded-oriented.

On the other hand, it is expected that sectors under different technological innovation regimes have distinct financing requirement to expand activities. In order to test whether the effects of exchange rate are associated with labor costs of sectors under a faster, or a slower, pace of technological progress, three additional equations are estimated:

$$emp_{tsi}=\alpha+\beta_1 mis_{t,i} + \beta_2 (mis_{t,i} \text{ x wage costs})+ \beta_2 (mis_{t,i} \text{ x wage costs x country})+f_t+f_i+ u_{it} \quad (15.1)$$

Equation (15.1) estimates the effects of changes in the exchange rate in the sectoral employment of Brazil, Indonesia, India, Mexico, and Korea by estimating an individual slope to each country. Equations (15.2) and (15.3) estimate the effects of exchange rate in employment of sectors under a fast and a slow pace of technological progress of Brazil, Indonesia, India, Mexico, and Korea:

$$emp_{tsi}=\alpha+\beta_1 mis_{t,i} + \beta_2 (mis_{t,i} \text{ x wage costs})+ \beta_2 (mis_{t,i} \text{ x wage costs x country})+ \beta_3 (mis_{t,i} \text{ x wage costs x country x fast pace})+f_t+f_i+ u_{it} \quad (15.2)$$

$$emp_{tsi}=\alpha+\beta_1 mis_{t,i} + \beta_2 (mis_{t,i} \text{ x wage costs})+ \beta_2 (mis_{t,i} \text{ x wage costs x country})+ \beta_3 (mis_{t,i} \text{ x wage costs x country x slow pace})+f_t+f_i+ u_{it} \quad (15.3)$$

Table 4.B 17 (appendix B) reports the estimates. The estimated parameter of $mis_{t,i}$ is not statistically significant in all outputs. However, the parameter of $mis_{t,i}$ x wage costs x country is significant and negative (around -0.60) in all estimates, confirming that devaluations of exchange rate increase the growth rate of sectoral employment, and such effect is stronger for sectors more financially constrained due to higher labor costs. In turn, the parameter of $mis_{t,i}$ x wage costs x country is not significant only in the case of Mexico and is negative for Brazil (-0.93), Indonesia (-3.58), and Korea (-0.45); moreover, it is positive for India (3.41). Thus, estimates of equation (15.1) indicate that a devaluation of 1% in exchange rate changes the sectoral employment growth in 0.73% (Brazil), 1% (Indonesia), 0.31% (India), 0.65% (Korea) and 0.59% (Mexico).[59]

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[58] Equation (14) using $mis_{t,i}$ and $mis_{t,i}$ x wage costs x export or $mis_{t,i}$ x wage costs x net export as dependent variables in addition to $mis_{t,i}$ (two specifications) was run, and both interactions were not significant.

[59] Using the overall average of labor costs: Brazil (0.16), Indonesia (0.12), India (0.08), Korea (0.14) and Mexico (0.11).

The estimates of equations (15.2) and (15.3) - reported in Table 4.B 17, indicate that the sectors a slow pace regime of technological progress are more sensitive to changes in the exchange rate. The estimates point out that a devaluation of 1% in exchange rate changes the growth rate of employment from sectors under a regime of fast technological progress pace by 1.41% (Brazil), 4.08% (Indonesia), -2.83% (India), 0.61% (Mexico), 1.04% (Korea).[60] Meanwhile, such effect for sectors under the regime of slow pace of technological progress is 1.99% (Brazil), 4.42% (Indonesia), -2.71% (India), 1.65% (Mexico), 1.37% (Korea).[61]

Therefore, exchange rate devaluations expand manufacturing sectors' activities, especially in sectors with a slow pace of technological progress. A possible explanation for that relies upon the stylized fact that those sectors are more labor-intense and with great labor costs, which leads to a short-retained profit and a limited capacity to expand activities. Though, it should be noted that the exchange rate matters in promoting the expansion of manufacturing activities of sectors under both regimes. Regressions indicate that the effect is stronger for sectors in which the conflict between workers and capitalists is more intense (the sectors under with slow pace of technological progress). By contrast, the results are suggestive that expanding activities of sectors under regime of a faster pace of technological progress is more challenging than simply a weak currency.

Concluding Remarks

The structural change towards manufacturing sectors is the engine of long-run growth in Classical-Kaldorian-Structuralist theory. This literature indicates that manufacturing has special properties that make the expansion of this sector within productive structure an important driver of long-run growth. The current article has tested the association between exchange rate changes and structural change, using aggregated and sectorial databases.

The empirical results have delivered evidence that the exchange rate matters for the structural composition within an economy. A weak currency is associated with a structural change toward tradable sectors, especially in the direction of manufacturing sectors in terms of the composition of GDP and employment. Interestingly, taking structural change as the manufacturing share in GDP, the results have indicated that the effect of exchange rate

[60] Using the average of labor costs for sectors under the regime of high pace of technological progress: Brazil (0.14), Indonesia (0.12), India (0.06), Korea (0.11) and Mexico (0.09).

[61] Using the average of labor costs for sectors under the regime of slow pace of technological progress: Brazil (0.17), Indonesia (0.12), India (0.09), Korea (0.16) and Mexico (0.11).

movements is stronger for low-income countries. Furthermore, the degree of economic complexity potentializes the effects of the exchange rate on the productive structure. On the one hand, those results indicate that devaluations of exchange rates act as a second-best mechanism to offset faulty institutions and foster structural change to modern sectors within developing countries, as Rodrik (2008) indicated. On the other hand, evidence suggests that structural change toward modern sectors requires *pari passu* to adopt other policies linked with the promotion of complexity in the productive structure (i.e., knowledge, good institutions, etc.) to enlarge the earnings of a weak currency.

In addition, empirical evidence points out that an active exchange rate policy for development (by making national goods more competitive/more affordable) increases the economy's complexity, diversifies production and increases the knowledge embedded in productive structure. Conversely, regressions indicate that the effects of movements in the exchange rate are stronger for high-income countries.

The estimates using sectorial data confirmed the influence of changes in the exchange rate on manufacturing sectors' performance. On average, devaluations of the exchange rate expand manufacturing employment. Though, this effect is associated with cross-countries and sector particularities. By estimating an individual slope for developing countries, the results suggest that devaluations have an expansionary effect on employment growth in Brazil, Indonesia, Korea, and Mexico. The same result applies to most manufacturing sectors of these countries. Conversely, exchange rate devaluations hurt the performance of most sectors of India. A possible explanation for this contrasting result relies upon the relative importance of exports in sectoral revenues and the share of costs associated with imports. India's manufacturing sectors are relatively less outwarded-oriented and import compounds a great share of costs.

Lastly, the sectoral estimates provided further evidence that the sectoral effects of changes in the exchange rate are associated with the regime of technological progress and financial constraint (i.e., low mark-up or great labor costs). A weak national currency boosts sectors' activity under a regime of high or slow pace of technological progress, while the effects of changes in the exchange rate are stronger for sectors more financially constrained, as Nucci and Pozzolo (1999) indicated. Still, sectors under a regime of slow pace of technological progress are more sensitive to changes in the exchange rate. The explanation for that relies on the stylized fact that those sectors are more labor-intense and have great labor costs, indicating that the retained profit and the capacity to expand activities are short. Thus, devaluations of the exchange rate enhance the retained profit (by enlarging exports), which alleviates the social conflict between workers and capitalists, generating the internal funds to expand manufacturing activities.

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Appendix A – Estimates using Aggregated Database

Table 4.A 1 List of Countries (Sample)

Country	Country	Country	Country	Country	Country
Angola	Chile	Ghana	Korea	Norway	Slovak Republic
Albania	China	Guinea-Bissau	Kuwait	Nepal	Slovenia
United Arab Emirates	Cote d'Ivoire	Equatorial Guinea	Lao PDR	New Zealand	Sweden
Armenia	Cameroon	Greece	Lebanon	Oman	Eswatini
Antigua and Barbuda	Colombia	Grenada	Sri Lanka	Pakistan	Seychelles
Australia	Comoros	Guatemala	Lesotho	Panama	Chad
Austria	Cabo Verde	Guyana	Lithuania	Peru	Togo
Burundi	Costa Rica	Hong Kong	Luxembourg	Philippines	Thailand
Belgium	Cyprus	Honduras	Latvia	Papua New Guinea	Tajikistan
Benin	Czech Republic	Croatia	Morocco	Poland	Turkmenistan
Burkina Faso	Germany	Haiti	Moldova	Portugal	Tonga
Bangladesh	Dominica	Hungary	Madagascar	Paraguay	Trinidad and Tobago
Bulgaria	Denmark	Indonesia	Maldives	Qatar	Tunisia
Bahrain	Dominican Republic	India	Mexico	Romania	Turkey
Bosnia and Herzegovina	Algeria	Ireland	North Macedonia	Russia	Tanzania
Belarus	Ecuador	Iceland	Mali	Rwanda	Uganda
Belize	Egypt	Israel	Malta	Saudi Arabia	Ukraine
Bolivia	Spain	Italy	Mongolia	Sudan	Uruguay
Brazil	Estonia	Jamaica	Mauritania	Senegal	United States
Barbados	Ethiopia	Japan	Mauritius	Singapore	Vietnam
Brunei Darussalam	Finland	Kazakhstan	Malaysia	Solomon Island	Samoa
Bhutan	Fiji	Kenya	Namibia	Sierra Leone	Yemen
Central African Republic	France	Kyrgyz Republic	Niger	El Salvador	South Africa
Canada	Gabon	Cambodia	Nigeria	Serbia	
Switzerland	United Kingdom	Kiribati	Netherlands	Sao Tome and Principe	

Table 4.A 2 - Estimates for Exchange Rate Misalignment

Variables	Model 1: mis_1	Model 2: mis_2
Hausman (FE X RE)	RE	RE
LPIBCAPITA	0.19*** (0.03)	
LTOT		-0.21 (0.20)
LASSET		-0.01 (0.01)
LW		0.24** (0.11)
Obs.	876	510
Groups	148	109

Notes: (1) The logarithm of Real Exchange Rate (RER) is the dependent variable; (2) FE and RE refer to Random and Fixed Effect estimation; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) estimates performed with fixed effects for time and robust variance-covariance matrix for heteroscedasticity; (5) Robust Standard Errors between parentheses; (6) L = variable in logarithm

Table 4.A 3 - Aggregated Database: basic information and descriptive statistics

Variable	Definition	Source	Obs	$\bar{x}$	σ
manufacturing share in GDP	Manufacturing, value added as % of GDP: *Manufacturing refers to industries belonging to ISIC divisions 15-37. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. The origin of value added is determined by the International Standard Industrial Classification (ISIC), revision 3.* Available for the period 1990-2018	World Bank	791	14.1	10.3
primary share in GDP	Agriculture, forestry and fishing, value added as % of GDP: *Agriculture corresponds to ISIC divisions 1-5 and includes forestry, hunting, and fishing, as well as cultivation of crops and livestock production. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. The origin of value added is determined by the International Standard Industrial Classification (ISIC), revision 3 or 4.* Available for the period 1990-2018	World Bank	822	13.1	12.4
services share in GDP	Services, value added as % of GDP: *Services correspond to ISIC divisions 50-99 and they include value added in wholesale and retail trade (including hotels and restaurants), transport, and government, financial, professional, and personal services such as education, health care, and real estate services. Also included are imputed bank service charges, import duties, and any statistical discrepancies noted by national compilers as well as discrepancies arising from rescaling. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. The industrial origin of value added is determined by the International Standard Industrial Classification (ISIC), revision 3 or 4.* Available for the period 1990-2018	World Bank	794	52.2	11.7
manufacturing share in employment	Employment in manufacturing (%) *The industry sector consists of mining and quarrying, manufacturing, construction, and public utilities (electricity, gas, and water), in accordance with divisions 2-5 (ISIC 2) or categories C-F (ISIC 3) or categories B-F (ISIC 4).* Available for the period 1991-2018	World Bank	858	20.8	9.02
Agriculture share in employment	Employment in agriculture (%) *The agriculture sector consists of activities in agriculture, hunting, forestry and fishing, in accordance with division 1 (ISIC 2) or categories A-B (ISIC 3) or category A (ISIC 4).* Available for the period 1991-2018	World Bank	858	28.7	24.0

services share in employment	Employment in services (%) *The services sector consists of wholesale and retail trade and restaurants and hotels; transport, storage, and communications; financing, insurance, real estate, and business services; and community, social, and personal services, in accordance with divisions 6-9 (ISIC 2) or categories G-Q (ISIC 3) or categories G-U (ISIC 4).* Available for the period 1991-2018	World Bank	858	50.4	18.4
economic complexity	Economic Complexity Index (ECI): available for the period 1995-2017	Observatory of Economic Complexity	531	0.10	0.98
Real exchange rate (LRER)	Bilateral exchange rate (Price level ratio of PPP conversion factor to market exchange rate: $RER_{t,i} = PPP_{t,i} / XRAT_{t,i}$. Negative (positive) values indicate that real exchange rate is undervalued (overvalued).	World Bank	878	-0.74	0.50
Per capita income	Real GDP per capita (PPP)- (beginning year of each 5-years period)	World Bank	877	16,974	19,282
Terms of Trade	Ratio of export to import prices	Penn World Table 9.1	852	1.03	0.10
Net foreign assets	Net foreign assets as % of GDP	World Bank	799	0.19	0.52
Wage-share	Wage-share as % of GDP	Penn World Table 9.1	684	0.52	0.12
Government consumption	Government consumption as % of GDP	Penn World Table 9.1	852	0.18	0.08
mis_1	Measure of RER misalignment using LPIBCAPITA	author	876	0.001	0.39
mis_2	Measure of RER misalignment using LTOT, LASSET and LW	author	510	-0.03	0.45
Mis_{CEPII}	Measure of RER misalignment calculated by CEPII (http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=34) employing the multilateral real exchange rate and real GDP per capita, terms of trade and net foreign assets	Couharde (2017)	849	-0.02	0.18

Source: authors

Table 4.A 4 - Exchange Rate and Structural Change (manufacturing share in GDP)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
lag of manufacturing share in GDP	0.89*** (0.01)	0.84*** (0.01)	0.88*** (0.01)	0.84*** (0.01)	0.73*** (0.04)	0.80*** (0.01)	0.63*** (0.06)	0.83*** (0.01)
LRER	-0.11*** (0.02)	-0.06*** (0.01)						
mis_1			-0.13*** (0.02)	-0.09*** (0.01)				
mis_2					-0.29*** (0.06)	-0.04* (0.02)		
mis_{cepii}							-0.11 (0.07)	-0.18*** (0.01)
income level	0.05*** (0.01)	0.03*** (0.008)	0.03*** (0.008)	0.02*** (0.006)	0.17*** (0.03)	0.02*** (0.01)	-0.009 (0.02)	-0.003 (0.008)
terms of trade	-0.07 (0.05)	0.29*** (0.06)	-0.15*** (0.05)	0.23*** (0.06)	0.67*** (0.19)	0.39*** (0.09)	0.41 (0.27)	0.43*** (0.09)
government consumption	-0.01 (0.02)		0.008 (0.01)		-0.11 (0.09)		-0.22*** (0.02)	
wage-share		-0.04*** (0.008)		-0.03** (0.01)		-0.002 (0.01)		0.02 (0.02)
AR (2)	0.52	0.84	0.47	0.80	0.16	0.11	0.82	0.90
Sargan	0.95	0.70	0.94	0.69	0.83	0.89	0.48	0.65
Hansen	0.64	0.50	0.68	0.73	0.16	0.27	0.19	0.33
Hansen-Diff	0.93	0.67	0.95	0.97	0.30	0.51	0.44	0.90
Groups	136	111	136	111	106	106	136	111
Instruments	78	76	78	76	41	75	41	73

Notes: (1) The dependent variable is the logarithm of manufacturing share in GDP; (2) estimates using two-step System GMM with Time Dummies; (2.1) [a] denotes that regression was performed using the robust matrix of variance-covariance robust for heteroskedasticity; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) Standard Errors between parentheses; (5) all independents variables are in logarithm form

Table 4.A 5 - Exchange Rate and Structural Change (manufacturing share in employment)

	(1)[a]	(2) [a]	(3)[a]	(4)[a]	(5)[a]	(6)[a]	(7)[a]	(8)[a]
lag of manufacturing share in employment	0.98*** (0.05)	0.73*** (0.07)	0.97*** (0.05)	0.72*** (0.17)	0.80*** (0.16)	0.89*** (0.10)	0.87*** (0.08)	0.60*** (0.13)
LRER	-0.12*** (0.04)	0.17* (0.10)						
mis_1			-0.11*** (0.04)	0.31 (0.29)				
mis_2					0.13 (0.12)	0.02 (0.08)		
mis_{cepii}							-0.20*** (0.06)	-0.01 (0.06)
income level	0.009 (0.02)	-0.08 (0.05)	-0.01 (0.02)	-0.21 (0.13)	-0.05 (0.08)	-0.57* (0.29)	-0.03 (0.03)	-0.09 (0.11)
terms of trade	-0.16 (0.20)	0.33	-0.17 (0.20)	1.30* (0.75)	0.19 (0.71)	0.91 (0.56)	0.34 (0.25)	0.41 (0.40)
government consumption	-0.05 (0.03)		-0.05 (0.03)		-0.21 (0.14)		0.01 (0.05)	
wage-share		-0.76*** (0.23)		-0.40 (0.33)		-0.57** (0.29)		0.19 (0.26)
AR (2)	0.15	0.18	0.16	0.24	0.11	0.15	0.10	0.14
Sargan	0.05	0.00	0.00	0.06	0.00	0.00	0.00	0.00
Hansen	0.12	0.37	0.14	0.34	0.30	0.33	0.14	0.41
Hansen-Diff	0.23	0.71	0.27	0.29	0.059	0.12	0.30	0.78
Groups	138	114	138	114	109	109	138	114
Instruments	41	56	41	20	28	27	41	31

Notes: (1) The dependent variable is the logarithm of manufacturing share in employment; (2) estimates using two-step System GMM with Time Dummies; (2.1) [a] denotes that regression was performed using the robust matrix of variance-covariance robust for heteroskedasticity; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) Standard Errors between parentheses; (5) all independent variables are in logarithm form

Table 4.A 6 - Exchange Rate and Structural Change (agriculture share in GDP)

	(1)[a]	(2) [a]	(3)[a]	(4)[a]	(5)[a]	(6)[a]	(7)[a]	(8)[a]
lag of agriculture share in GDP	0.83*** (0.04)	0.84*** (0.04)	0.82*** (0.04)	0.59*** (0.10)	0.81*** (0.06)	0.60*** (0.09)	0.23 (0.16)	0.66*** (0.10)
LRER	-0.12** (0.05)	-0.11* (0.06)						
mis_1			-0.13** (0.05)	-0.19*** (0.08)				
mis_2					-0.09 (0.06)	-0.16 (0.10)		
mis_{cepii}							-0.04 (0.11)	0.07 (0.12)
income level	- 0.13*** (0.04)	-0.12*** (0.04)	-0.16*** (0.04)	-0.37*** (0.08)	-0.19*** (0.05)	-0.36*** (0.07)	-0.72*** (0.13)	-0.33*** (0.09)
terms of trade	-0.25 (0.17)	-0.12 (0.15)	-0.32* (0.16)	-0.33 (0.31)	-0.33* (0.19)	-0.32 (0.30)	-0.70 (0.81)	0.15 (0.23)
government consumption	0.003 (0.03)		0.01 (0.04)		0.07 (0.07)		0.24* (0.13)	
wage-share		-0.05 (0.10)		0.20 (0.27)		0.21 (0.19)		0.21 (0.16)
AR (2)	0.72	0.44	0.74	0.53	0.43	0.39	0.67	0.46
Sargan	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hansen	0.17	0.12	0.092	0.14	0.35	0.33	0.10	0.18
Hansen-Diff	0.70	0.44	0.44	0.92	0.28	0.80	0.62	0.51
Groups	138	111	138	111	106	106	138	111
Instruments	75	63	75	51	78	52	49	65

Notes: (1) The dependent variable is the logarithm of agriculture share in GDP; (2) estimates using two-step System GMM with Time Dummies; (2.1) [a] denotes that regression was performed using the robust matrix of variance-covariance robust for heteroskedasticity; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) Standard Errors between parentheses; (5) all independent variables are in logarithm form

Table 4.A 7 - Exchange Rate and Structural Change (agriculture share in employment)

	(1)[a]	(2) [a]	(3)[a]	(4)[a]	(5)[a]	(6)[a]	(7)[a]	(8)[a]
lag of agriculture share in employment	0.85*** (0.04)	0.94*** (0.05)	0.90*** (0.03)	0.94*** (0.04)	0.95*** (0.03)	0.92*** (0.02)	0.93*** (0.03)	0.90*** (0.03)
LRER	- 0.20*** (0.06)	-0.15 (0.09)						
mis_1			-0.16** (0.06)	-0.04 (0.06)				
mis_2					-0.01 (0.03)	-0.01 (0.04)		
mis_{cepii}							-0.04 (0.06)	-0.03 (0.06)
income level	-0.07** (0.03)	-0.01 (0.06)	-0.10*** (0.03)	-0.07** (0.03)	-0.07*** (0.02)	-0.09*** (0.02)	-0.09 (0.03)	-0.13*** (0.03)
terms of trade	-0.06 (0.24)	-0.56*** (0.20)	-0.29 (0.18)	-0.14 (0.18)	-0.21 (0.17)	-0.20 (0.15)	-0.09 (0.15)	-0.09 (0.12)
government consumption	0.14 (0.08)		-0.06 (0.04)		-0.003 (0.04)		-0.02 (0.03)	
wage-share		-0.03 (0.12)		0.01 (0.09)		0.02 (0.06)		-0.13*** (0.03)
AR (2)	0.11	0.14	**0.02**	**0.07**	0.31	0.28	**0.01**	**0.03**
Sargan	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Hansen	0.24	0.13	**0.05**	**0.02**	0.17	0.29	**0.05**	0.13
Hansen-Diff	0.29	0.13	0.14	**0.02**	0.06	0.20	**0.05**	0.25
Groups	138	114	138	114	109	109	138	114
Instruments	30	29	41	41	65	65	58	58

Notes: (1) The dependent variable is the logarithm of manufacturing share in employment; (2) estimates using two-step System GMM with Time Dummies; (2.1) [a] denotes that regression was performed using the robust matrix of variance-covariance robust for heteroskedasticity; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) Standard Errors between parentheses; (5) all independent variables are in logarithm form

Table 4.A 8 - Exchange Rate and Structural Change (service share in GDP)

	(1)	(2) [a]	(3)[a]	(4)[a]	(5)[a]	(6)[a]	(7)[a]	(8)[a]
lag of service share in GDP	0.71*** (0.10)	0.62*** (0.09)	0.41*** (0.14)	0.54*** (0.09)	0.70*** (0.09)	0.72*** (0.06)	0.46*** (0.11)	0.43*** (0.08)
LRER	-0.04 (0.03)	-0.03 (0.02)						
mis_1			-0.05 (0.05)	-0.03 (0.03)				
mis_2					-0.04 (0.03)	-0.04 (0.03)		
mis_{cepii}							0.02 (0.04)	0.07 (0.06)
income level	0.06*** (0.02)	0.06*** (0.01)	0.09*** (0.03)	0.07*** (0.01)	0.07*** (0.01)	0.06*** (0.02)	0.08** (0.03)	0.08*** (0.01)
terms of trade	0.22 (0.20)	0.22* (0.12)	0.66*** (0.22)	0.24* (0.13)	0.04 (0.13)	0.03 (0.09)	0.66** (0.32)	0.28* (0.17)
government consumption	0.02 (0.03)		0.07 (0.09)		0.01 (0.03)		0.04 (0.08)	
wage-share		0.02 (0.06)		0.05 (0.07)		0.04 (0.04)		0.05 (0.05)
AR (2)	0.10	0.17	0.12	0.16	0.23	0.23	0.12	0.12
Sargan	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hansen	0.19	0.12	0.10	0.11	0.21	0.28	0.15	0.16
Hansen-Diff	0.34	0.41	0.61	0.43	0.45	0.52	0.66	0.97
Groups	138	111	138	111	105	105	138	111
Instruments	30	75	39	66	60	78	48	64

Notes: (1) The dependent variable is the logarithm of service share in GDP; (2) estimates using two-step System GMM with Time Dummies; (2.1) [a] denotes that regression was performed using the robust matrix of variance-covariance robust for heteroskedasticity; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) Standard Errors between parentheses; (5) all independent variables are in logarithm form

Table 4.A 9 - Exchange Rate and Structural Change (service share in employment)

	(1)[a]	(2) [a]	(3)[a]	(4)[a]	(5)[a]	(6)[a]	(7)[a]	(8)[a]
lag of service share in employment	0.64*** (0.15)	0.72*** (0.11)	0.97*** (0.04)	0.66** (0.27)	0.83*** (0.09)	0.83*** (0.10)	0.94*** (0.02)	0.72*** (0.16)
LRER	0.02 (0.02)	0.007 (0.02)						
mis_1			-0.01 (0.02)	-0.05 (0.09)				
mis_2					-0.04 (0.03)	-0.02 (0.02)		
mis_{cepii}							0.03 (0.03)	-0.05 (0.03)
income level	0.07 (0.04)	0.06 (0.04)	-0.02 (0.01)	0.06 (0.08)	0.03 (0.03)	0.02 (0.02)	-0.006 (0.008)	0.07 (0.06)
terms of trade	0.37* (0.19)	-0.09 (0.09)	0.27*** (0.08)	0.49 (0.40)	0.42*** (0.12)	0.22** (0.10)	0.03 (0.05)	-0.02 (0.18)
government consumption	0.05 (0.04)		0.02 (0.01)		0.03 (0.03)		0.01 (0.01)	
wage-share		0.14*** (0.05)		0.05 (0.11)		0.05 (0.05)		0.03 (0.05)
AR (2)	0.15	0.12	**0.00**	0.31	0.15	0.10	**0.00**	0.13
Sargan	0.01	0.00	0.00	0.37	0.04	0.00	**0.00**	0.00
Hansen	0.12	0.49	0.30	0.37	0.82	0.23	0.10	0.11
Hansen-Diff	0.80	0.83	0.47	0.33	0.94	0.28	0.63	0.29
Groups	138	114	138	114	109	109	138	114
Instruments	35	51	55	25	32	35	55	39

Notes: (1) The dependent variable is the logarithm of service share in employment; (2) estimates using two-step System GMM with Time Dummies; (2.1) [a] denotes that regression was performed using the robust matrix of variance-covariance robust for heteroskedasticity; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) Standard Errors between parentheses; (5) all independent variables are in logarithm form

Table 4.A 10 - Exchange Rate and Structural Change (economic complexity)

	(1)	(2)	(3)	(4)[a]	(5)	(6)	(7)	(8)
lag of economic complexity	0.80*** (0.03)	0.73*** (0.09)	0.81*** (0.03)	0.77*** (0.09)	0.91*** (0.01)	0.80*** (0.02)	0.84*** (0.02)	0.81*** (0.02)
LRER	-0.001** (0.0007)	-0.0003 (0.001)						
mis_1			-0.001** (0.0006)	-0.0007 (0.001)				
mis_2					-0.001*** (0.0004)	-0.00001 (0.0004)		
mis_{cepii}							0.002*** (0.0005)	0.0001 (0.0005)
income level	0.001*** (0.0003)	0.0007 (0.0005)	0.001*** (0.003)	0.001 (0.0007)	-0.000002 (0.0001)	0.0006** (0.0002)	0.001*** (0.0001)	0.001*** (0.0001)
terms of trade	0.01*** (0.002)	0.01** (0.003)	0.009*** (0.001)	0.007*** (0.002)	0.002*** (0.0008)	0.004*** (0.001)	0.008*** (0.001)	0.007*** (0.0008)
government consumption	-0.0005 (0.0004)		-0.0002 (0.0003)		-0.0004 (0.0002)		-0.0003 (0.0003)	
wage-share		0.001 (0.001)		0.001 (0.002)		0.002*** (0.0006)		0.002*** (0.0005)
AR (2)	0.41	0.46	0.40	0.41	0.96	0.91	0.41	0.43
Sargan	0.42	0.12	0.56	0.03	0.38	0.23	0.37	0.13
Hansen	0.28	0.20	0.33	0.39	0.38	0.11	0.13	0.03
Hansen-Diff	0.12	0.41	0.22	0.77	0.17	0.18	0.78	0.56
Groups	116	99	116	99	88	88	116	99
Instruments	56	52	54	54	68	62	68	68

Notes: (1) The dependent variable is the economic complexity; (2) estimates using two-step System GMM with Time Dummies; (2.1) [a] denotes that regression was performed using the robust matrix of variance-covariance robust for heteroskedasticity; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) Standard Errors between parentheses; (5) all independents variables are in logarithm form; (6) an additional lag of measure of exchange rate was introduced into the right side of estimated equation, this specification fitted better in terms of AR (2) and Sargan/Hansen tests (the respective parameters are not presented)

Table 4.A 11 - Exchange Rate, Structural Change (manufacturing share in GDP) and Income Level

	(1)	(2)	(3)	(4)[a]	(5)	(6)	(7)	(8)
lag of manufacturing share in GDP	0.93*** (0.01)	0.89*** (0.009)	0.92*** (0.007)	0.87*** (0.01)	0.86*** (0.02)	0.81*** (0.03)	0.91*** (0.01)	0.94*** (0.01)
LRER	-0.06*** (0.01)	-0.04*** (0.01)						
LRER*YN	-2.67-e07 (2.40e-07)	3.12e-06*** (2.60e-07)						
mis_1			-0.12*** (0.02)	-0.35*** (0.02)				
mis_1*YN			1.94e-06*** (5.32-07)	0.00001*** (7.09e-07)				
mis_2					-0.10*** (0.03)	-0.15*** (0.04)		
mis_2*YN					-2.80e-06* (1.50-e06)	-1.75 e-06 (1.48e-06)		
mis_{cepii}							0.16*** (0.03)	-0.20*** (0.03)
mis_{cepii}*YN							2.85e-06*** (6.54e-07)	5.09e-06*** (6.42e-07)
terms of trade	-0.14*** (0.05)	0.16*** (0.04)	-0.21*** (0.04)	0.25*** (0.06)	0.09 (0.12)	0.66*** (0.14)	-0.19*** (0.07)	0.24*** (0.04)
government consumption	0.02 (0.01)		0.03** (0.01)		-0.21*** (0.04)		0.07*** (0.01)	
wage-share		-0.18*** (0.02)		-0.33*** (0.03)		-0.28*** (0.04)		-0.03 (0.02)

AR (2)	0.42	0.76	0.38	0.98	0.15	0.11	0.35	0.85
Sargan	0.87	0.92	0.87	0.90	0.87	0.93	0.91	0.63
Hansen	0.43	0.15	0.33	0.43	0.24	0.45	0.09	0.20
Hansen-Diff	0.54	0.09	0.40	0.33	0.11	0.34	0.53	0.71
Groups	136	111	136	111	106	106	136	111
Instruments	78	76	78	76	64	64	78	74

Notes: (1) The dependent variable is the economic complexity; (2) estimates using two-step System GMM with Time Dummies; (2.1) [a] denotes that regression was performed using the robust matrix of variance-covariance robust for heteroskedasticity; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) Standard Errors between parentheses; (5) all independent variables are in logarithm form;

Table 4.A 12 - Exchange Rate, Structural Change (manufacturing share in GDP) and Economic Complexity

	(1)	(2)	(3)	(4)	(5)[a]	(6)[a]	(7)[a]	(8)[a]
lag of manufacturing share in GDP	0.79***	0.73***	0.78***	0.93***	0.83***	0.85***	0.79***	0.88***
	(0.06)	(0.06)	(0.05)	(0.04)	(0.07)	(0.09)	(0.06)	(0.06)
LRER	10.32**	13.47***						
	(4.22)	(3.97)						
LRER* economic complexity	-10.52**	-13.62***						
	(4.25)	(4.00)						
mis_1			19.65**	22.17***				
			(9.32)	(6.96)				
mis_1* economic complexity			-19.67**	-22.13***				
			(9.31)	(6.93)				
mis_2					2.11	-9.02		
					(9.10)	(11.36)		
mis_2* economic complexity					-2.15	8.90		
					(9.02)	(11.26)		
mis_{cepii}							35.46*	27.28
							(21.29)	(26.20)
mis_{cepii}* economic complexity							-35.49*	-27.52
							921.36)	(26.27)
terms of trade	-0.23	-0.30	-0.47**	-0.32**	-0.42	0.10	0.53	0.59**
	(0.28)	(0.31)	(0.23)	(0.15)	(0.27)	(0.28)	(0.37)	(0.28)
government consumption	0.003		-0.06		0.12		-0.001	
	(0.09)		(0.09)		(0.11)		(0.10)	

wage-share		-0.07 (0.15)		-0.24** (0.11)		-0.01 (0.10)		-0.07 (0.17)
AR (2)	0.12	0.22	0.10	0.21	0.32	0.38	0.20	0.40
Sargan	0.33	0.109	0.17	0.18	0.00	0.005	0.00	0.00
Hansen	0.03	0.103	0.69	0.45	0.16	0.28	0.54	0.21
Hansen-Diff	0.15	0.26	0.75	0.77	0.00	0.81	0.44	0.33
Groups	111	97	111	97	91	91	111	97
Instruments	33	33	38	38	59	59	52	52

Notes: (1) The dependent variable is the economic complexity; (2) estimates using two-step System GMM with Time Dummies; (2.1) [a] denotes that regression was performed using the robust matrix of variance-covariance robust for heteroskedasticity; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) Standard Errors between parentheses; (5) all independent variables are in logarithm form.

Table 4.A 13 - Exchange Rate, Structural Change (economic complexity) and Income Level

	(1)	(2)	(3)	(4)[a]	(5)	(6)	(7)	(8)
lag of economic complexity	0.85*** (0.02)	0.79*** (0.01)	0.95*** (0.01)	0.92*** (0.01)	0.90*** (0.01)	0.91*** (0.01)	0.93*** (0.006)	0.93*** (0.007)
LRER	0.0003 (0.0007)	0.0008 (0.0007)						
LRER*YN	-1.30e-07*** (9.64-09)	-1.38*** (5.91-09)						
mis_1			0.0002 (0.0008)	0.001 (0.001)				
mis_1*YN			-6.04e-08*** (8.70e-09)	-7.46e-08** (3.47e-08)				
mis_2					0.0004 (0.0005)	-0.0006 (0.0007)		
mis_2*YN					-4.50e-08*** (1.54e-08)	-1.96e-08 (2.18e-08)		
mis_{cepii}							5.01e-08*** (1.23e-08)	0.005*** (0.001)
mis_{cepii}*YN							0.002*** (0.0007)	-2.16e-08 (1.69e-08)
terms of trade	0.009*** (0.001)	0.008*** (0.0009)	0.007*** (0.001)	0.005*** (0.001)	0.003*** (0.0007)	-0.0004 (0.0009)	0.002*** (0.0007)	0.003*** (0.0007)
government consumption	0.0007**** (0.0002)		0.0002 (0.0002)		-0.00001 (0.0002)		0.0002 (0.0002)	
wage-share		0.001*** (0.0006)		0.0005 (0.0008)		0.002*** (0.0002)		-0.0008** (0.0004)

AR (2)	0.32	0.31	0.38	0.40	0.96	0.54	0.39	0.49
Sargan	0.82	0.11	0.65	0.16	0.64	0.34	0.92	0.81
Hansen	0.32	0.10	0.05	0.08	0.58	0.47	0.05	0.12
Hansen-Diff	0.76	0.25	0.12	0.26	0.68	0.50	0.15	0.28
Groups	116	99	116	99	88	88	116	99
Instruments	62	62	62	56	68	68	68	62

Notes: (1) The dependent variable is the economic complexity; (2) estimates using two-step System GMM with Time Dummies; (2.1) [a] denotes that regression was performed using the robust matrix of variance-covariance robust for heteroskedasticity; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) Standard Errors between parentheses; (5) all independents variables are in logarithm form; (6) an additional lag of measure of exchange rate (single and interacted) was introduced into the right side of estimated equation, this specification fitted better in terms of AR (2) and Sargan/Hansen tests (the respective parameters are not presented)

Appendix B – Estimates using Sectoral Database

Table 4.B 1 - List of Countries (Sample)

Country	Country
Australia	Italy
Austria	Japan
Belgium	Korea
Bulgaria	Lithuania
Brazil	Luxembourg
Canada	Latvia
Switzerland	Mexico
Cyprus	Malta
Czech Republic	Netherlands
Germany	Norway
Denmark	Poland
Spain	Portugal
Estonia	Romania
Finland	Russia
France	Slovak Republic
United Kingdom	Slovenia
Greece	Sweden
Croatia	Turkey
Hungary	United States
Indonesia	
India	
Ireland	

Table 4.B 2 - List of Manufacturing Sectors (Sample)

Sectors	Technological Regime
10-12 Food products, beverages and tobacco products	Low Intense
13-15 Textiles, wearing apparel and leather products	Low Intense
16 Wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	Low Intense
17 Paper and paper products	Low Intense
18 Printing and reproduction of recorded media	Low Intense
19 Coke and refined petroleum products	Low Intense
20 Chemicals and chemical products	High Intense
21 Basic pharmaceutical products and pharmaceutical preparations	High Intense
22 Rubber and plastic products	Low Intense
23 Other non-metallic mineral products	Low Intense
24 Basic metals	Low Intense
25 Fabricated metal products, except machinery and equipment	Low Intense
26 Computer, electronic and optical products	High Intense
27 Electrical equipment	High Intense
28 Machinery and equipment	High Intense
29 Motor vehicles, trailers and semi-trailers	High Intense
30 Other transport equipment	High Intense
31-32 Furniture; other manufacturing	Low Intense
33 Repair and installation of machinery and equipment	Low Intense

Table 4.B 3 - Sectoral Database: basic information and descriptive statistics

Variable	Definition	Source	Obs	$\bar{x}$	σ
manufacturing employment	*Number of employees (thousands)* Available for the period 2000-2014	WIOD/ Timmer (2015)	11.695	1.65e+08	4.59e+08
export	Calculated by authors using the WIOD/Timmer (2015) data; the share of output from sectors from exports. Available for the period 2000-2014	Authors	11.440	0.43	0.29
import	Calculated by authors using the WIOD/Timmer (2015) data; the share of intermediate inputs that is imported. Available for the period 2000-2014	Authors	11.440	0.36	0.19

Table 4.B 4 - Exchange Rate and Manufacturing Sectors

	(1)	(2)	(3)	(4)	(5)
Mis_{cepii}	-0.12***	-0.14***	-0.17***	-0.12***	-0.17***
Mis_{cepii} x export		0.05			-0.01
Mis_{cepii} x import			0.13		0.14
Mis_{cepii} x liquid export				-0.02	
Constant	-0.02***	-0.02***	-0.02***	-0.02***	-0.02***
Hausmann *p-value*/	0.08/	0.00/	0.01/	0.03/	0.01/
(FE X RE ?)	FE	FE	FE	FE	FE
Observations	10,670	10,670	10,670	10,670	10,670

Obs.: (1) Standard Errors adjusted for clusters of countries; (2) liquid export is the difference between export and import; (3) Year fixed effects was employed in all estimates.

Table 4.B 5 - Exchange Rate and Heterogenous Effects on Manufacturing Sectors: Brazil

	Equation (11)	Equation (11.1)	Equation (11.2)
Mis_{cepii}	-0.11***	-0.11***	-0.11***
Mis_{cepii} X Brazil	-0.18***	-0.33***	-0.14***
10-12 Food products, beverages, and tobacco products		0.22***	0.31***
13-15 Textiles, wearing apparel and leather products		0.32***	4.02***
16 Wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials		0.08***	-0.80***
17 Paper and paper products		0.16***	0.06
18 Printing and reproduction of recorded media		0.36***	-1.75***
19 Coke and refined petroleum products		-0.62***	10.41***
20 Chemicals and chemical products		0.35***	-3.32***
21 Basic pharmaceutical products and pharmaceutical preparations		-0.17***	7.04***
22 Rubber and plastic products		0.20***	-0.32***
23 Other non-metallic mineral products		0.19***	-15.24***
24 Basic metals		0.43***	0.90
25 Fabricated metal products, except machinery and equipment		0.05***	-2.36***
26 Computer, electronic and optical products		0.30***	0.08
27 Electrical equipment		0.41***	-6.43***
28 Machinery and equipment		0.19***	-1.02***
29 Motor vehicles, trailers, and semi-trailers		0.03***	0.05
30 Other transport equipment		0.14***	0.24***
Constant	-0.02***	-0.02***	-0.01***
Observations	10,670	10,670	10,670

Obs.: (1) Year fixed effects was employed in all estimates; (2) * significant at 1%, ** significant at 5% and *** significant at 1%; (3) robust errors clustered by countries (not reported).

Table 4.B 6 - Exchange Rate and Heterogenous Effects on Manufacturing Sectors in Brazil: A devaluation of 1%

	Equation (11.1)	Equation (11.2) [a]														
		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
10-12 Food products, beverages and tobacco products	0.22	0.23	0.21	0.2	0.2	0.19	0.2	0.2	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21
13-15 Textiles, wearing apparel and leather products	0.12	0.13	0.02	-0.06	-0.17	-0.14	- 0.06	0.01	0.17	0.3	0.38	0.43	0.44	0.45	0.43	0.43
16 Wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	0.36	0.41	0.46	0.54	0.54	0.58	0.53	0.5	0.44	0.38	0.34	0.33	0.3	0.32	0.33	0.36
17 Paper and paper products	0.26	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
18 Printing and reproduction of recorded media	0.08	0.09	0.07	0.08	0.06	0.05	0.08	0.08	0.1	0.06	0.07	0.06	0.06	0.05	0.04	0.03
19 Coke and refined petroleum products	1.06	1.25	0.96	0.98	1.03	1.28	0.85	0.79	0.94	1.14	0.96	1.29	1.39	1.21	1.45	1.68
20 Chemicals and chemical products	0.90	0.08	0.04	0.12	0.09	0.07	0.2	0.26	0.15	0.07	0.14	0.1	0.07	0.07	0.02	- 0.03
21 Basic pharmaceutical products and	0.61	0.64	0.69	0.59	0.64	0.64	0.54	0.48	0.58	0.63	0.52	0.6	0.6	0.65	0.7	0.69

pharmaceutical preparations																
22 Rubber and plastic products	0.24	0.23	0.23	0.23	0.23	0.23	0.23	0.24	0.23	0.22	0.23	0.23	0.22	0.22	0.22	0.22
23 Other non-metallic mineral products	0.25	0.23	0.28	0.8	0.6	0.8	0.94	0.79	0.44	-0.21	-0.19	-0.35	-0.56	-0.56	-0.6	-0.61
24 Basic metals	0.01	0.08	0.1	0.05	0.04	0.04	0.07	0.06	0.12	0.14	0.14	0.17	0.13	0.12	0.15	0.12
25 Fabricated metal products, except machinery and equipment	0.39	0.16	0.15	0.2	0.18	0.18	0.19	0.15	0.12	0.11	0.16	0.1	0.1	0.11	0.09	0.08
26 Computer, electronic and optical products	0.14	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
27 Electrical equipment	0.03	0.06	0.05	0.19	0.34	0.33	0.39	0.41	0.37	0.26	0.28	0.02	-0.02	0	-0.06	-0.11
28 Machinery and equipment	0.25	0.29	0.27	0.3	0.31	0.36	0.36	0.34	0.3	0.27	0.24	0.23	0.24	0.25	0.21	0.2
29 Motor vehicles, trailers and semi-trailers	0.41	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
30 Other transport equipment	0.30	0.2	0.19	0.19	0.22	0.18	0.26	0.28	0.27	0.27	0.29	0.28	0.28	0.27	0.23	0.27

Notes: [a] calculated using yearly database on export share of revenues and import share of inputs

Table 4.B 7 - Exchange Rate and Heterogenous Effects on Manufacturing Sectors: Indonesia

	Equation (11)	Equation (11.1)	Equation (11.2)
Mis_{cepii}	-0.11***	-0.11***	-0.11***
Mis_{cepii} X Indonesia	-0.43***	-1.43***	-0.53***
10-12 Food products, beverages and tobacco products		0.97***	-3.00***
13-15 Textiles, wearing apparel and leather products		1.19***	0.50***
16 Wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials		0.72***	-0.72***
17 Paper and paper products		1.46***	4.36***
18 Printing and reproduction of recorded media		1.46***	-3.23***
19 Coke and refined petroleum products		1.06***	-0.03
20 Chemicals and chemical products		1.30***	3.27***
21 Basic pharmaceutical products and pharmaceutical preparations		1.30***	-3.06***
22 Rubber and plastic products		1.55***	3.05***
23 Other non-metallic mineral products		0.83***	-2.84***
24 Basic metals		0.96***	1.96***
25 Fabricated metal products, except machinery and equipment		0.96***	-2.10***
26 Computer, electronic and optical products		1.29***	-0.76***
27 Electrical equipment		1.29***	-1.14***
28 Machinery and equipment		0.44***	1.85***
29 Motor vehicles, trailers and semi-trailers		0.60***	0.30***
30 Other transport equipment		0.60***	-1.00***
Constant	-0.02***	-0.02***	-0.02***
Observations	10,670	10,670	10,670

Obs.: (1) Year fixed effects was employed in all estimates; (2) * significant at 1%, ** significant at 5% and *** significant at 1%; (3) robust errors clustered by countries (not reported).

Table 4.B 8 - Exchange Rate and Heterogenous Effects on Manufacturing Sectors in Indonesia: A devaluation of 1%

	Equation (11.1)	Equation (11.2) [a]														
		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
10-12 Food products, beverages and tobacco products	0.57	0.51	0.46	0.56	0.57	0.63	0.67	0.65	0.7	0.83	0.68	0.67	0.69	0.69	0.67	0.72
13-15 Textiles, wearing apparel and leather products	0.35	0.21	0.2	0.29	0.29	0.29	0.27	0.27	0.26	0.34	0.32	0.34	0.35	0.35	0.34	0.34
16 Wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	0.82	0.95	0.82	0.81	0.77	0.78	0.73	0.68	0.61	0.54	0.52	0.52	0.52	0.53	0.54	0.56
17 Paper and paper products	0.08	-0.26	-0.45	-0.25	-0.11	0.12	0	-0.18	-0.18	-0.24	-0.13	-0.1	0.06	0.04	-0.07	-0.05
18 Printing and reproduction of recorded media	0.08	-0.31	-0.3	-0.21	-0.11	-0.2	-0.22	-0.11	-0.13	-0.16	0.03	-0.03	-0.06	0.03	-0.01	-0.1
19 Coke and refined petroleum products	0.48	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42
20 Chemicals and chemical products	0.24	0.12	0.27	0.27	0.38	0.39	0.31	0.31	0.13	0.37	0.28	0.22	0.08	0.22	0.2	0.16
21 Basic pharmaceutical products and	0.24	-0.17	-0.15	-0.07	0.07	-0.06	-0.13	0.05	0.12	0.14	0.31	0.33	0.32	0.32	0.28	0.29

pharmaceutical preparations																
22 Rubber and plastic products	-0.01	0.2	0.15	0.08	0.03	0.14	0.09	0.02	0	0.09	-0.2	-0.18	-0.21	-0.22	-0.34	-0.39
23 Other non-metallic mineral products	0.71	0.57	0.42	0.36	0.37	0.27	0.24	0.21	0.16	0.09	0.2	0.14	0.1	0.08	0.05	0.03
24 Basic metals	0.58	0.42	0.49	0.55	0.51	0.5	0.45	0.25	0.06	0.14	0.02	-0.23	-0.28	-0.07	0.05	0.03
25 Fabricated metal products, except machinery and equipment	0.58	0.24	0.29	0.28	0.31	0.21	0.18	0.2	0.13	0.04	0.12	0.04	0.05	0.03	0.01	0.07
26 Computer, electronic and optical products	0.25	1.01	0.92	0.82	0.8	0.78	0.76	0.7	0.61	0.49	0.61	0.52	0.48	0.5	0.45	0.46
27 Electrical equipment	0.25	0.58	0.52	0.5	0.56	0.5	0.46	0.55	0.54	0.4	0.47	0.49	0.49	0.44	0.45	0.48
28 Machinery and equipment	1.10	-0.14	0.29	0.29	0.35	0.49	0.51	0.55	0.64	0.81	0.72	0.96	0.93	1.08	0.98	1.02
29 Motor vehicles, trailers and semi-trailers	0.94	0.51	0.52	0.51	0.52	0.52	0.54	0.47	0.45	0.47	0.44	0.45	0.45	0.45	0.45	0.44
30 Other transport equipment	0.94	0.77	0.48	0.67	0.68	0.57	0.82	0.94	0.88	0.78	0.82	0.76	0.75	0.67	0.7	0.66

Notes: [a] calculated using yearly database on export share of revenues and import share of inputs

Table 4.B 9 - Exchange Rate and Heterogenous Effects on Manufacturing Sectors: India

	Equation (11)	Equation (11.1)	Equation (11.2)
Mis_{cepii}	-0.13***	-0.13***	-0.13***
Mis_{cepii} X India	0.29***	0.70***	0.24***
10-12 Food products, beverages, and tobacco products		-0.81***	-4.82***
13-15 Textiles, wearing apparel and leather products		-0.53***	-0.36***
16 Wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials		-0.03***	-5.71***
17 Paper and paper products		-0.82***	0.67**
18 Printing and reproduction of recorded media		-0.79***	0.52***
19 Coke and refined petroleum products		0.69***	2.32***
20 Chemicals and chemical products		-0.34***	-3.97***
21 Basic pharmaceutical products and pharmaceutical preparations		-0.29***	-5.87***
22 Rubber and plastic products		0.71***	-4.79***
23 Other non-metallic mineral products		-0.28***	-0.04
24 Basic metals		-0.52***	-4.10***
25 Fabricated metal products, except machinery and equipment		-0.40***	0.54***
26 Computer, electronic and optical products		-0.20***	-6.58***
27 Electrical equipment		-0.16***	-4.19***
28 Machinery and equipment		-0.75***	-0.71***
29 Motor vehicles, trailers and semi-trailers		-1.39***	2.85***
30 Other transport equipment		-1.39***	0.13**
Constant	-0.01**	-0.01**	-0.01**
Observations	10,670	10,670	10,670

Obs.: (1) Year fixed effects was employed in all estimates; (2) * significant at 1%, ** significant at 5% and *** significant at 1%; (3) robust errors clustered by countries (not reported)

Table 4.B 10 - Exchange Rate and Heterogenous Effects on Manufacturing Sectors in India: A devaluation of 1%

	Equation (11.1)	Equation (11.2) [a]														
		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
10-12 Food products, beverages and tobacco products	0.24	0.01	0	-0.02	-0.1	-0.1	-0.07	-0.01	-0.04	-0.01	-0.09	-0.08	-0.02	0.1	0.16	0.12
13-15 Textiles, wearing apparel and leather products	-0.04	-0.02	-0.02	-0.02	-0.03	-0.04	-0.05	-0.05	-0.07	-0.07	-0.06	-0.07	-0.07	-0.07	-0.05	-0.05
16 Wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	-0.54	0.01	-0.17	0	-0.09	-0.37	-0.36	-0.24	-0.29	-0.31	-0.2	-0.18	-0.14	-0.23	-0.23	-0.24
17 Paper and paper products	0.25	-0.05	-0.05	-0.06	-0.06	-0.05	-0.05	-0.05	-0.04	-0.04	-0.06	-0.06	-0.06	-0.04	-0.05	-0.05
18 Printing and reproduction of recorded media	0.22	-0.05	-0.05	-0.05	-0.06	-0.05	-0.04	-0.05	-0.05	-0.05	-0.06	-0.05	-0.06	-0.06	-0.06	-0.06
19 Coke and refined petroleum products	1.26	0.87	0.52	0.52	0.35	0.36	0.35	0.91	0.95	0.96	0.89	0.81	0.83	0.9	0.79	0.82
20 Chemicals and chemical products	-0.23	-0.15	-0.17	-0.12	-0.09	-0.11	-0.16	-0.05	-0.2	-0.32	-0.22	-0.19	-0.17	-0.16	-0.04	-0.13
21 Basic pharmaceutical products and	-0.28	-0.58	-0.62	-0.64	-0.56	-0.65	-0.78	-0.63	-0.68	-0.76	-0.61	-0.6	-0.55	-0.55	-0.45	-0.49

pharmaceutical preparations																
22 Rubber and plastic products	-1.28	-0.17	-0.17	-0.14	-0.15	-0.24	-0.31	-0.2	-0.33	-0.39	-0.33	-0.31	-0.22	-0.21	-0.12	-0.18
23 Other non-metallic mineral products	-0.29	-0.11	-0.11	-0.11	-0.11	-0.11	-0.11	-0.11	-0.11	-0.11	-0.11	-0.11	-0.11	-0.11	-0.11	-0.11
24 Basic metals	-0.07	-0.63	-0.57	-0.4	-0.36	-0.45	-0.52	-0.69	-0.86	-0.88	-0.81	-0.75	-0.88	-1.28	-1.08	-0.92
25 Fabricated metal products, except machinery and equipment	-0.17	-0.06	-0.05	-0.07	-0.07	-0.04	-0.02	-0.04	-0.03	-0.05	-0.04	-0.03	-0.03	-0.02	-0.05	-0.06
26 Computer, electronic and optical products	-0.37	-0.83	-0.68	-0.69	-0.57	-0.77	-0.89	-0.7	-0.81	-0.6	-0.23	-0.48	-0.41	-0.38	-0.29	-0.44
27 Electrical equipment	-0.41	-0.4	-0.41	-0.35	-0.35	-0.52	-0.6	-0.4	-0.5	-0.36	-0.39	-0.41	-0.42	-0.41	-0.25	-0.2
28 Machinery and equipment	0.18	-0.2	-0.2	-0.19	-0.19	-0.2	-0.22	-0.18	-0.2	-0.17	-0.19	-0.19	-0.19	-0.18	-0.15	-0.14
29 Motor vehicles, trailers and semi-trailers	0.82	0.09	0.1	0.09	0.06	0.11	0.15	0.08	0.16	0.1	0.1	0.04	0.08	0.07	-0.06	-0.11
30 Other transport equipment	0.82	-0.1	-0.1	-0.1	-0.09	-0.1	-0.09	-0.07	-0.09	-0.09	-0.11	-0.12	-0.13	-0.12	-0.14	-0.15

Notes: [a] calculated using yearly database on export share of revenues and import share of inputs

Table 4.B 11 - Exchange Rate and Heterogenous Effects on Manufacturing Sectors: Mexico

	Equation (11)	Equation (11.1)	Equation (11.2)
Mis_{cepii}	-0.13***	-0.13***	-0.13***
Mis_{cepii} X Mexico	0.04	0.03	0.10***
10-12 Food products, beverages and tobacco products		0.15***	-1.02***
13-15 Textiles, wearing apparel and leather products		-0.02***	-0.29***
16 Wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials		-0.10***	3.17***
17 Paper and paper products		0.04***	0.20***
18 Printing and reproduction of recorded media		0.16***	0.005
19 Coke and refined petroleum products		0.31***	8.87***
20 Chemicals and chemical products		-0.03***	0.60***
21 Basic pharmaceutical products and pharmaceutical preparations		0.07***	0.19
22 Rubber and plastic products		0.17***	2.70***
23 Other non-metallic mineral products		0.26***	-1.24
24 Basic metals		0.004***	-0.17
25 Fabricated metal products, except machinery and equipment		-0.05***	-1.87***
26 Computer, electronic and optical products		-0.09***	-0.81***
27 Electrical equipment		-0.29***	-0.90***
28 Machinery and equipment		-0.20***	0.76***
29 Motor vehicles, trailers and semi-trailers		0.05***	0.13*
30 Other transport equipment		-0.20***	-1.40***
Constant	-0.02***	-0.02***	-0.02***
Observations	10,670	10,670	10,670

Obs.: (1) Year fixed effects was employed in all estimates; (2) * significant at 1%, ** significant at 5% and *** significant at 1%; (3) robust errors clustered by countries (not reported)

Table 4.B 12 - Exchange Rate and Heterogenous Effects on Manufacturing Sectors in Mexico: A devaluation of 1%

	Equation (11.1)	Equation (11.2) [a]														
		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
10-12 Food products, beverages and tobacco products	- 0.02	- 0,05	- 0,05	- 0,05	- 0,06	- 0,06	- 0,05	- 0,05	- 0,06	- 0,08	- 0,04	- 0,05	- 0,08	- 0,07	- 0,06	- 0,05
13-15 Textiles, wearing apparel and leather products	0.15	0,08	0,07	0,07	0,07	0,07	0,06	0,05	0,04	0,04	0,05	0,04	0,04	0,04	0,04	0,05
16 Wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	0.23	0,17	0,20	0,21	0,21	0,21	0,21	0,19	0,19	0,20	0,17	0,22	0,26	0,28	0,23	0,22
17 Paper and paper products	0.09	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,05
18 Printing and reproduction of recorded media	-0.03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03
19 Coke and refined petroleum products	-0.18	0,18	0,14	0,04	0,06	0,09	0,11	0,21	0,28	0,31	- 0,02	0,38	0,59	0,74	0,60	0,59
20 Chemicals and chemical products	0.16	0,08	0,07	0,07	0,08	0,08	0,08	0,09	0,09	0,09	0,07	0,08	0,07	0,07	0,07	0,08
21 Basic pharmaceutical products and	0.06	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03

pharmaceutical preparations																
22 Rubber and plastic products	-0.04	0,04	0,06	0,07	-0,02	-0,02	0,03	0,17	0,21	0,28	0,19	0,24	0,28	0,27	0,15	0,13
23 Other non-metallic mineral products	-0.13	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03
24 Basic metals	0.13	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03
25 Fabricated metal products, except machinery and equipment	0.18	0,01	0,22	0,29	0,13	0,15	0,21	0,18	0,23	0,15	0,22	0,12	0,14	0,17	0,24	0,28
26 Computer, electronic and optical products	0.22	0,14	0,17	0,18	0,18	0,19	0,17	0,17	0,14	0,17	0,21	0,20	0,19	0,22	0,22	0,22
27 Electrical equipment	0.42	0,30	0,23	0,24	0,33	0,31	0,32	0,35	0,38	0,45	0,44	0,40	0,41	0,42	0,43	0,44
28 Machinery and equipment	0.33	0,03	0,04	0,02	-0,03	-0,08	-0,14	-0,21	-0,28	-0,36	-0,38	-0,36	-0,37	-0,38	-0,39	-0,40
29 Motor vehicles, trailers and semi-trailers	0.08	0,02	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,02	0,03	0,02	0,02	0,02
30 Other transport equipment	0.33	0,20	0,26	0,31	0,32	0,28	0,28	0,48	0,57	0,47	0,62	0,81	0,75	0,77	0,79	0,78

Notes: [a] calculated using yearly database on export share of revenues and import share of inputs

Table 4.B 13 - Exchange Rate and Heterogenous Effects on Manufacturing Sectors: Korea

	Equation (11)	Equation (11.1)	Equation (11.2)
Mis_{cepii}	-0.12***	-0.12***	-0.12***
Mis_{cepii} X Korea	-0.07**	0.32***	0.09***
10-12 Food products, beverages and tobacco products		-0.58***	4.56***
13-15 Textiles, wearing apparel and leather products		-0.50***	-0.97***
16 Wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials		-0.80***	2.64***
17 Paper and paper products		-0.40***	-16.27***
18 Printing and reproduction of recorded media		-0.64***	4.43***
19 Coke and refined petroleum products		-0.32***	0.33***
20 Chemicals and chemical products		-0.23***	-0.20***
21 Basic pharmaceutical products and pharmaceutical preparations		-0.42***	2.63***
22 Rubber and plastic products		-0.69***	-2.72***
23 Other non-metallic mineral products		-0.37***	0.77***
24 Basic metals		-0.35***	0.88***
25 Fabricated metal products, except machinery and equipment		-0.16***	-6.82***
26 Computer, electronic and optical products		-0.28***	-0.07***
27 Electrical equipment		-0.36***	-0.75***
28 Machinery and equipment		-0.43***	-2.23***
29 Motor vehicles, trailers and semi-trailers		-0.33***	-0.35***
30 Other transport equipment		-0.31***	-0.50***
Constant	-0.02***	-0.02***	-0.02***
Observations	10,670	10,670	10,670

Obs.: (1) Year fixed effects was employed in all estimates; (2) * significant at 1%, ** significant at 5% and *** significant at 1%; (3) robust errors clustered by countries (not reported)

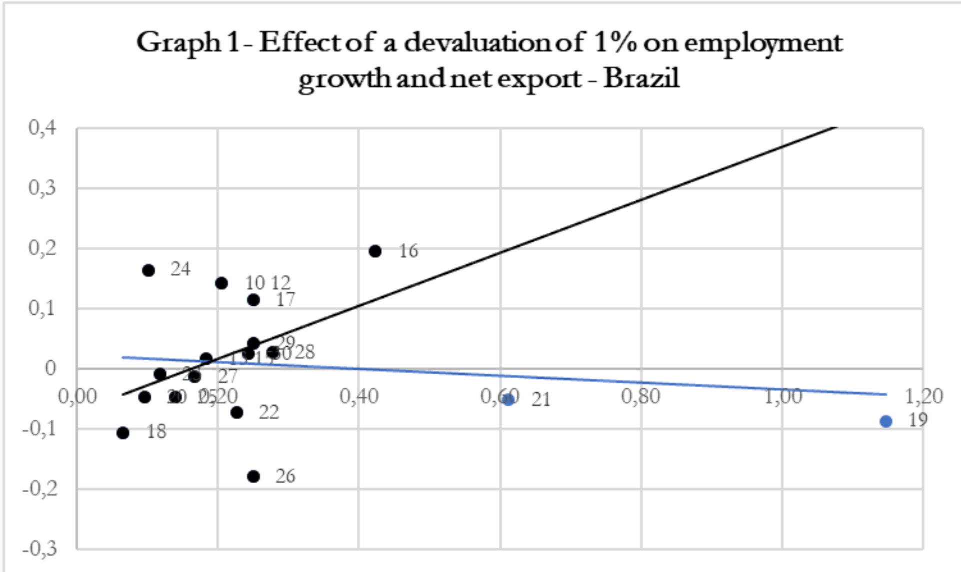
Table 4.B 14 - Exchange Rate and Heterogenous Effects on Manufacturing Sectors in Mexico: A devaluation of 1%

	Equation (11.1)	Equation (11.2) [a]														
		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
10-12 Food products, beverages and tobacco products	0.38	0.31	0.33	0.31	0.32	0.34	0.31	0.31	0.34	0.45	0.3	0.34	0.42	0.37	0.34	0.29
13-15 Textiles, wearing apparel and leather products	0.37	0.41	0.42	0.37	0.35	0.33	0.24	0.2	0.18	0.2	0.2	0.17	0.17	0.26	0.23	0.21
16 Wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	0.60	0.57	0.6	0.63	0.61	0.61	0.56	0.58	0.6	0.6	0.5	0.51	0.55	0.48	0.49	0.48
17 Paper and paper products	0.20	0.23	0.33	0.08	0.16	0.29	0.09	-0.08	-0.23	0	0.42	0.07	0.13	0.34	0.61	0.49
18 Printing and reproduction of recorded media	0.44	0.47	0.48	0.42	0.43	0.45	0.41	0.43	0.48	0.49	0.46	0.52	0.54	0.53	0.51	0.46
19 Coke and refined petroleum products	0.12	0.19	0.2	0.2	0.21	0.21	0.2	0.2	0.18	0.17	0.16	0.17	0.16	0.15	0.15	0.14
20 Chemicals and chemical products	0.03	0.04	0.03	0.03	0.04	0.04	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05
21 Basic pharmaceutical products and	0.22	0.25	0.23	0.23	0.24	0.26	0.28	0.26	0.26	0.23	0.15	0.27	0.3	0.29	0.26	0.24

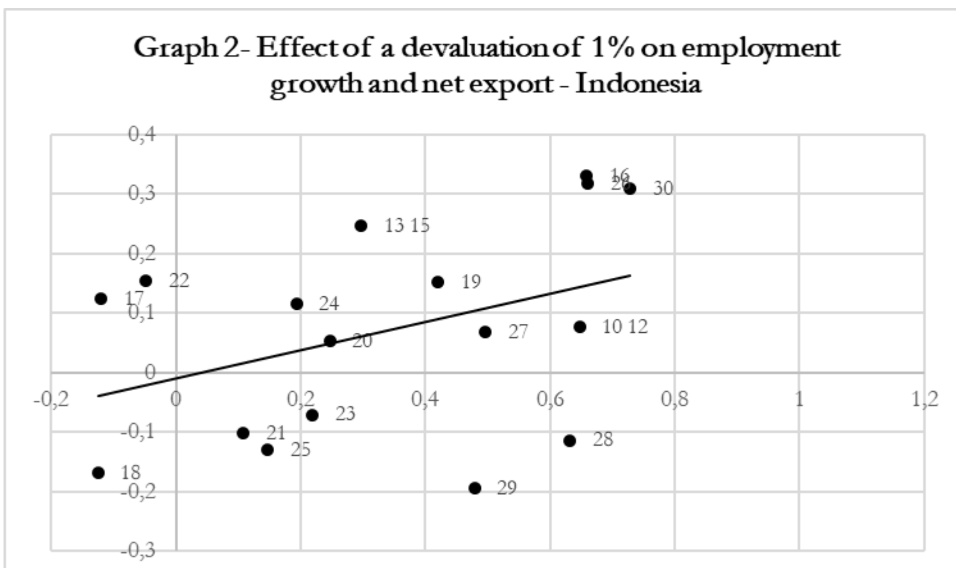
pharmaceutical preparations																
22 Rubber and plastic products	0.49	0.55	0.56	0.52	0.47	0.57	0.61	0.45	0.38	0.42	0.47	0.49	0.57	0.68	0.74	0.67
23 Other non-metallic mineral products	0.17	0.13	0.14	0.15	0.17	0.17	0.17	0.16	0.14	0.19	0.16	0.15	0.18	0.14	0.11	0.09
24 Basic metals	0.15	0.11	0.11	0.12	0.11	0.12	0.12	0.13	0.14	0.2	0.14	0.16	0.17	0.16	0.14	0.12
25 Fabricated metal products, except machinery and equipment	-0.04	0.49	0.73	0.54	0.11	-0.07	-0.04	-0.12	-0.26	-0.36	0.11	-0.21	-0.5	-0.25	-0.2	-0.12
26 Computer, electronic and optical products	0.08	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
27 Electrical equipment	0.16	0.05	0.08	0.07	0.07	0.07	0.08	0.08	0.07	0.09	0.12	0.11	0.11	0.17	0.19	0.17
28 Machinery and equipment	0.23	0.1	0.17	0.18	0.2	0.25	0.23	0.23	0.25	0.34	0.4	0.37	0.29	0.35	0.4	0.38
29 Motor vehicles, trailers and semi-trailers	0.13	0.11	0.12	0.11	0.13	0.16	0.14	0.13	0.13	0.14	0.13	0.14	0.14	0.15	0.16	0.15
30 Other transport equipment	0.11	0.09	0.13	0.12	0.11	0.12	0.11	0.13	0.13	0.21	0.28	0.23	0.2	0.18	0.2	0.19

Notes: [a] calculated using yearly database on export share of revenues and import share of inputs

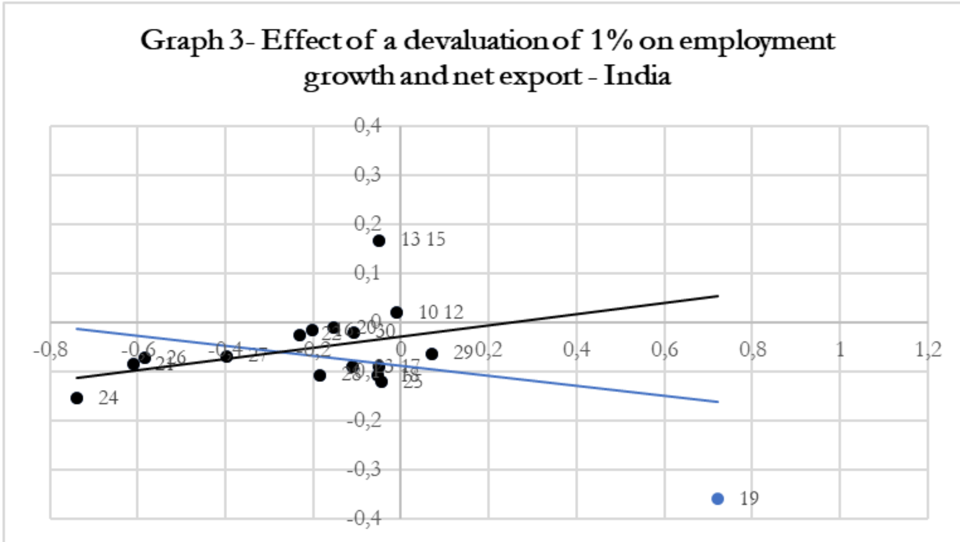
Graph 4.B 1 - Effect of a devaluation of 1% on employment growth and net export - Brazil



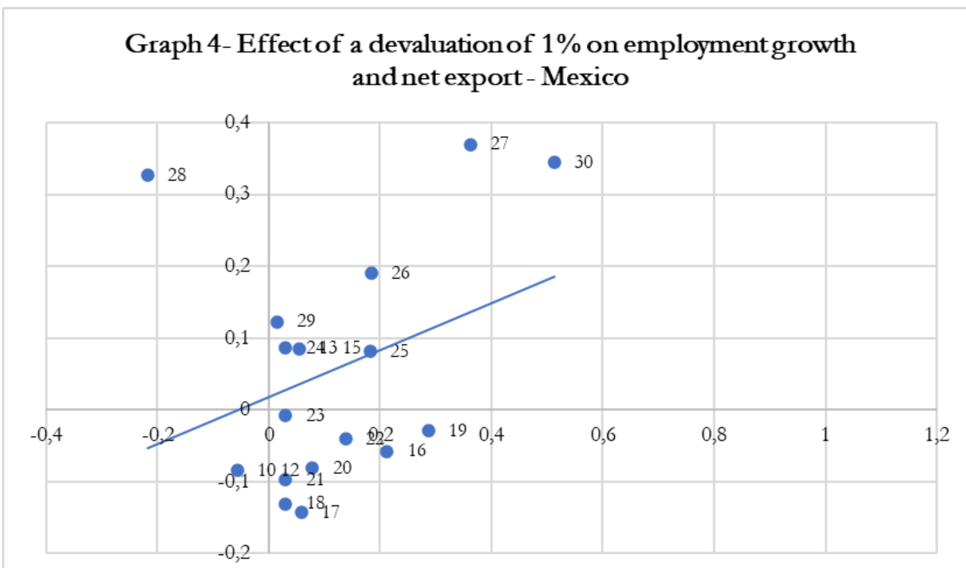
Graph 4.B 2 - Effect of a devaluation of 1% on employment growth and net export - Indonesia



Graph 4.B 3 - Effect of a devaluation of 1% on employment growth and net export - India



Graph 4.B 4 - Effect of a devaluation of 1% on employment growth and net export - Mexico



Graph 4.B 5 - Effect of a devaluation of 1% on employment growth and net export - Korea

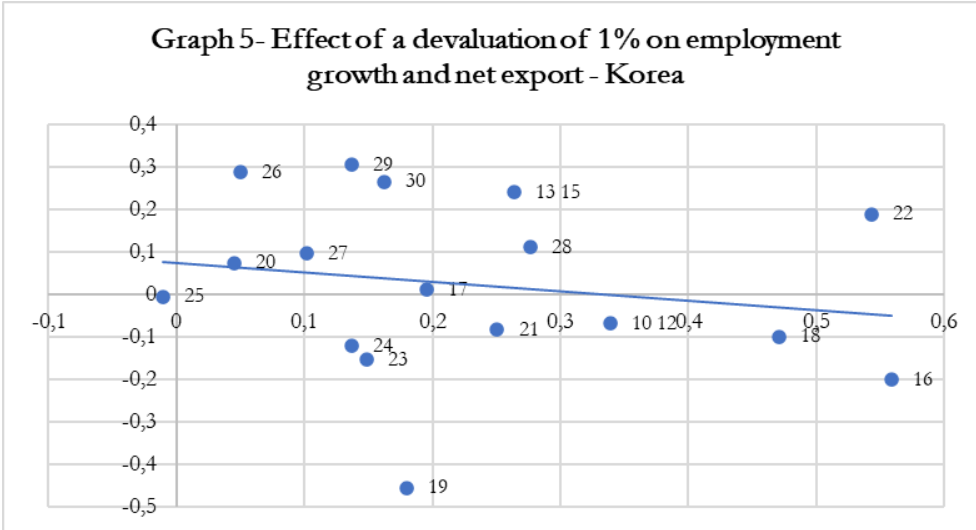


Table 4.B 15 - Exchange Rate and Heterogenous Effects on Manufacturing Sectors by Technological Regime

	Equation (12) *High sectors*	Final effect of a devaluation of 1%	Equation (13) *Low sectors*	Final effect of a devaluation of 1%
Mis_{cepii}	-0.09***		-0.09***	
Mis_{cepii} x country:				
Brazil	-0.21***		-0.16***	
Indonesia	-0.43***		-0.47***	
India	0.41***		0.01	
Mexico	0.07**		-0.10***	
Korea	-0.14***		-0.04	
Mis_{cepii} x country x dummy for Regime of Technological Regime:				
Brazil	0.05***	0.25%	-0.05***	0.30%
Indonesia	-0.04***	0.56%	0.04***	0.52%
India	-0.39***	0.07%	0.39***	-0.30%
Mexico	-0.17***	0.19%	0.17***	0.02%
Korea	0.09***	0.14%	-0.09***	0.26%
Constant	-0.02***		-0.02***	
Observations	10,670		10,670	

Obs.: (1) Year fixed effects was employed in all estimates; (2) * significant at 1%, ** significant at 5% and *** significant at 1%; (3) robust errors clustered by countries (not reported)

Table 4.B 16 - Exchange Rate, Labor Costs and Manufacturing Sectors

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Mis_{cepii}	-0.02	-0.04	-0.07	-0.07			
Mis_{cepii} x wage costs	-0.53**	-0.52**	-0.51**	-0.51**	-0.69***		
Mis_{cepii} x export		0.03		-0.01	-0.02		
Mis_{cepii} x import			0.10	0.12	0.05		
Mis_{cepii} x wage costs x exports						-1.03***	
Mis_{cepii} x wage costs x net exports							-1.07***
Constant	-0.01***	-0.01***	-0.01***	-0.01***	-0.01***	-0.01**	-0.01**
Obs.	10,670	10,670	10,670	10,670	10,670	10,670	10,670

Obs.: (1) Standard Errors adjusted for clusters of countries; (2) liquid export is the difference between export and import; (3) Year fixed effects was employed in all estimates

Table 4.B 17 - Exchange Rate, Wage-costs and Heterogenous Effects on Manufacturing Sectors by Technological Regime

	Equation (14.1)	Equation (14.2)	Equation (14.3)
Mis_{cepii}	0.008	0.01	0.01
Mis_{cepii} x wage-costs	-0.59***	-0.61**	-0.61***
Mis_{cepii} x country x wage-costs:			
Brazil	-0.93***	-0.69***	-1.52***
Indonesia	-3.58***	-3.42***	-3.86***
India	3.41***	3.44***	3.32***
Mexico	-0.19	0.22	-1.19***
Korea	-0.45***	-0.39***	-0.83**
Mis_{cepii} x country x wage-costs x dummy for Regime of Technological Regime:			
Brazil		-0.83***	0.83***
Indonesia		-0.44***	0.44***
India		-0.11	0.11
Mexico		-1.42	1.42***
Korea		-0.44***	0.44*
Constant	-0.01**	-0.01**	-0.01**
Observations	10,670	10,670	10,670

Obs.: (1) Year fixed effects was employed in all estimates; (2) * significant at 1%, ** significant at 5% and *** significant at 1%; (3) robust errors clustered by countries (not reported)

FIFTH ESSAY - Exchange Rate and Prices: An Extended Kaleckian Approach for Brazilian Manufacturing Sectors (2010-2019)

Abstract

The objective of this article is twofold. The first goal is to comprehend the effect of exchange rate on prices using the Kaleckian approach. The study aims at understanding the determinants of exchange rate pass-through into prices and the conditions required for controlled inflation within an economy under a regime of exchange rate for development. The basic model showed that the greater the share of imported inputs in costs more powerful is the pass-through. Considering inflation as a real phenomenon derived from social conflict, the theoretical model indicated that the magnitude of salaries in costs potentializes the effects of wage changes on prices via the exchange rate pass-through. Thus, the exchange rate pass-through of sectors with a small (great) share of salaries in costs is less (more) sensitive to salary changes. The basic Kaleckian model was extended to endogenize the pass-through in relation to the effects of a regime of exchange rate for development in markup rate and in the economy's structural composition. The industrial development induced by the regime of exchange rate for development (by internalizing the production of inputs used in manufacturing) reduces the import of inputs leading to the declining of pass-through. Plus, simulations displayed that pass-through is stronger (weaker) and more (less) sensitive to changes in markup rate and in wage policy for sectors under a regime of sluggish (more intense) technological progress. The second goal of the article is to provide time-series evidence about the exchange rate pass-through manufacturing sectors' prices for the Brazilian economy over the period from 2010 until 2019. Empirical results deliver evidence that pass-through is partial and varies across sectors. The study reveals that sectoral differences of pass-through are associated with the markup rate, the degree of outward orientation, the competition between firms, and the share of imported inputs of each sector.

Keywords: Kaleckian Approach for Pricing; Exchange Rate Pass-Through; Brazilian Economy; Manufacturing Sectors.

1- Introduction

Many authors stressed the importance of the exchange rate in promoting economic growth. Pursuing a devalued exchange rate potentializes the fundamentals of long-run growth (education, saving/investment, good institutions, technological innovation etc.), but it does not substitute its importance (Eichengreen, 2008). Devaluations of the exchange rate act as a second-best mechanism to foster growth (Rodrik, 2008).

There exist many transmission channels that justify the positive effects of a weak national currency on growth. Exchange rate devaluations make the tradable goods cheaper in the international currency, which expands exports and generates more rapid growth (Rodrik, 2008). A weak national currency enhances profitability and enlarges internal funds to firms finance new investments, encouraging production and employment (Frenkel and Ros, 2006). Such an effect is reinforced by smaller real wages sparked by higher domestic prices. Exchange rate devaluations generate inflation because firms increase their markup to benefit from higher competitiveness in relation to foreign goods (Blecker, 1989) and because firms increase their prices to transfer the more significant costs associated with imported inputs. A regime of exchange rate for development drives the long-run growth by influencing the composition of national income towards saving/investment and exports, and the productive structure towards manufacturing and sectors more complex.

The other part of the story is that the exchange rate, as a relative price, affects the domestic prices: devaluations make domestic prices more expensive and international prices cheaper. However, strong devaluations may corrode the gains of competitiveness of national goods in international markets: by increasing the costs with imported inputs or due to social conflict between workers (real wage) and entrepreneurs (markup rate). Considering inflation as a real phenomenon resulted from social conflict, a certain inflationary acceleration within an economy under an exchange rate regime for development is inescapable. Devaluations of exchange rate have a distributive effect in favor of firms (markup rate) as real wages are eroded. However, if neither workers nor firms accept a smaller real income, the regime of exchange rate for development may engender an inflationary spiral, and the increasing inflation worsens the competitiveness of national goods, weakening the effects of exchange rate on growth.

The regime of exchange rate effectiveness for development, by promoting exports and growth, depends on the exchange rate pass-through into prices. The smaller the effect of the exchange rate on prices greater the gain of competitiveness; thus, the economy tends to grow more rapidly.[62] Put differently, the exchange rate is crucial in determining the international competitiveness of national goods. However, the exchange rate's devaluations change the income distribution between workers and firms, strengthening the social conflict around real income. A possible consequence is an accelerating inflation as neither workers nor firms may not be willing to accommodate the costs of a weak national currency, which reduces the effects on growth. The inflationary effects of exchange rate devaluations should be the tinier as possible to make feasible and potentialize the export-led growth strategy. This story suggests that the effectiveness of the regime of exchange rate for development requires that workers accept smaller real wages, in the short-run, in exchange for possible higher real wages in the long-run; it is a tradeoff with distributive effects in the present and possible gains in future (Guzman *et al*, 2018).

It turns out that the advocates of regime of the exchange rate for the development focus on studying the association between exchange rate and long-run growth. Little attention is paid to understand the effects of exchange rate on prices *pari passu* the adoption a strategy for development based on a weak national currency. This paper aims to fill this gap in the literature. The first goal is to understand the effect of devaluations of exchange rates on prices using the cost-push approach provided by Kalecki (1956). In particular, the objective is to comprehend the determinants of exchange rate pass-through on prices and the required conditions for a controlled/stable inflation within an economy under regime of exchange rate for development. An extended version of the Kaleckian approach is developed endogenizing the distributive effects of exchange rate devaluations and productive structure changes.

In other respects, literature points out that the adjustment of prices to exchange rate movements is incomplete and varies across countries, periods; moreover, it is associated with many macro and microeconomic aspects (Campa and Goldberg, 2002). Exchange rate pass-through is associated with industry characteristics such as product substitutability, the number of domestic and foreign firms, and market structure (Dornbusch, 1987). It is supposed that each industry has a specific dynamic of price adjustment after movements in the exchange rate (Dornbusch, 1987). The incomplete exchange rate pass-through also occurs because export

[62] This is an alternative vision to the Purchasing Power Parity according to which exchange rate equilibrates the divergence between foreign and national prices and changes in domestic prices are a monetary phenomenon (exchange rate does not influence prices). Consequently, there is no room for debate on a growth strategy based on a weak national currency. Still, there is much evidence in the literature that indicates that: (i) the exchange rate is not a simple outcome from an equilibrium between national and foreign prices and (ii) national prices are affected by the exchange rate.

firms absorb exchange rate devaluations by raising the prices. (Krugman, 1987). Prices of exporters do not follow *pari passu* changes in exchange rate because firms increase markup by taking benefits from market power and pricing goods discriminated in accordance with characteristics of the end market (Krugman, 1987). Arestis and Milberg (1993), in turn, argue that firms pass, partially, increases in costs due to exchange rate devaluations because of the degree of competition within the industry. Hence, a lower markup rate absorbs the increased costs (Arestis and Milberg, 1993). The second goal of this article is to provide time-series evidence on exchange rate pass-through into the prices of 23 manufacturing sectors of the Brazilian economy over the period from 2010 until 2019 and explaining the results in light of these approaches.

The article consists of nine parts. Section 2 discusses the Kaleckian approach for determining industrial prices and the role played by the exchange rate. An extended model is developed in Section 3. Section 4 introduces the structuralist notion of the neutral exchange rate in Kaleckian approach. Section 5 delivers numerical simulations showing the dynamic of exchange rate pass-through on prices considering the technological regime, industrial policy, and social conflict. Section 6 discusses the empirical strategy and database employed in estimates. Section 7 presents the estimates performed by the Generalized Method of Moments, while Section 8 presents the estimates performed by Vector Autoregressive models. Section 9 associates the empirical results with stylized facts of the Brazilian economy. Lastly, the concluding remarks end the article with the main conclusions derived from the theoretical model and empirical estimates.

2- The Kaleckian Approach to Pricing

A pricing theory describes the behavior of agents in determining prices; the post-Keynesian theory is essentially a cost-plus pricing framework (Lavoie, 2014). The Kaleckian approach is a branching of this perspective as it prescribes a cost-oriented theory for the pricing setting of firms.

Kalecki (1956) has drawn a distinction between two kinds of prices. The prices of primary commodities are demand-determined because supply is given and constant in the short-run (Kalecki, 1956). Consequently, increases in demand greater than supply lead to higher prices, and the market-clearing mechanisms are valid to explain it. In contrast, the prices of manufactured goods are cost-determined (Kalecki, 1956). The Kaleckian approach's *rationale* is that industrial firms operate below full capacity, keeping a certain level of idle capacity installed. Supply is elastic, and demand pressures do not lead to higher prices because firms fill the idle capacity installed (Kalecki, 1956). Nonetheless, demand pressures may increase manufacturing prices, but such influence occurs by means of rising input costs or when there is no idle capacity (Kalecki, 1956).

The Kaleckian approach explains the industrial pricing taking costs as the main determining component. Kalecki (1956) states that firms set prices applying a markup rate on average variable costs (inputs and salaries), which is represented as:

$$P_{t,s} = C_{t-1,s}e^{\mu t} \tag{1}$$

where the subscripts *t* and *s* stand for time and sector, *P* represents price and *C* the average variable costs. Kalecki (1956) assumes that firms operate under non-competitive markets; hence markup rate μ is positive. The variable *C* is formalized in the following way:

$$C_{t,s} = N_t^{\psi} + W_t^{1-\psi} \tag{2}$$

where the parameter ψ is the share of inputs *N* in costs and (1- ψ) represents the share of salaries *W* in costs, ψ ranges from 0 to 1. The averaged costs with inputs are represented as:

$$N_{t,s} = (E_t M_{t,s})^{\theta} Z_{t,s}^{1-\theta} \tag{3}$$

where θ is the share of inputs that comes from abroad (ranging from 0 to 1), and (1-θ) is the share of inputs in national currency, *M* represents the imported costs in foreign currency, *Z* the costs in national currency, and *E* the real exchange rate that denotes the price of domestic currency in foreign currency (increases/decreases represent devaluations/overvaluations of national currency). Putting (3) into (2) leads to:

$$C_{t,s} = ((E_t M_{t,s})^{\theta} Z_{t,s}^{1-\theta})^{\psi} + W_t^{1-\psi} \tag{2.1}$$

Introducing (2.1) into (1) leads to:

$$P_{t,s} = [((E_{t-1} M_{t-1,s})^{\theta} Z_{t-1,s}^{1-\theta})^{\psi} + W_{t-1}^{(1-\psi)}]e^{\mu t} \tag{1.1}$$

Taking the first difference with respect to time of equation (1.1) in logarithmic form:

$$p_{t,s} = \mu + [\psi\theta(e_{t-1} + m_{t-1,s}) + \psi(1-\theta)z_{t-1,s} + (1-\psi)w_{t-1,s}] \tag{4}$$

where the lowercase letters denote variables in growth rate. Assuming that *m* and *z* are null (for the sake of simplicity):

$$p_{t,s} = \mu + [\psi\theta(e_{t-1}) + (1-\psi)\, w_{t-1,s}] \tag{5}$$

Equation (5) means that inflation is determined by markup rate, exchange rate and nominal wage growth. Increases in markup rate and in nominal wages rise the prices, just like a devalued exchange rate, everything else remaining equal; however, such an effect depends on the magnitude of the parameters ψ and θ. The greater the share of inputs in all costs and the share of imported inputs in all input costs, the stronger is the effects of devaluations of exchange rate in prices. Similarly, the greater the share of labor costs in all costs, the stronger the effects of readjustments in nominal wages in prices.

In accordance with equation (5), the necessary condition for stable inflation over time, combined with devaluations of exchange rate, is that workers or entrepreneurs accommodate a weak national currency's costs via lower real wages/markup rate. Given the parameters ψ and θ, the exchange rate pass-through on prices is given by $\psi\theta$, and this is the magnitude that markup rate or real wage should decrease to reach a stable inflation after a devaluation of 1%. Therefore, distributive effects are inevitable for a stable inflation in an economy under exchange regime for development, unless some acceleration in the price change's pace may be acceptable.

3- Extending the Kaleckian Approach

This section extends the basic Kaleckian model presented earlier, making the markup rate endogenous to the exchange rate and considering the effects of the exchange rate regime for development on the economy's structural composition.

Kalecki (1956) indicates that the markup rate is associated with each industry's idiosyncrasies, as industrial concentration, fixed costs, labor unions, and costs. Blecker (1989) argues that, within an open economy, the exchange rate influences the markup rate. Devaluations expand the markup rate because firms increase domestic prices to benefit from higher competitiveness in relation to foreign goods (Blecker, 1989). Nevertheless, when the real exchange rate appreciates, firms reduce markups to offset the loss of competitiveness (Blecker, 1989). Blecker (1989) formalizes the influence of exchange rate on markup rate as:

$$\mu = \mu^d + \eta e_{t-1} \tag{6}$$

where μ^d represents the desired markup rate and η is the price-cost margin elasticity to real exchange rate, which is assumed to be positive. Equation (6) says that increases in desired markup rate and/or in exchange rate lead to a higher markup rate. Introducing (6) into (1.1):

$$P_{t,s} = [((E_{t-1}M_{t-1,s})^{\theta}Z_{t-1,s}^{1-\theta})^{\psi} + W_{t-1}^{(1-\psi)}]e^{(\mu d + \eta e)t} \tag{7}$$

Taking the first difference with respect time of equation (7) in logarithmic form:

$$p_{t,s} = \mu^d + \eta e_{t-1} + [\psi\theta(e_{t-1} + m_{t-1,s}) + \psi(1-\theta)z_{t-1,s} + (1-\psi)w_{t-1,s}] \quad (8)$$

This is the equation that expresses the price changes of manufacturing firms in an open economy according to the Kaleckian approach considering the markup rate endogenous to the exchange rate. In accordance with equation (8), the necessary condition for stable inflation combined with devaluations of the exchange rate is that workers accommodate the costs of a weak national currency via lower real wages. The expanded markup rate is a further source of inflationary acceleration, in addition to the costs due to the devaluation. Given the parameters η and θ, the exchange rate pass-through on prices is given by the sum of η and $\psi\theta$. A devalued exchange rate of 1% increases the prices by (η + $\psi\theta$) %. As the markup rate depends on the exchange rate, a weak national currency increases the markup rate in η% and (given μ^d, η and θ), then, real wages should decrease (η + $\psi\theta$) % to reach stable inflation after a devaluation of 1%. In this case, the real wage squeeze is inevitable for stable inflation in an economy under an exchange regime for development, unless some acceleration in the pace of price changes may be acceptable. That is, the growth rate of nominal wages should be smaller than the change in prices for a stable inflation.

On the other side, many authors stressed the influence of the exchange rate on the economy's structural composition. A weak national currency is associated with manufacturing development or a structural change towards a more diversified productive structure. A devalued currency works as a uniform subside (tariff) on exports (imports), benefiting the national manufacturing sectors (Frenkel and Ros, 2006). Devaluations of exchange rate influence profitability because it increases exports and reduces salary costs due to the smaller real wages. Moreover, such expanded profitability encourages production and investment (Frenkel and Ros, 2006).

The argument pursued here is that economies with an industrialized productive structure are less dependent on imports because the domestic production internalizes manufacturing inputs. Thus, the parameter θ is endogenous to structural change (the degree of complexity of productive structure) and devaluations of exchange rate reduce the magnitude of θ:

$$\theta_t = \theta_0 e^{-\sigma IND t} \quad (9)$$

where θ_0 is the initial value of θ, *IND* represents structural change[63], σ is a negative parameter that captures industrial development's influence in the share of imported inputs. Equation (9) means that structural change toward manufacturing sectors lowers the imports of inputs. Consequently, the parameter θ decreases as the industrializing process is carried out.

In turn, the influence of the exchange rate on the sectoral composition of economy (*IND*) is expressed as a positive and linear function of *e*:

$$IND_t = \delta + \lambda(e_{t-1}) \tag{10}$$

the parameter λ is the sensitivity of structural change towards manufacturing sectors to exchange rate; the constant δ captures other elements that influence structural change (which is assumed to be positive). Equation (10) says that devaluations (overvaluations) of exchange rate promote structural change within the economy towards manufacturing (non-manufacturing) sectors. Introducing equation (10) into (9):

$$\theta_t = \theta_0 e^{-\sigma(\delta + \lambda(e))t} \tag{11}$$

This equation means that exchange rate devaluations reduce the share of imported inputs as it induces a structural change towards manufacturing and internalizes the production of inputs.

Introducing equation (11) into (8) and assuming that *m* and *z* are null leads to:

$$p_{t,s} = \mu^d + (\eta + \psi\theta_0 e^{-\sigma(\delta + \lambda(e))t})\, e_{t-1} + (1-\psi)w_{t-1,s} \tag{12}$$

the novelty of equation (12) is that the markup rate and the parameter θ_t are not constant over time, as it used to be before. The exchange rate influences both vectors: devaluations increase the markup rate and reduce the parameter θ_t.

Equation (12) means that the structural change induced by devaluations of the exchange rate may reinforce/mitigate the distributive the effects of exchange rate regime for development. The exchange rate pass-through on prices is still given by $(\eta + \psi\theta)$. However, the parameter θ is not constant over time anymore. As the exchange rate regime for development induces industrialization, the required imported inputs lower. As a result, the parameter θ_t becomes smaller. This opens room for two possibilities in the context of social conflict and stable inflation over time. Firstly, the reduced costs induced by devaluations are fulfilled by a greater markup rate. Entrepreneurs embrace by themselves the benefits of a productive structure more diversified. This way, structural change potentializes the boosting effect of devaluations over the markup rate. The second possibility is that structural change mitigates the redistributive effects

63 The growth rate of the industrial share of GDP, within employment, economic complexity, etc.

of exchange rate regime for development on workers. The fruits of a modern productive structure are distributed between entrepreneurs and workers. The falling trend of the parameter θ induced by the exchange rate regime for development allows that nominal wages increase at the same pace or more rapidly than prices without profit squeezing and with stable inflation over time.

4- Income Distribution and Neutral Inflation: the structuralist approach

The Latin American structuralists Noyola (1957), Sunkel (1958), and Furtado (2009) argue that inflation is a real phenomenon associated with social conflict. Inflation comes from the attempt to change the relative prices and defend the respective real income. The prices are readjusted to pass on the expanded costs due to higher wages or input costs (i.e., past inflation is passed on current prices) in order to keep the markup rate unchanged.

In this regard, devaluations of the exchange rate strengthen the social conflict around real income by creating misalignments of relative prices (i.e., national goods are cheaper in international markets to the detriment of higher prices in the national market). The smaller real wage induced by the exchange rate regime for development increases workers' claims for readjustments. As a result, the cost pressures due to readjustments of wages and the expanded costs caused by devaluations of exchange rate lead the firms to pass it on to prices. The bottom line is an inflationary process in which firms and workers defend the respective real income. Therefore, inflation results from the attempt of agents to neutralize the distributive effects of exchange rate devaluations. This is what Furtado (2009) calls neutral inflation.

Figure 5.1 summarizes the notion of neutral inflation in an economy under an exchange rate regime for development.

Figure 5. 1- Equilibrium, devaluations of the exchange rate, and neutral inflation

Economy in "equilibrium"
Entrepreneurs and workers are satisfied with real income

The first round of inflation: Exchange rate regime for development is adopted
A devalued exchange rate alters the equilibrium; Costs with imported inputs increase and firms increase the markup rate; Inflationary pressures are absorbed by workers (lower real wage) – inflation constant over time to assure the effectiveness of the exchange rate regime for development

The second round of inflation: Workers are unsatisfied with lower real wage
Readjustment in salaries (past inflation is passed on) and economy initially returns to initial equilibrium (entrepreneurs and workers are satisfied with real income)

The third round of inflation: Exchange rate regime for development is less effective in promoting export as inflation accelerates and competitiveness is corroded
Firms pass on the higher labor costs on prices. New devaluations of the nominal exchange rate are required to keep the real exchange devalued. The equilibrium is altered again; inflation is strengthened, and the inflationary process returns to the first round

Devaluations of exchange rate alter the economy's equilibrium by transferring income from workers to firms (higher markup rate). Inflation is the mechanism through which such income transfer occurs - assuming that the economy is initially under the equilibrium position (both entrepreneurs and workers are satisfied with income distribution). The adoption of an exchange rate regime for development *pari-passu* with stable inflation over time leads to the real wage squeeze, as equation (12) has shown ("first round of inflation"). It turns out, though, that workers will not accept a smaller real wage for a long time. Labor unions will claim readjustments in wages to restore the initial equilibrium in terms of the income distribution ("second round of inflation"). In turn, firms will pass on the higher labor costs on prices to defend the markup rate. As expected, the acceleration in the pace of changes in prices reduces the effectiveness of the exchange rate regime for development in promoting exports because inflation corrodes the international competitiveness of national goods. Therefore, a more substantial devaluation in the nominal exchange rate is required to keep the real exchange rate devalued, to the restored equilibrium be altered again ("third round of inflation"). As a result, inflation strengthens, as long the social classes attempt to restore the initial equilibrium (neutral inflation), *pari-passu* the adoption of exchange rate regime for development.

The inflationary dynamic of an economy under an exchange rate regime for development, associated with the Furtadian notion of neutral inflation, means that all agents reproduce past inflation (costs) in the current prices ($p_{t-1,s} = w_t = p_t$). That is, firms not only pass on the expanded costs due to exchange rate devaluations on prices but increase the markup rate as the real exchange rate remains devalued (equation 12). In turn, workers claim that the real wage grows at same pace that prices are determined by firms (constant real wage). Therefore, assuming that $p_{t-1,s} = w_t = p_t$, equation (12) becomes:

$$p_t = \mu^d/\psi + [(\eta + \psi\theta_0 e^{-\sigma(\delta + \lambda(e))t})/\psi]\, e_{t-1} \quad (13)$$

Equation (13) represents the effects of exchange rate pass-through on prices considering the social conflict that produces neutral inflation. It indicates that the social conflict and a productive structure strongly dependent on imports potentialize the inflationary effects of devaluations; the higher the parameters μ^d, η, θ stronger the exchange rate pass-through on prices. It should be noticed that if the parameter ψ equals 1 (only inputs costs), the effect of 1% devalued exchange rate pass-through is ($\eta + \theta$) %. Nevertheless, if the parameter ψ equals 0 (only labor costs), the inflationary process tends to be explosive. However, it is likely that the parameter ψ ranges between 0 and 1. So, lower values for the parameter ψ (or greater values for (1- ψ), which means strong social conflict is more intense because labor represents a larger share of costs) intensify, the inflation associated with the exchange rate regime for development with no distributive effects.

Table 5.1 presents numerical simulations for equation (13) (neutral inflation) for a constant parameter θ. It assumes a real exchange rate devalued in 1%. While the baseline parameters are μ^d (2%), ψ (0.5), θ (0.5) and η (0.07). This configuration produces an inflation of 4.64% (column 1). Changing the parameters produce different results. By increasing the parameters μ^d or η, the stronger social conflict accelerates the neutral inflation, as indicated by columns (2) and (3). Therefore, higher μ^d or η stronger the inflationary process induced by a weak national currency.

Table 5. 1 – Numerical Simulations I: Neutral inflation and Exchange Rate Regime for Development

Parameter/ Simulations	(1)	(2)	(3)	(4)	(5)
e	1%	1%	1%	1%	1%
μ^d	2%	4%	2%	2%	2%
ψ	0.5	0.5	0.5	0.4	0.5
$(1-\psi)$	0.5	0.5	0.5	0.6	0.5
θ	0.5	0.5	0.5	0.5	0.75
η	0.07	0.07	0.14	0.07	0.07
Neutral inflation	4.64%	8.64%	4.78%	5.8%	4.89%

Numerical simulations provided by Table 5.1 indicate that smaller values for the parameter ψ (high labor costs, i.e., the social conflict is stronger (more substantial)) increase the inflation without distributive effects within an economy under an exchange rate regime for development. Conversely, in economies with greater values of ψ (small labor costs, i.e., the social conflict is weaker (more limited)), the inflationary effects of devaluations are relatively reduced. Plus, greater values for the parameter θ (strong dependence of imports) increase the neutral inflation induced by devaluations.

Numerical simulations are performed in what follows to illustrate the dynamic of exchange rate pass-through on prices according to equation (13) for an economy under the regime of exchange rate for development in which the structural change influences the parameter θ.

5- Simulations: Neutral Inflation and Exchange Rate Devaluations

Simulations developed in this section presume the existence of two sectors: one under a regime of faster technological progress and another one under a sluggish low intense. Following Marx (1967), the argument is that high labor costs increase firms' endeavors in promoting labor-saving technological progress. Higher the labor costs accelerate the pace of technological progress. As a result, firms with great efforts to enhance labor productivity incur a lower share of salaries in costs. The parameter $(1-\psi)$ tends to be lower for sectors under a regime of faster technological progress. Conversely, firms with feeble efforts to enhance labor productivity incur a high share of salaries in costs. Therefore, the parameter $(1-\psi)$ tends to be substantial for sectors under a regime of sluggish technological progress.

Table 5.2 presents the parameters of baseline simulations for sectors under the regime of the faster and slower pace of technological progress.

Table 5. 2 - Baseline Simulation

Parameter/ Sector	Technological Regime: *Slower pace*	Technological Regime: *Faster pace*
e	1	1
λ	0.1	0.1
δ	0.1	0.1
σ	-0.1	-0.1
θ_0	1	1
η	0.07	0.07
ψ	0.2	0.8
1-ψ	0.8	0.2

It assumes that the economy is under the regime of exchange rate for development. Simulations assume the national currency becomes 1% more devalued in relation to international currency in real terms (e = 1%;).[64] The parameters λ, δ, σ, η are taken as 0.1, 0.1, -0.1 and 0.07 for both sectors. Intuitively, increases of 1% in the real exchange rate increase by 0.01% the share of manufacturing in GDP. Likewise, increases of 1% in the share of manufacturing in GDP reduce the share of imported inputs in costs by 0.01%. The baseline simulations assume the extreme case in which full inputs are imported (θ_0=1) because it does not impose any values to θ_0. The model's dynamic suggests that θ falls as exchange rate devaluations induce structural change; thus that all possible values of θ appear in simulation. The difference for the sectors concerns the magnitude of ψ, which is 0.2 for sectors under a slower pace of technological progress and 0.8 for sectors under a more rapid technological progress pace. This captures the argument according to which the parameter (1-ψ) is associated with the pace of saving-labor technological progress.

5.1- Pass-through and Technological Regime: baseline simulations

Figure 5.2 presents the output for the dynamic of exchange rate pass-through over time for sectors under different technological regimes.

[64] This facilitates the interpretation according which exchange rate pass-through into prices is the response of prices change to an increase of 1% in exchange rate.

Figure 5. 2 - Baseline Simulations

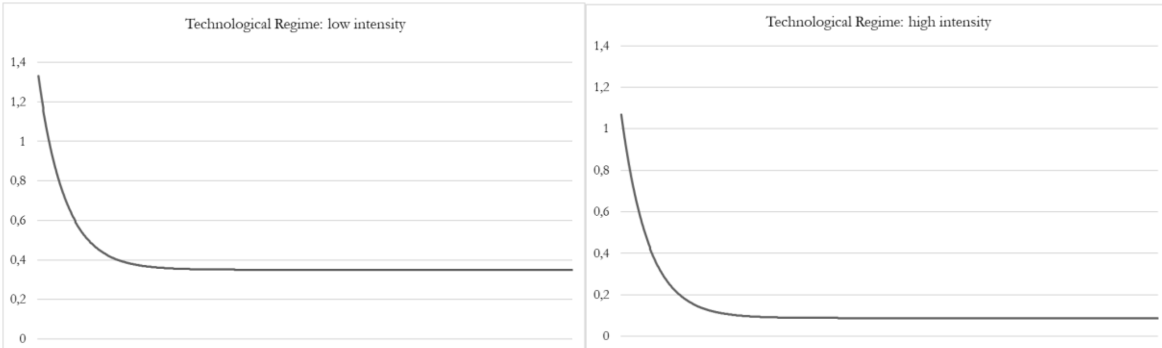


Figure 5.2 shows that changing the parameter ψ produces different results. Despite the similar dynamic over time (as expected), the initial and final values of exchange rate pass-through of sectors under a low intense regime of technological progress are greater than that for sectors more intense. When θ is 1 (first value), the exchange rate pass-through is 1.33 and 1.07, respectively. When θ is around 0, the exchange rate pass-through is respectively 0.35 and 0.08.

Baseline simulations suggest that the inflationary effects of exchange rate devaluations are stronger in economies where the sectors under the regime of slow pace of technological progress prevail. The argument is that labor costs predominate over input costs in these sectors. Consequently, the social conflict due to devaluations of the exchange rate is more noticeable. As equation (13) points, even though the "first round of inflation" is relatively weaker because the parameter ψ is smaller, the "second and third rounds of inflation" tend to be stronger since (1-ψ) is relatively greater. The reverse applies to sectors under the regime of faster pace of technological progress. The "first round of inflation" tends to be relatively stronger because the parameter ψ is greater. However, the "second and third rounds of inflation" tend to be weaker since (1-ψ) is relatively smaller. The social conflict between the markup rate and the real wage is discrete.

5.2- Pass-through and Industrial Policy

Figures 5.3 and 5.4 report the results of simulations by changing the parameters λ and σ. The results indicate that increases in the parameters λ or σ produce the same dynamic of exchange rate pass-through on prices over time: the declining trending of the parameter θ becomes faster and, consequently, the effects of exchange rate on prices tend to be reduced more rapidly over time, while exchange rate regime for development is adopted.

Figure 5. 3 - Changes in Industrial Policy I

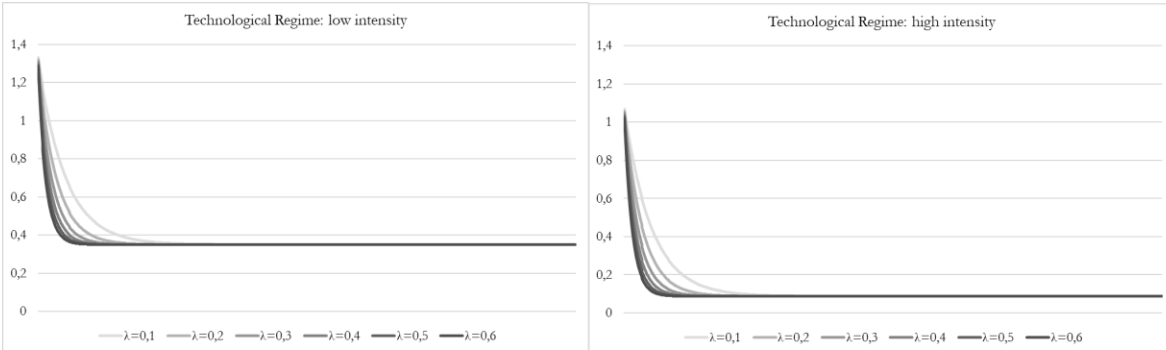
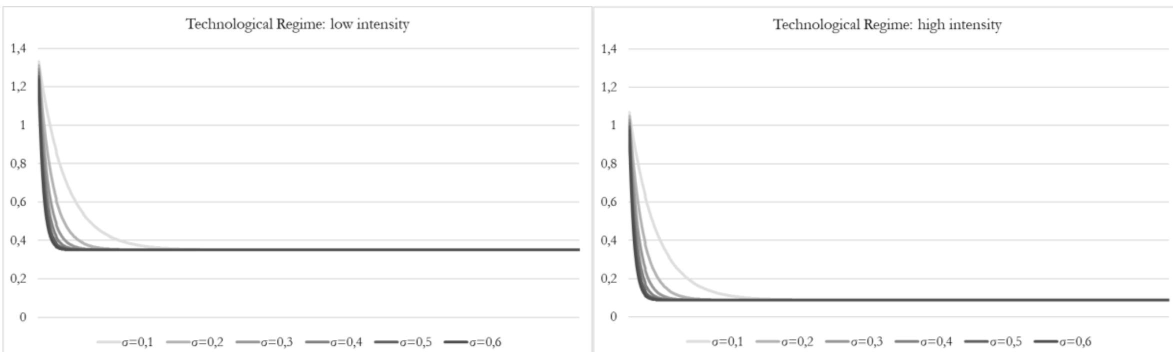


Figure 5. 4 - Changes in Industrial Policy II



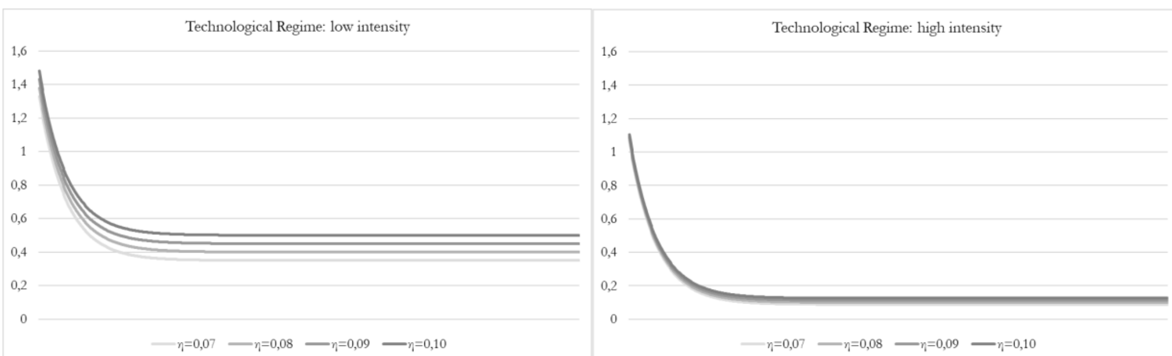
Simulations in Figures 5.3 and 5.4 evidence the importance in establish the regime of exchange rate for development *pari-passu* the adoption of industrial policies that increase the sensibility of structural change towards manufacturing sectors to devaluations in the exchange rate and the sensibility of imported inputs to industrial development, represented by λ and σ respectively. This is important to reduce the inflationary effects of a weak national currency over time or to alleviate the strengthening of social conflict due to the exchange rate devaluations.

An alternative argument is that the constant of equation (10) δ captures the influence of industrial policies (e.g., trade, fiscal and monetary policies, a national system of innovation, social capabilities, etc.) on manufacturing development. In this regard, a complementary industrial policy potentializes the industrialization induced by a devalued exchange rate, leading to a more rapid decline in the imported inputs employed in domestic production. As a consequence of that, the inflationary dynamic associated with devaluations in the exchange rate is alleviated. This leads to a moderated social conflict in terms of neutral inflation within an economy under the exchange rate regime for development.

5.3- Pass-through and Social Conflict: mark-up rate and wage-policy

Figure 5.5 reports the dynamic of exchange rate pass-through on prices over time for a stronger sensibility of markup rate to exchange rate. The results indicate that greater values for the parameter η increase the exchange rate pass-through on prices. When the parameter θ is 1 (first value), the exchange rate pass-through ranges from 1.33 and 1.48 for sectors under a regime of the sluggish pace of technological progress, and from 1.07 and 1.11 for sectors under a regime of the fast pace of technological regime as η increases. Analogously, when the parameter θ is 0 (final value), the exchange rate pass-through ranges from 0.35 and 0.50 for sectors under a regime of the sluggish pace of technological progress, and from 0.08 and 0.13 for sectors under a regime of the fast pace of technological regime as η increases.

Figure 5. 5 - Changes in Markup rate



In a nutshell, the numerical simulation provided by Figure 5.5 indicates that increases in the parameter η enlarger the exchange rate pass-through on prices. Furthermore, this effect is stronger (weaker) for economies in which sectors under a regime of the sluggish (faster) technological progress pace prevails.

On the other hand, the Furtadian notion of neutral inflation means that nominal wages are entirely readjusted, considering the past inflation (workers seek to obtain a constant real wage; $p_{t-1,s} = w_t$), which leads to the results of equation (13). It turns out that, however, the real wage may increase or decrease. That is, the growth rate of nominal wage may be greater or smaller than past inflation. This is modeled in the following way:

$$w_t = \varrho p_{t-1};\ \varrho \geq 0 \qquad (14)$$

A constant real wage requires that the parameter ϱ equals 1 (inflation is fully passed on nominal wages). Whilst a declining (growing) real wage requires that the parameter ϱ be smaller (greater) than 1. Therefore, the parameter ϱ represents the wage-policy in the determination of real wages.

Introducing equation (14) into (12) (and assuming that agents reproduce past inflation in current prices $p_{t-1,s} = w_t = p_t$):

$$p_t = [\mu^d/(1-(1-\psi)\,\varrho)] + [(\eta + \psi\theta_0 e^{-\sigma(\delta + \lambda(e))t})/(1-(1-\psi)\,\varrho)]\, e_{t-1} \qquad (15)$$

There exist three scenarios for equation (15) for an economy under a regime of exchange rate policy for development. First, no inflation is passed on nominal wages ($\varrho = 0$). The smaller real wages absorb the higher prices, and a devaluation of the exchange rate of 1% increases prices by ($\eta + \psi\theta$) %. Second, past inflation is fully passed on nominal wages ($\varrho = 1$). Neither firms nor workers absorb inflation through reducing real income (neutral inflation), and equation (15) equals (12) in a way that a devaluation of the exchange rate of 1% increases prices in $[(\eta + \psi\theta)/\psi]$ %. Third, past inflation is partially passed on nominal wages ($0<\varrho<1$). An increase of 1% in exchange rate increases inflation in $[(\eta + \psi\theta)/(1-(1-\psi)\,\varrho)]$ %. The parameter ϱ potentializes the inflationary effects of devaluations of the exchange rate (the "third round of inflation" becomes more robust).

Figure 5.6 shows the exchange pass-through over time for different wage-policies.

Figure 5. 6 - Changes in Wage-policy

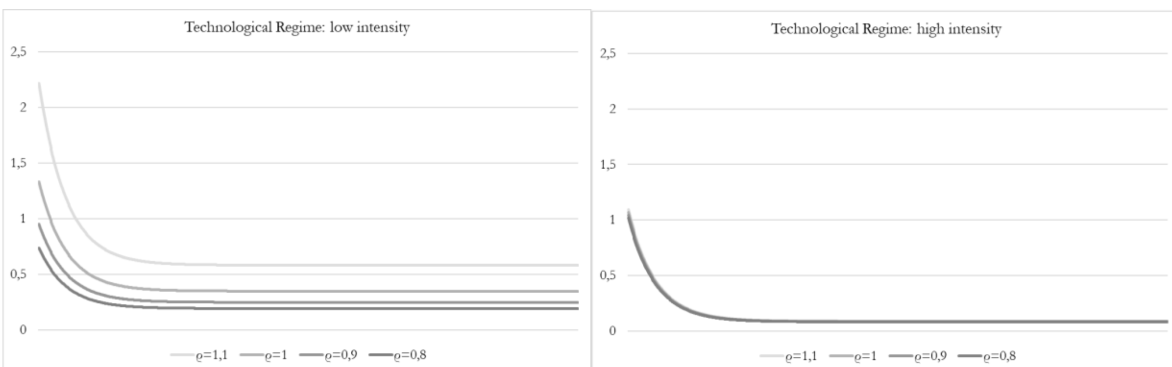


Figure 5.6 shows that the salary policy does not exert much influence on the exchange rate pass-through on prices of economies in which sectors under a regime of the faster pace of technological progress prevail. In contrast, salary policy changes dramatically the magnitude of the effect of exchange rate on prices of economies in which sectors under a regime of the sluggish pace of technological progress prevails. This is because the social conflict around real income is stronger in these economies as long salaries represent a larger share of costs. Besides, as the inflationary effects of a weak national currency are discussed in terms of neutral inflation (i.e., without distributive effects), changes in the parameter ϱ (such as in η) exert influence in inflation by means of strengthening the social conflict between firms (markup rate) and workers

(salaries), induced by devaluations of the exchange rate. Thus, the parameter ϱ potentializes the inflationary effects of devaluations of the exchange rate (the "second round of inflation" becomes stronger).

Interestingly, Figure 5.6 suggests that exchange rate devaluations have smaller effects in terms of strengthening the social conflict between firms and workers (and in inflation) of economies with modern productive structure. Real gains in wages can be combined with the adoption of exchange rate regime for development and a stable and low inflation in those economies. Such possibility arises from a productive structure more technological improved and a small using of labor as input in production.

The empirical estimates of exchange rate pass-through on prices of Brazilian manufacturing sectors are performed in what follows.

6- Econometric Estimates: empirical strategy and database

The empirical strategy consists of estimating the effects of the exchange rate on industry prices of 23 sectors of CNAE 2.0 (Standard Industrial Classification 2.0)[65] following two different procedures. Following Campa and Goldberg (2002) strategy:

$$p_{t,s} = \alpha + b_1 x_t + \beta_j e_{t-j} + \varepsilon_t \tag{14}$$

where the subscripts *t* and *s* stand for time and sector, *p* represents price variation of industry, *e* the exchange rate and *x* a vector of controls, *ε* is the error term. Campa and Goldberg (2002) introduced lagged exchange rate values in the right side of equation (14) to capture the gradual adjustment of prices to exchange rate. The short-run relationship between exchange rate and industrial prices is given by the estimated coefficient β_0, whereas the long-run relationship is given by the sum of the coefficients on the contemporaneous exchange rate and its lagged values $\sum_{t=0}^{t} \beta_{t-j}$ (Campa and Goldberg, 2002).[66]

Campa and Goldberg (2002) have estimated the equation (14) for 25 OECD countries using Ordinary Least Square (OLS) estimators controlling for energy costs and real GDP. The exchange rate is represented by the nominal exchange rate. Our estimates are performed using the Generalized Method of Moments (GMM) to address the endogeneity issues. Many non-controlled variables likely influence the exchange rate, leading to biased estimates. The GMM

[65] See Table 5.A 2 in appendix A.

[66] Using quarterly data, Campa and Goldberg (2002) introduced three lags of the exchange rate to capture the sluggish price adjustment to exchange rate over a year.

estimator solves this problem using lagged values of covariates as instruments, which are valid since the Hansen's (1982) test (test-J) does not reject the null hypothesis that instruments are exogenous. It is used a heteroskedasticity- and autocorrelation- consistent (HAC) estimators for the variance-covariance (Bartlett Kernel), being its lags chosen by the Newey-West method.

Two specifications of equation (14) were performed. As our data is monthly, the first specification employs only contemporaneous and eleven lags of the exchange rate. No other explanatory variable was considered to minimize collinearity issues and to ensure that freedom degrees are scarce. It is important to notice that the degrees of freedom of test-J are the difference between moments and estimated parameters. Many instruments reduce the accuracy of test-J. Two sets of instruments are used with 4 and 5 degrees of freedom:

Instruments 1: constant, (lags: e_{t-12} until e_{t-27}) - 4 degrees of freedom

Instruments 2: constant, (lags: e_{t-12} until e_{t-28}) - 5 degrees of freedom

The second specification of equation (14) introduces the first lag of inflation to capture inertial inflation, sectoral production q to represent demand pressures, and oil price o as a measure of imported costs in addition to the exchange rate. Contemporaneous and lagged values of these variables were considered, using three lags of each variable as instruments as follow:

Instruments: constant, ($p_{t-2}, p_{t-3}, p_{t-4}$; $e_{t-2}, e_{t-3}, e_{t-4}$; $q_{t-2}, q_{t-3}, q_{t-4}$; $o_{t-2}, o_{t-3}, o_{t-4}$) - 5 degrees of freedom

This specification does not estimate the long-run pass-through of exchange rate into sectoral prices (over a year); it captures the short-run effect of the exchange rate in industrial prices (at least until the preceding month), controlling for other variables.

The second strategy consists of estimating a Vector Autoregressive (VAR) to explore the results of Impulse Response Function (IRF), seeking to investigate how sectoral price reacts after a positive shock in the exchange rate (of one standard deviation). The long-run pass-through is calculated as the accumulated change of sectoral inflation after a shock of one standard deviation in the exchange rate (Cumulative Impulse Response Function – CIRF). Another result delivered by VAR estimates is the Forecast-Error Variance Decomposition (FEVD) that allows accounting what percentage of inflation's forecasted variance is due to exchange rate movements.

Following McCarthy (2007), Belaisch (2003), Nogueira, Mori and Marçal (2013), and Correa (2017) a further estimate of pass-through is calculated in which the cumulative change of inflation (after a shock of one standard deviation in exchange rate) is standardized with respect to the cumulative change of the exchange rate after such shock. In this fashion, the pass-through is inflation response due to an increase of 1% in the exchange rate (devaluation).

The VAR model is estimated using three endogenous variables (inflation, production, and exchange rate) and one exogenous variable (oil price). Small lag lengths generate a model misspecified, whereas long lag lengths produce inefficient estimates (Enders, 2003). The appropriated lag length was chosen by analyzing the usual information criterion of Akaike (AIC), Hannan-Quinn (HQIC), and Schwarz (SBIC). However, it should be noticed that the lag lengths suggested by the information criterion is not always enough to vanish residual correlation. In this case, further lags are necessary in order to the LM teste does not reject the null hypothesis of no residual correlation, which enlargers the variance of errors and the probability to include the zero in the interval of confidence of IRF (non-statistically significance). Still, a VAR model is not interested in estimated parameters (due to the high collinearity), but in determining the interrelationship between variables – which has been made by means of IRF (Sims, 1980). Therefore, our guide to select the number of lags is the information criterion.[67]

The VAR model does not allow to identify all parameters in its structural form because there is a feedback between the endogenous variables in the system (Enders, 2003). This leads to the necessity of imposing restrictions on the contemporaneous feedback effect. Sims (1980) has solved it, making the upper triangular part of the covariance matrix equals zero (Enders, 2003). This is known as Cholesky decomposition. It turns out that this solution imposes arbitrarily the contemporaneous causality (restrictions) between endogenous variables - which is not always in agreement with economic theory, leading to different results of IRF (Enders, 2003).

Our strategy is to estimate the VAR model with two different orders of endogenous variables to circumvent the identification issue. Estimates assume that the exchange rate is the most exogenous variable (influenced contemporaneously by no variable). The first system adopts the following ordering [e; q; p] to capture the possible effect of the exchange rate in sectoral

[67] In the case that the lag length that minimizes the information criterion was not enough to vanish residual autocorrelation, additional specifications with further lags were performed (until the Lagrange Multiplier test does not reject the null hypothesis of no residual autocorrelation). This is a problematic issue when the econometrician is concerned with parameters estimated by ordinary least squared (OLS) as the tests t and F are not valid anymore due to the biased error variance. As I am interested in IRF and FEVD of VAR estimates, the more parsimonious model (according to the information criterion) was chosen since the addition of further lags (used to vanish residual correlation) increase the error variance, as far as one further lag means the addition of one parameter of cross-correlation for each endogenous variable/equation. Thus, the results with further lags produced large confidence intervals in IRF, confirming that the model more parsimonious suits better. The results were similar to some extent, indicating the results' robustness (using the more parsimonious specification).

demand and, then, on sectoral inflation. There are two arguments for that. First, sectors with higher external demand are expected to be more benefited by exchange rate devaluations in a manner that such greater demand puts pressure on prices up. Second, another transmission channel from exchange rate into demand is the protection of the domestic market from international competition provided by exchange rate devaluation prices. The second system adopts the following ordering [*e*; *p*; *q*] to capture the possible demand-induced effect of exchange rate on sectoral inflation and, then, on sectoral production.[68] The *rationale* is that exchange rate devaluations increase prices, which leads firms to increase production. It should be noticed that the exchange rate influences contemporaneously inflation in both systems.

Data from 23 industrial sectors of Standard Industrial Classification 2.0 (CNAE 2.0) are used in this study. The data are monthly and covers the period between 2010:1 through 2019:12 (120 months). The variables are presented in Table 5.A 1 in appendix A.

The Producer Price Index (PPI) comes from the Brazilian Institute of Geography and Economy (IBGE) and represents the sales prices received by firms free of taxes, tariffs, and freight. The pass-through is calculated using the nominal and the sectoral effective exchange rate to obtain robust results. Such variables are the price of Real (R$) in Dollar (US$) expressed in growth rate; hence, positive (negative) values denote devaluations (overvaluations). The sectoral demand is represented by the industrial production that comes from Monthly Industrial Survey Production (PIM-PF) in growth rate. It should be noted that both PPI and sectoral demand variables are seasonally adjusted.[69] The oil price is represented by the price of Brent Crude in US$, denoted in growth rate and came from the Federal Reserve of ST. Louis. The descriptive statistics of variables are presented in Table 5.A 3 (appendix A). The Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests were performed and assured that all variables are stationary (see Tables 5.A 4- 5.A 7).[70] The empirical findings are discussed in what follows.

[68] Assuming that demand can be higher than supply in the short-run, but it equals supply in the long-run.

[69] The variable PPI was seasonally adjusted by authors using ARIMA-X13, whilst sectoral demand is seasonally adjusted by IBGE.

[70] The ADF test was performed with constant, no constant, trend, and drift, while the PP test with constant, no constant, and with a trend. All tests suggested the stationarity of variables.

7- Estimates I: Generalized Method of Moments (GMM)

This section discusses the results of estimates by the Generalized Method of Moments. Table 5.2 reports the long-run exchange pass-through estimated using GMM.[71]

Table 5. 3 - Sectoral Pass-Through (long-run: 12 months): GMM estimates

	Nominal exchange rate pass-through				*Sectoral effective exchange rate*			
	First Specification		*Second Specification*		*First Specification*		*Second Specification*	
Devaluation/ Sector	*1%*	*1 s.d.*[a]	*1%*	*1 s.d.*[a]	*1%*	*1 s.d.*[b]	*1%*	*1 s.d.*[b]
10	0.47	2.14	0.48	2.18	0.15	0.56	0.13	0.49
11			0.11	0.50	-0.12	-0.47	-0.13	-0.51
12	0.75	3.42	0.80	3.64	0.80	3.09	0.87	3.36
13	0.13	0.59	0.01	0.04			0.06	0.22
14	0.33	1.50	0.30	1.36	-0.38	-1.55	-0.12	-0.49
15	0.26	1.18	0.25	1.14	0.23	0.95	0.35	1.45
16	0.32	1.45	0.33	1.50	0.34	1.39	0.38	1.55
17	0.64	2.91	0.65	2.96	0.50	1.95	0.72	2.81
18	-0.17	-0.77	-0.03	-0.13				
19							0.16	0.75
20b	-0.22	-1.0	0.00	0.0				
20c	0.63	2.87	0.76	3.46				
21	0.10	0.45	0.46	2.09	-0.05	-0.16	-0.23	-0.75
22	0.7	0.31	0.07	0.31				
23	0.15	0.68	0.24	1.09	0.46	2.18	0.53	2.52
24							0.01	0.04
25	0.23	1.04	0.24	1.09	0.04	0.16	0.04	0.16
26	0.35	1.59	0.34	1.55				
27	-0.4	-0.18	-0.08	-0.36			-0.07	-0.26
28	0.8	0.36	0.06	0.27				
29	0.3	0.13	0.03	0.13	0.09	0.37	0.03	0.12
30	0.78	3.55	0.99	4.51	0.11	0.55	0.08	0.40
31	-0.1	-0.04	0.00	0.0	0.17	0.66	0.17	0.66
Extractive	0.20	0.91	0.21	0.95	0.27	1.17	0.53	2.30
PPI	0.18	0.82	0.17	0.77	0.34	1.47	0.41	1.78

Notes: (1) Tables 5.B 1, 5.B 2, 5.B 3 and 5. B4 (in appendix B) present the full output of regressions; (2) specification 1 was run using 4 degrees of freedom of test-J (the instruments regressions contains a constant and 16 lags of exchange rate variable - from 12 until 27 periods); (3) specification 2 was run using 5 degrees of freedom of test-J (the instruments regressions contains a constant and 17 lags of exchange rate variable- from 12 until 28 periods); (4) the long-run pass-through is calculated as the sum of statistically significant parameters (at least at 10%); (5) the instruments has been valid for all regressions; (6) empty cells mean that no parameter was statistically significant; [a]1 standard deviation of the nominal exchange rate (4.56%); [b]1 standard deviation of the sectoral effective exchange rate (see Table 5. A3 in Appendix A).

[71] The full output of GMM estimates for the first specification of equation (2A) is reported in Tables 5.B 1-5.B 4 in Appendix B.

Using nominal exchange rate as independent variable, the results suggested that the pass-through from 1% of exchange rate devaluation into aggregated IPP is 18% and 17%, respectively for specifications 1 and 2. Only the following sectors have a pass-through greater than 50%: 12 (75% and 80%), 17 (64% and 65%), 20c (63% and 76%) and 30 (78% and 99%), in specifications 1 and 2 respectively. Whereas the sectors 10, 11, 13, 14, 15, 16, 21, 22, 23, 25, 26, 28, 29 and extractive industry have a pass-through lesser than 50%: (47% and 48%), (0% and 11%), (13% and 1%), (33% and 30%), (26% and 25%), (32% and 33%), (10% and 0%), (7% and 7%), (15% and 24%), (23% and 24%), (35% and 34%), (8% and 6%), (3% and 3%) and (20% and 21%), respectively in specifications 1 and 2. The sectors 18, 20b, 27 and 31 have anomalous results once its exchange rate pass-through into prices was negative.

Using the sectoral effective exchange rate instead nominal exchange rate, results are different, but the incomplete pass-through remains. The pass-through from effective exchange rate to aggregated IPP is 27% and 53%, respectively, for specifications 1 and 2. The sectoral effective exchange rate's pass-through has shown more modest than that from nominal exchange rate. Only the following sectors have a pass-through greater than 50%: 12 (80% and 87%) and 17 (50% and 72%). Whilst the sectors 10, 13, 15, 16, 19, 23, 24, 25, 29, 30, 31 have a pass-through lesser than 50%: 10 (15% and 13%), 13 (0% and 6%), 15 (23% and 35%), 16 (34% and 38%), 19 (0% and 16%), 23 (46% and 53%), 25 (4% and 4%), 29 (9% and 3%), 30 (11% and 8%), 31 (17% and 17%) and extractive industry (27% and 53%), respectively, for specifications 1 and 2. The sectors 11, 14, 21, and 27 presented negative exchange rate pass-through.

Although the results suggest that no sector has a full pass-through of exchange rate devaluations (either nominal or real) around 1% into prices, the analysis changes when exchange rate devaluations are analyzed in terms of one standard deviation. A devaluation of 4.56% in the nominal exchange rate is fully passed to industries' prices and larger than 100% for various sectors. Only sectors 11, 13, 22, 28, 29, and extractive industries do not have a full pass-through. The same applies to a devaluation of 1 standard deviation in the sectoral effective exchange rate. In this case, only the prices of sectors 15, 25, 29, 30, and 31 increase less than 100% after an exchange rate devaluation of 1 standard deviation.

The results of second specification of equation (14) controlling other covariates are presented Appendix B. The estimates using both nominal as effective exchange rate delivered evidences that industrial prices accommodate partially exchange rate devaluations of 1% in short-run. Table 5.B 5 presents estimates using nominal exchange rate and suggests that the pass-through of a devaluation of 1% into aggregated PPI is 9% and 41% in terms of an exchange rate devaluation of a standard deviation. While the pass-through into prices has shown statistically significant (at least at 10%) only for the sectors 10, 12, 15, 17, 25, 30 and extractive industry with the respective pass-through of exchange rate devaluation of 1%: 31%, 29%, 17%, 33%, 18%, 49% and 9% - which correspond to 141%, 132%, 77%, 150%, 82%, 223% and 41% after an increasing of 1 standard deviation in nominal exchange rate.

Lastly, Table B6 presents estimates using the effective exchange rate. The pass-through of a devaluation of 1% into aggregated PPI is 25% and 108% in terms of an increase of 1 standard deviation in the effective exchange rate. Despite the anomalous result for sectors 11 and 18 (negative pass-through), the pass-through to prices was statistically significant (at least at 10%) only for the sectors 17, 24, 30 and extractive industry with the respective pass-through exchange rate devaluation of 1%: 24%, 24%, 35% and 27% - which correspond to 93%, 111%, 175% and 117% after an increase of 1 standard deviation in the sectoral effective exchange rate.

8- Estimates II: Vector Auto Regressive (VAR)

This section discusses the results of estimates by Vector Auto Regressive. The full results of VAR estimates are reported in Tables 5.C 1- 5.C 24 in Appendix C. The estimates have been proved robust to the different orders of endogenous variables (different systems produced the same IRF and FEVD), and all eigenvalues lie inside the unit circle. The long-run pass-through after a shock of 1 standard deviation in the exchange rate and after an increase of 1% in the exchange rate (pass-through standardized) are summarized in Table 5.3.

Table 5. 4 - Sectoral Pass-Through (long-run: 12 months): VAR's Results

Sector	*Nominal exchange rate*				*Sectoral effective exchange rate*			
	Pass-Through[a]	*FEVD*[b]	*Month*[c]	*Pass-Through standardized*[d]	*Pass-Through*[a]	*FEVD*[b]	*Month*[c]	*Pass-Through standardized*[d]
10	135%	21%	12	34%	64%	9%	2	17%
11		3%				16%		
12	213%	65%	12	61%	138%	34%	12	39%
13		5%				2%		
14	22%	2%	1	5%	26%	1%	1	5%
15	125%	42%	12	29%	109%	36%	12	20%
16	132%	38%	12	32%	86%	35%	12	17%
17	154%	36%	12	37%	136%	36%	12	41%
18		2%			-66%	12%	10	-17%
19	79%	9%	12	21%	-61%	15%	1	-13%
20b		2%				4%		
20c	182%	29%	12	49%	84%	14%	3	31%
21		2%				2%		
22	32%	6%	12	8%	67%	19%	12	25%
23	34%	7%	12	8%	71%	14%	12	12%
24	75%	16%	12	21%	39%	6%	1	7%
25	75%	42%	12	19%	93%	39%	12	21%
26	42%	6%	12	11%	50%	8%	12	7%
27		3%			33%	7%	12	7%
28	30%	12%	12	7%	31%	10%	12	6%
29	20%	12%	12	4%	20%	10%	12	3%
30	216%	68%	12	58%	224%	66%	12	41%
31	33%	13%	12	8%	39%	18%	12	10%
Extractive	72%	53%	12	19%	69%	44%	12	15%
PPI	83%	59%	12	22%	100%	59%	12	24%

Notes: [a] inflation's IRF (after a shock of 1 standard deviation in the exchange rate) represented by the value of the last month in which CRIF is statistically significant (when 0 is not within confidence interval); empty cells mean that no value of CRIF was statistically significant, [b] in the case that no value of CRIF is statistically significant, the value of FEVD represents the twelfth month; (1) Tables 5. C1- 5. C24 (in Appendix C) present the full outputs of estimates; [c] last month in which CRIF is statistically significant; [d] standardized following the procedure of McCarthy (2007) to express the response of inflation to a shock of 1% in the exchange rate, which is calculated dividing the cumulative change of inflation after a shock in exchange rate by the cumulative change of exchange rate after such shock; (1) see Tables 5.C 1- 5.C 24 in Appendix C to check the number of lags used and the stability conditions; (2) it is important to note that the CRIF of the exchange rate after a shock in exchange rate is not statistically significant for all 12 periods. The calculations of pass-through standardized are carried out using the values of cumulative change in the exchange rate of the value of the last month in which CRIF of inflation is statistically significant.

Estimates using the nominal exchange rate indicate that pass-through into aggregated IPP (after a shock of 1 standard deviation in exchange rate) is around 83%. The same applies for the sectors 14, 19, 22, 23, 24, 25, 26, 28, 29, 31 and extractive industry once the estimated pass-throughs are 22%, 79%, 32%, 34%, 75%, 75%, 42%, 30%, 20% and 33%, respectively. The FEVD for these sectors is lower than average[72] (except for the sector 25): 14 (2%), 19 (9%), 22 (6%), 23 (7%), 24 (16%), 25 (42%), 26 (6%), 28 (12%), 29 (12%), 31 (13%). The pass-through is larger than 100% for the remaining sectors: 12 (232%), 15 (125%), 16 (132%), 17 (154%), 20c (182%) and 30 (216%). The respective FEVD are higher than average: 12 (65%), 15 (42%), 16 (38%), 17 (36%), 20c (29%) and 30 (68%), suggesting that exchange rate explain more the prices of these sectors.

The results using sectoral effective exchange rate indicate that pass-through into aggregated IPP (after a shock of 1 standard deviation in the exchange rate) is 100%. The pass-through is larger than 100% for the sectors: 12 (138%), 15 (109%), 17 (136%), and 30 (224%). The FEVD corroborated the importance of sectoral effective exchange rate in influencing prices of these sectors once it is greater than the average[73]: 12 (34%), 15 (36%), 17 (36%), and 30 (66%). The same does not apply for the remaining sectors because its pass-through is lesser than 100%, and FEVD is lesser than the average in most sectors.

Estimates suggest that the pass-through standardized is incomplete (employing nominal or sectoral effective exchange rate). Using nominal exchange rate, the pass-through into aggregated IPP is 22%. While the sectoral pass-through is: 10 (34%), 12 (61%), 14 (5%), 15 (29%), 16 (32%), 17 (37%), 19 (21%), 20c (49%), 22 (8%), 23 (8%), 24 (21%), 25 (19%), 26 (11%), 28 (7%), 29 (4%), 30 (58%), 31 (8%) and extractive industry (19%). This result is confirmed by regressions employing sectoral effective exchange rate. The pass-through into aggregated IPP is 24%. Whilst the sectoral pass-through is: 10 (17%), 12 (39%), 14 (5%), 15 (20%), 16 (17%), 17 (41%), 18 (-17%), 19 (-13%), 20c (31%), 22 (25%), 23 (12%), 24 (7%), 25 (21%), 26 (7%), 27 (7%), 28 (6%), 29 (3%), 30 (41%), 31 (10%) and extractive industry (15%).

The estimates of exchange rate pass-through are robust. Both GMM as VAR estimates go in the same direction and suggest that prices increase less than 1% due to a 1% devaluation in the exchange rate - employing nominal or effective exchange rate. This is valid for aggregated and sectoral estimates. Therefore, Brazilian manufacturing sectors do not entirely pass devaluations of 1% in exchange rate into prices. Results are like those obtained by Correa (2017). Interestingly, all findings point out that the exchange rate pass-through estimated using nominal exchange rate is greater than that estimated using the effective exchange rate in both estimates.

[72] 19%

[73] 18%

9- Explaining the Pass-through for Brazilian Economy

The previous section demonstrated the prevalence of partial exchange rate pass-through for devaluations of 1% in the exchange rate on prices of Brazilian manufacturing sectors over the period between 2010 and 2019, and large variation of pass-through across the sectors. This section aims at exploring the previous findings in light of stylized sectoral facts (markup rate, outward orientation, competition among national and foreign firms, and costs with imported inputs) to offer possible explanations for those sectoral differences.

9.1. Market Power

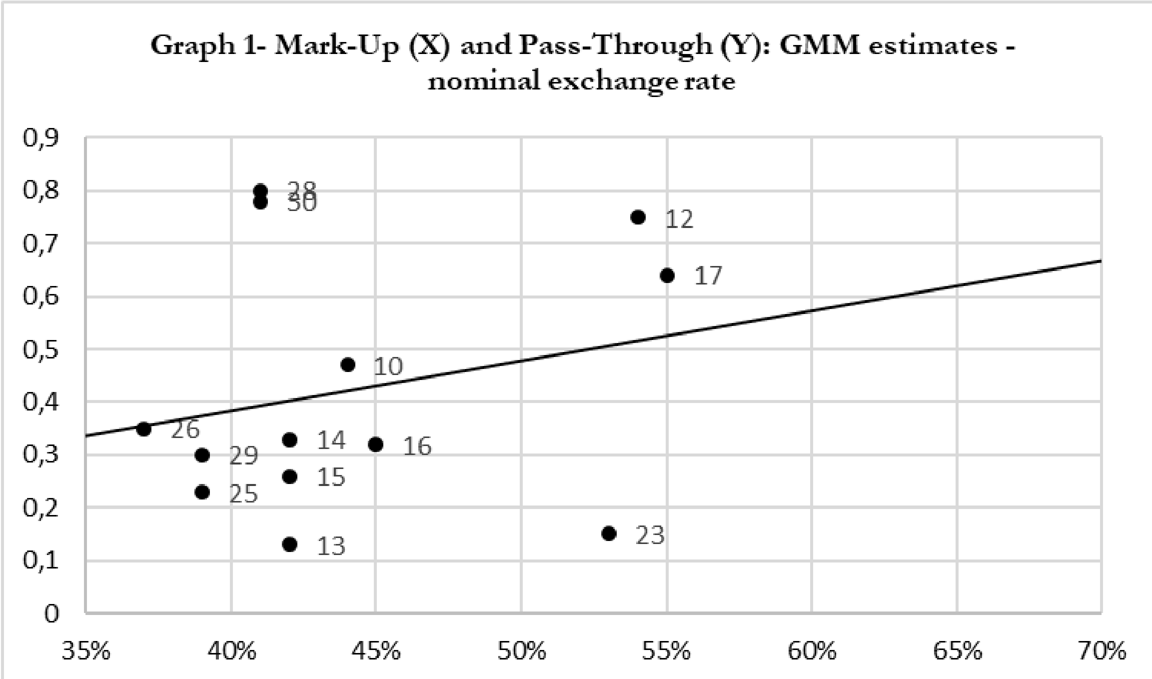
According to the theoretical model developed earlier, larger the markup rate stronger is the effects of devaluations of the exchange rate in prices, and the degree of imported inputs in costs intensifies such effect. The larger the share of imported inputs in costs, the higher is the increase in exchange rate pass-through due to an increase in markup rate, all else constant. The association between markup rate and pass-through is performed by a graphical analysis. This strategy is the only one possible because there is no monthly data that allows the use of econometric methods. Although this is a fragile analytical method, it delivers empirical evidence that suggests an association between the variables. The markup variable was constructed using the annual data from Annual Industry Survey (PIA) from IBGE over the period between 2010 and 2017. The methodology of computation is the same as Nucci and Pozzolo (2001).[74]

Graphs 5.1 and 5.2 present the correlogram for the average of the markup over the period 2010-2017 and the estimated pass-through by GMM[75]:

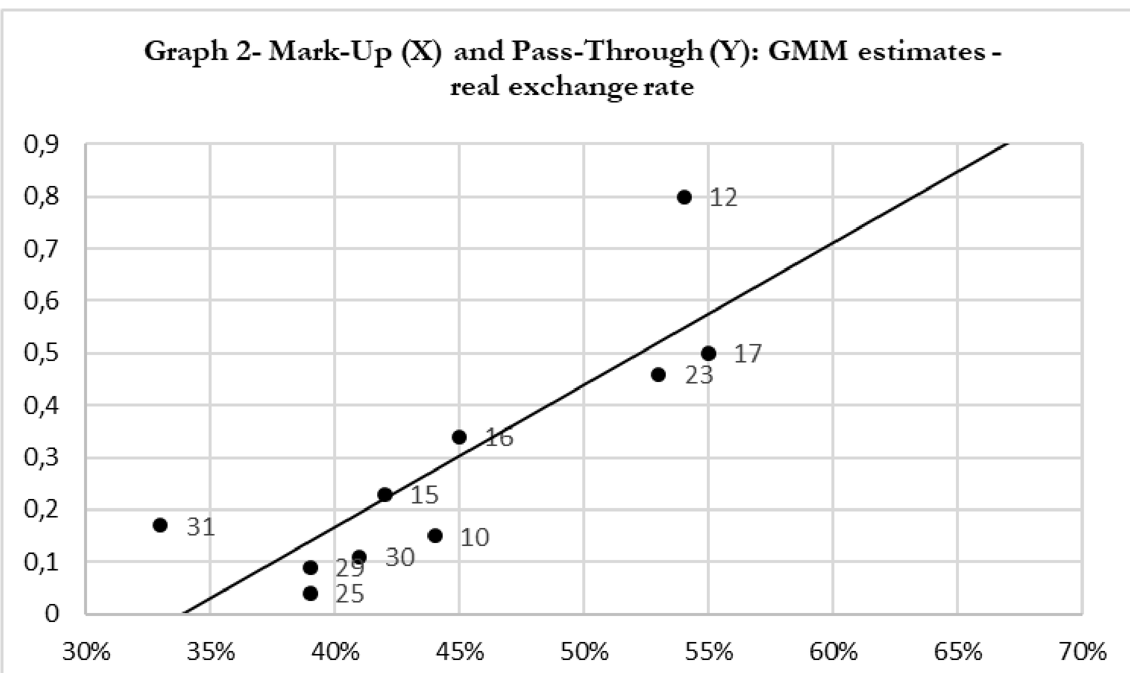
[74] The mark-up is calculated as [(value of sales + Δ inventories – payroll – costs of material)/(value of sales + Δ inventories)].

[75] Estimated using 4 degrees of freedom.

Graph 5. 1 - Markup rate and Pass-Through: GMM estimates using the nominal exchange rate



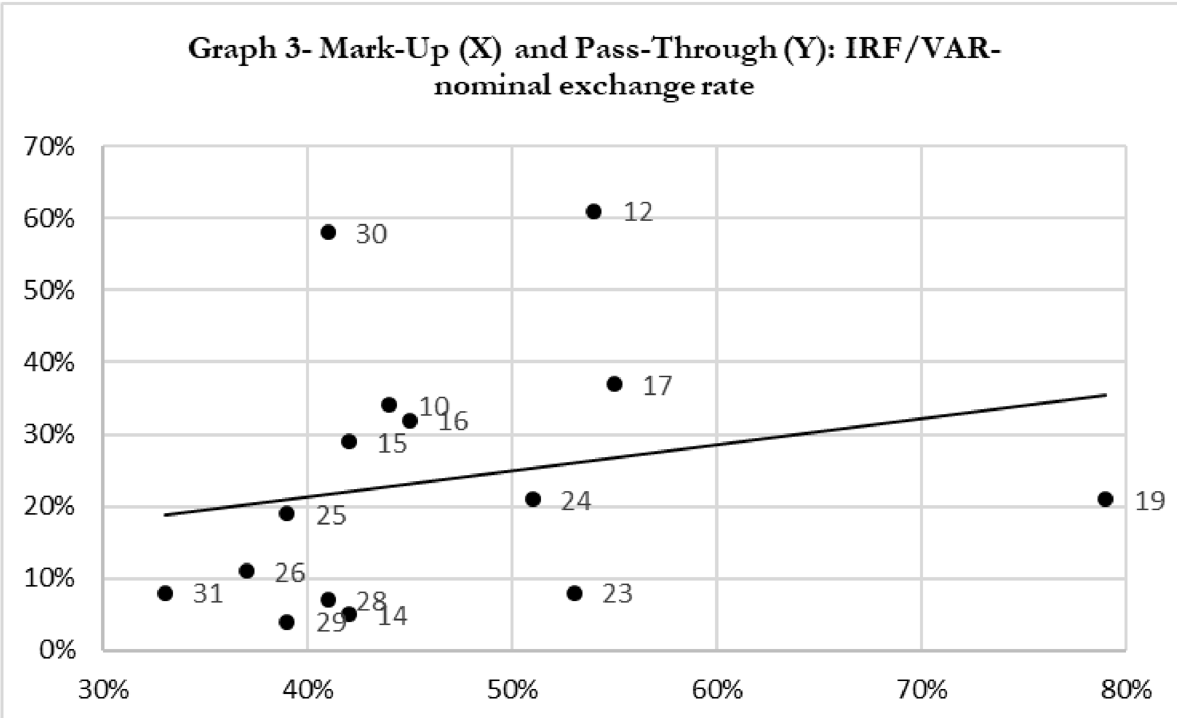
Graph 5. 2 - Markup rate and Pass-Through: GMM estimates using the real exchange rate



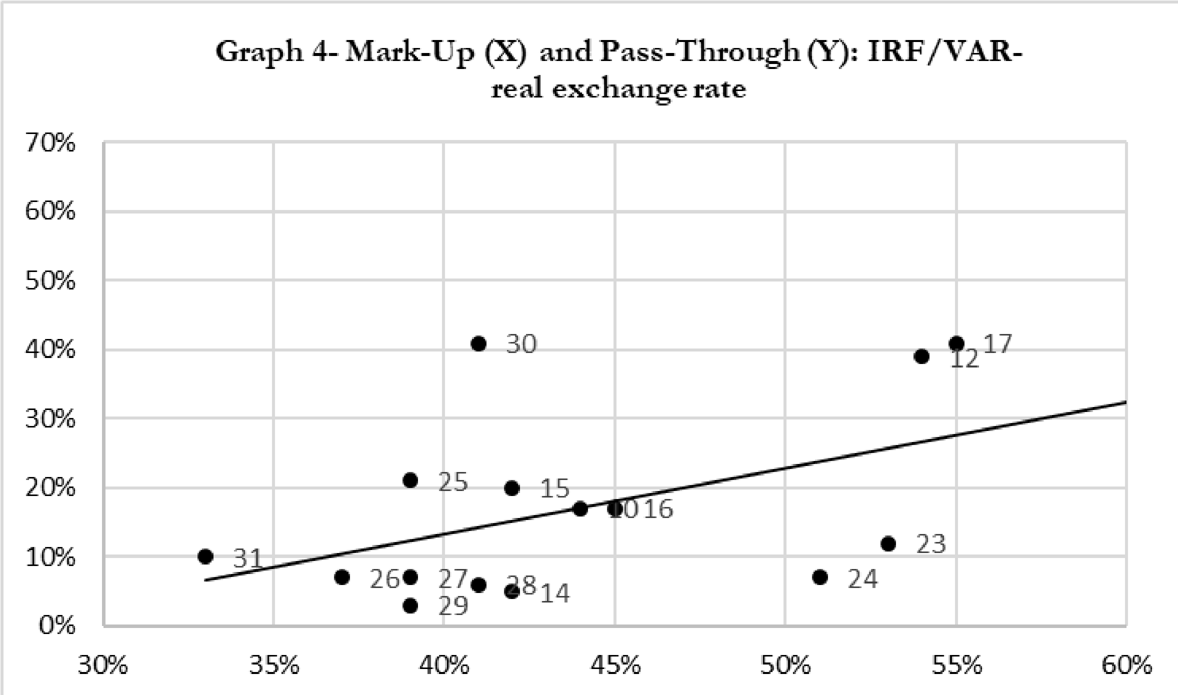
Both graphs suggest a positive association between mark-up rate and pass-through. The higher is the mark-up, the stronger is the effect of exchange rate devaluations in prices. Sectors with higher market power are more capable to pass exchange rate devaluations into prices because of increased costs, or because of competitiveness gain.

The correlogram for the average of the markup over the period 2010-2017 and the estimated pass-through (standardized) and the FEVD are reported below.

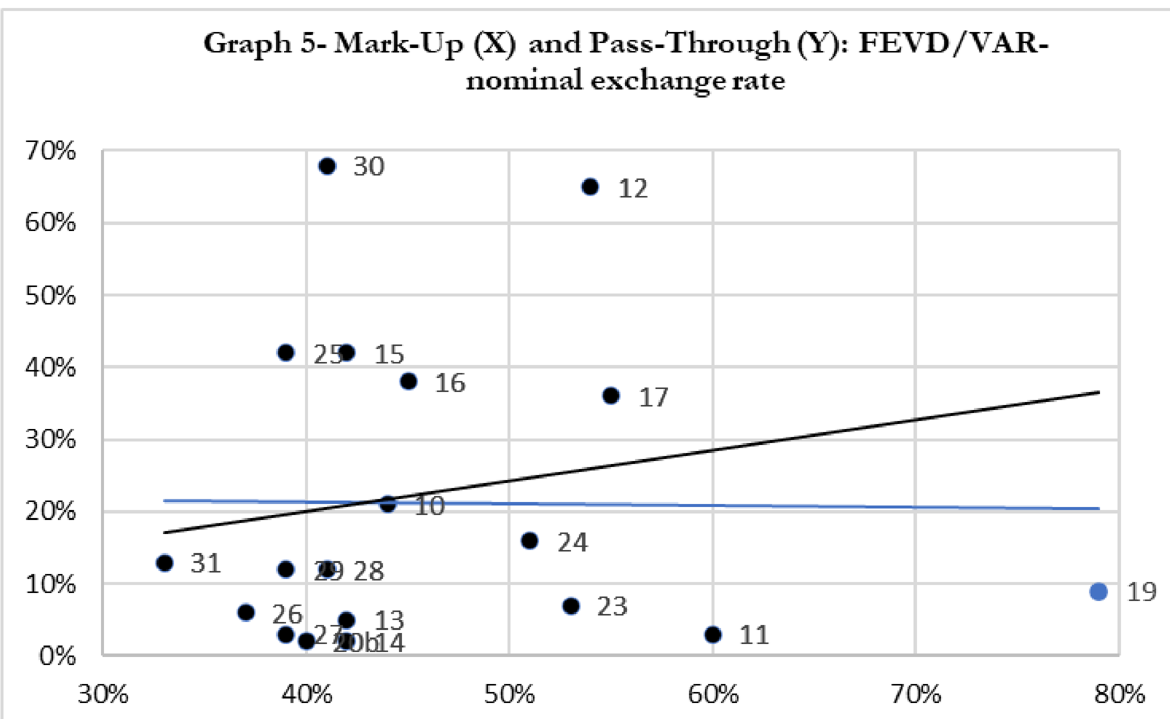
Graph 5. 3 – Markup and Pass-Through: IRF-VAR using the nominal exchange rate



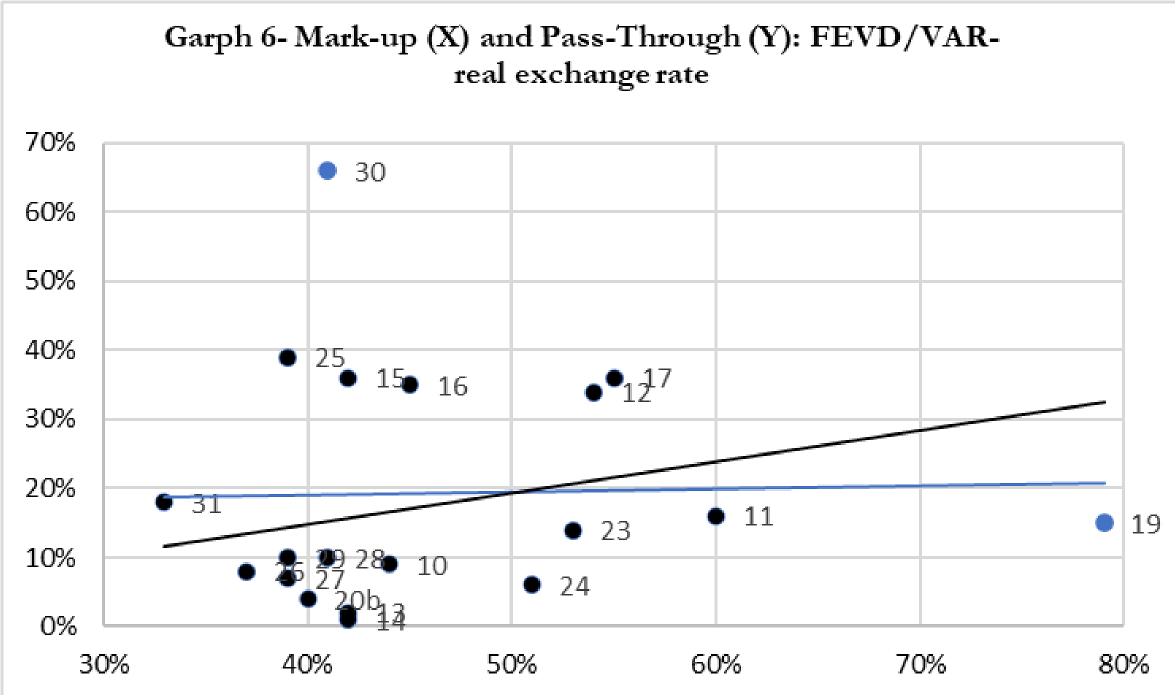
Graph 5. 4 - Markup and Pass-Through: IRF-VAR using the real exchange rate



Graph 5. 5 – Markup rate and Pass-through: FEVD-VAR using the nominal exchange rate



Graph 5. 6 - Markup rate and Pass-through: FEVD-VAR using the nominal exchange rate



The graphs confirmed the previous findings; the higher is market power, the higher is the capability of firms to pass on exchange rate devaluations into prices. The correlogram also suggested a positive association between FEVD[76] and markup rate, indicating that the exchange rate explains more the price changes of sectors in which markup is higher.

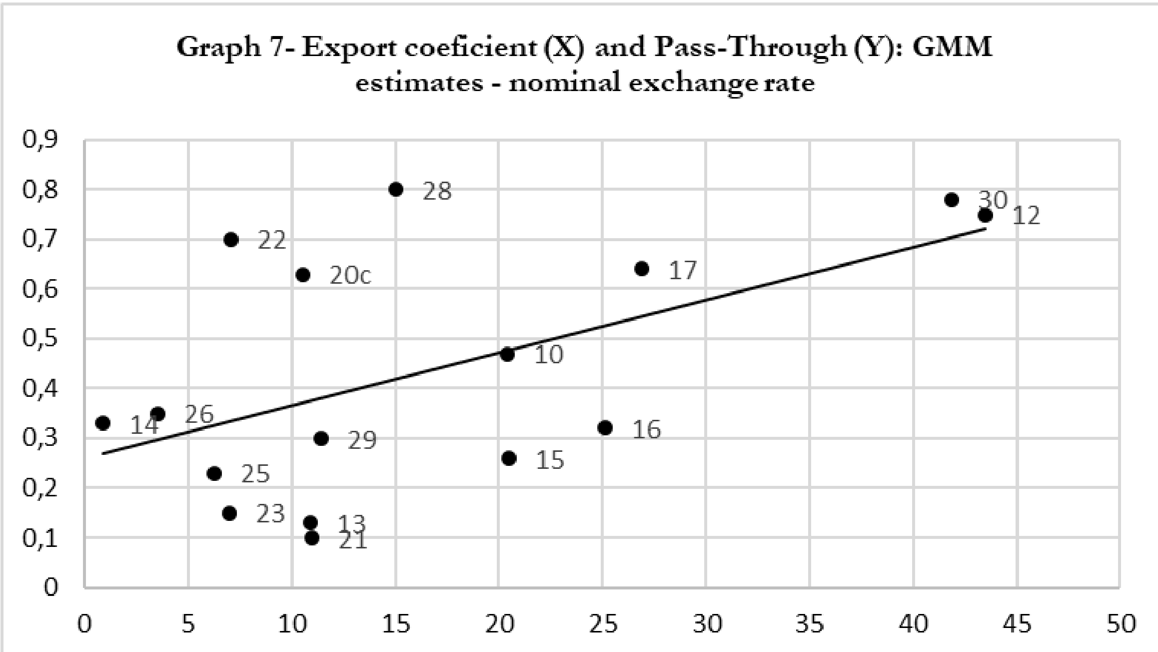
9.2. Outward Orientation

Krugman (1987) argues that the incomplete exchange rate pass-through occurs because export firms absorb exchange rate devaluations rising prices (Krugman, 1987). Exporters increase the price to take benefits from market power and discriminate prices in accordance with features of the end market (Krugman, 1987). Exchange rate devaluations are not passed fully into prices (in dollar), which increases the markup rate of these firms, *ceteris paribus*. Following this explanation, all else constant, it is expected that the effects of exchange rate devaluations are stronger for exporter firms. Graphs 7 and 8 present the correlogram for the average export

[76] Sectors with extreme values were removed from correlograms (black line). The trend line of the correlogram with all sectors is represented by the one with the blue line.

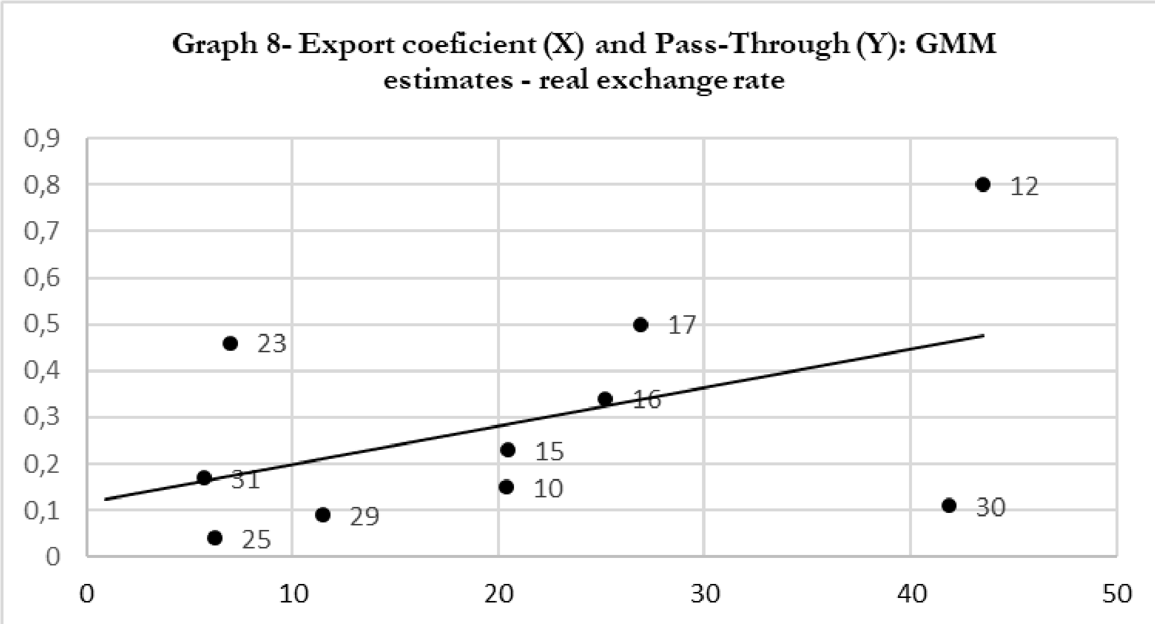
coefficient (share of revenue that comes from exports) for the period 2010-2018 and the estimated pass-through by GMM (using nominal and effective exchange rate).[77]

Graph 5. 7 – Export coefficient and Pass-through: GMM estimates using the nominal exchange rate



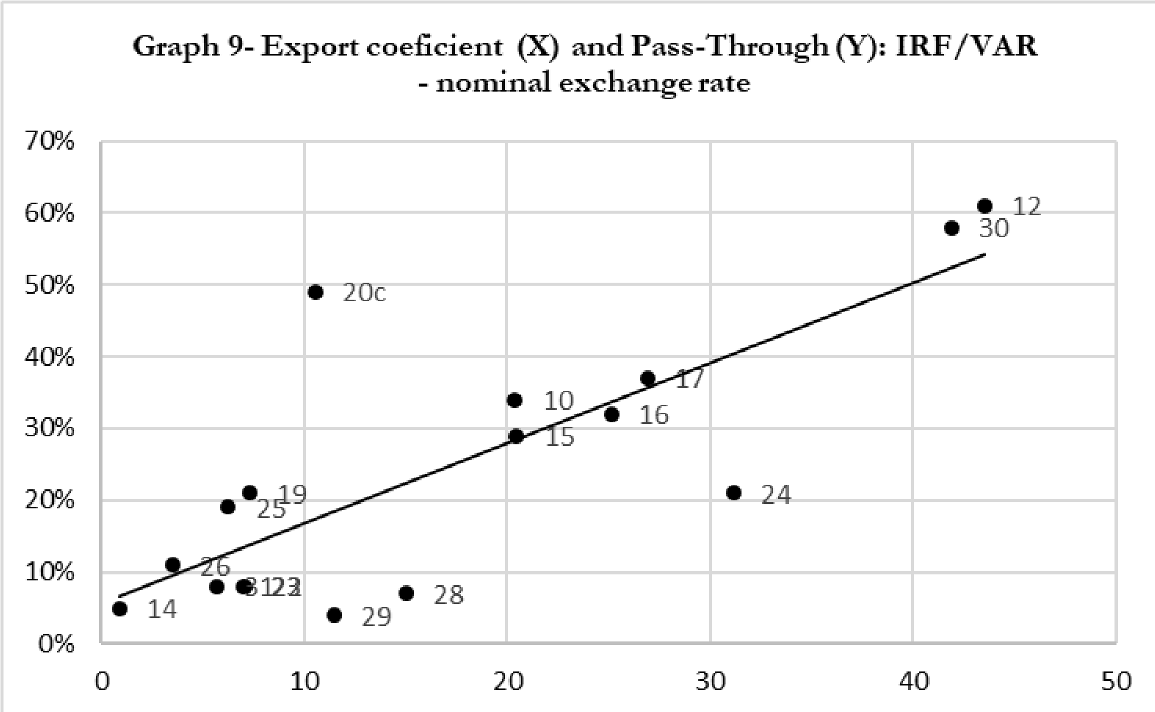
[77] The export coefficient came from National Conference Industry and represented the share in a percentage of revenues associated with exports. The GMM estimates refer to the equation performed with four freedom degrees.

Graph 5. 8 - Export coefficient and Pass-through: GMM estimates using the real exchange rate

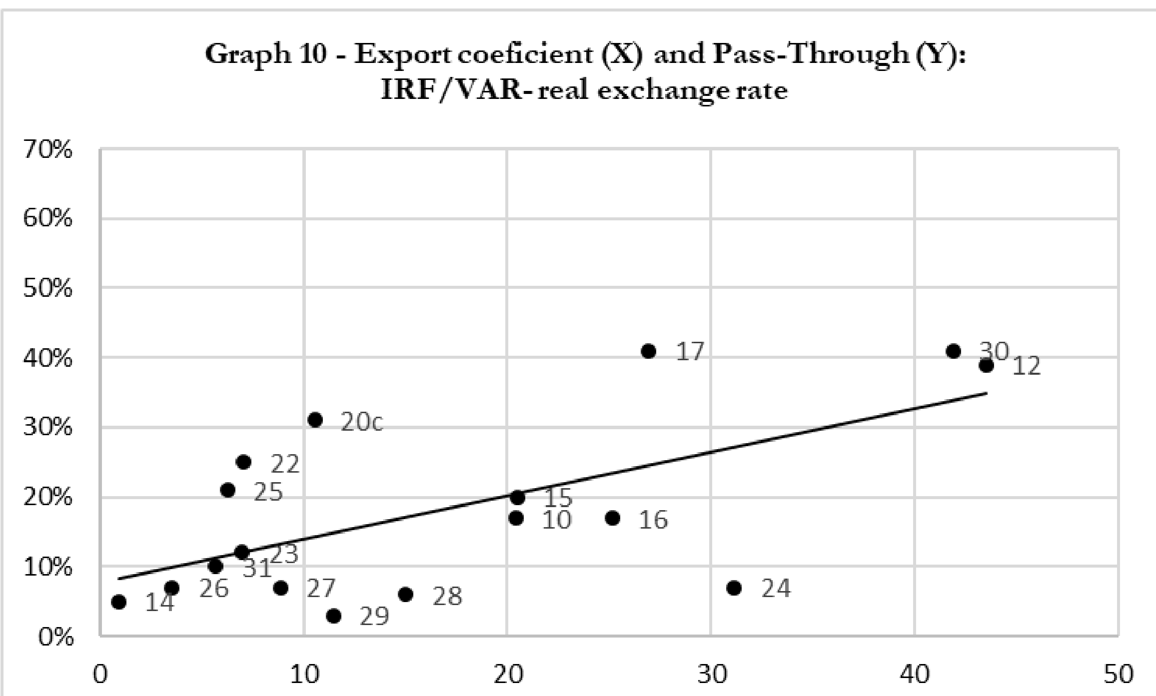


The correlograms indicate a positive association between export coefficient and pass-through. The outward orientation matters as export firms have a higher pass-through because of the adoption to some extent of price-to-market discrimination. The correlogram for the average export coefficient for the period 2010-2018 and the estimated pass-through (standardized), and the FEVD (using nominal and effective exchange rate) are reported below.

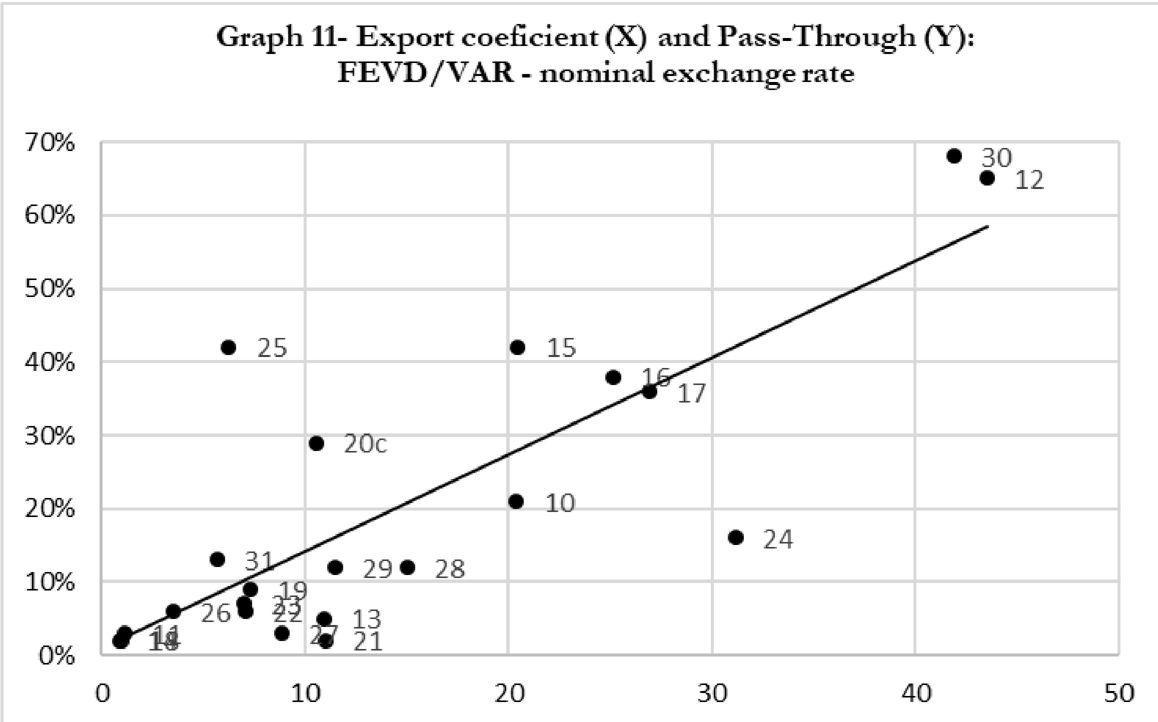
Graph 5. 9 - Export coefficient and Pass-through: IRF-VAR using the nominal exchange rate



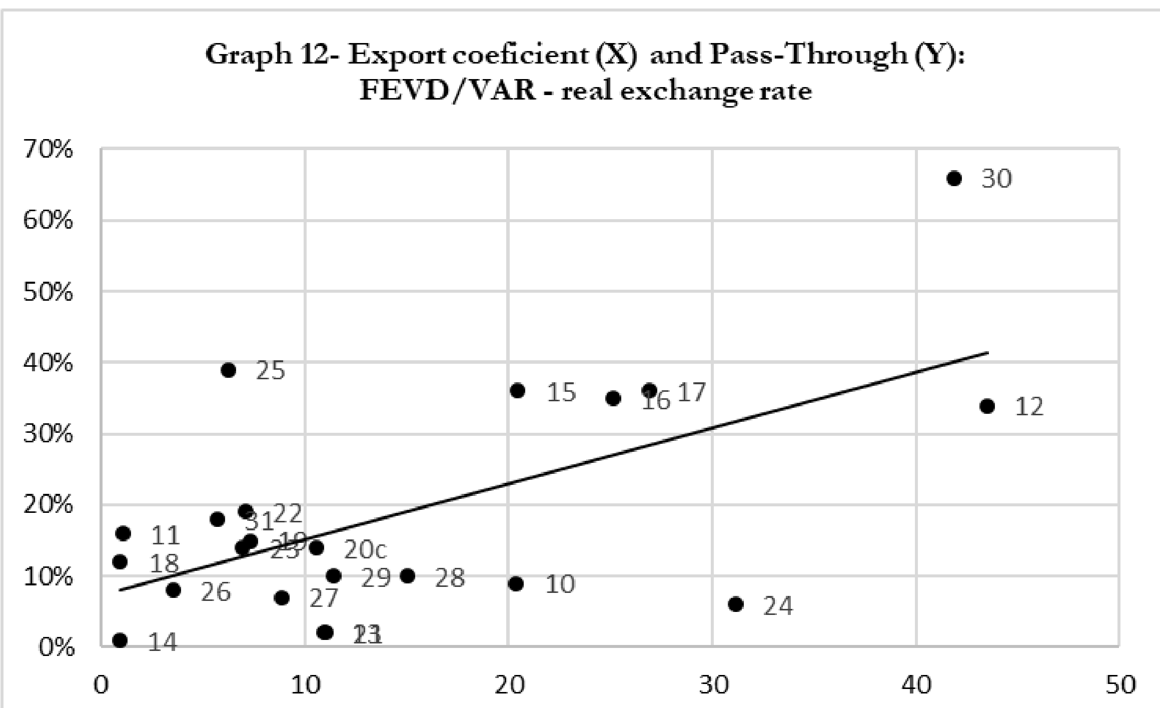
Graph 5. 10 - Export coefficient and Pass-through: IRF-VAR using the real exchange rate



Graph 5. 11 – Export Coefficient and Pass-Through: FEVD-VR using the nominal exchange rate



Graph 5. 12 - Export Coefficient and Pass-Through: FEVD-VR using the real exchange rate



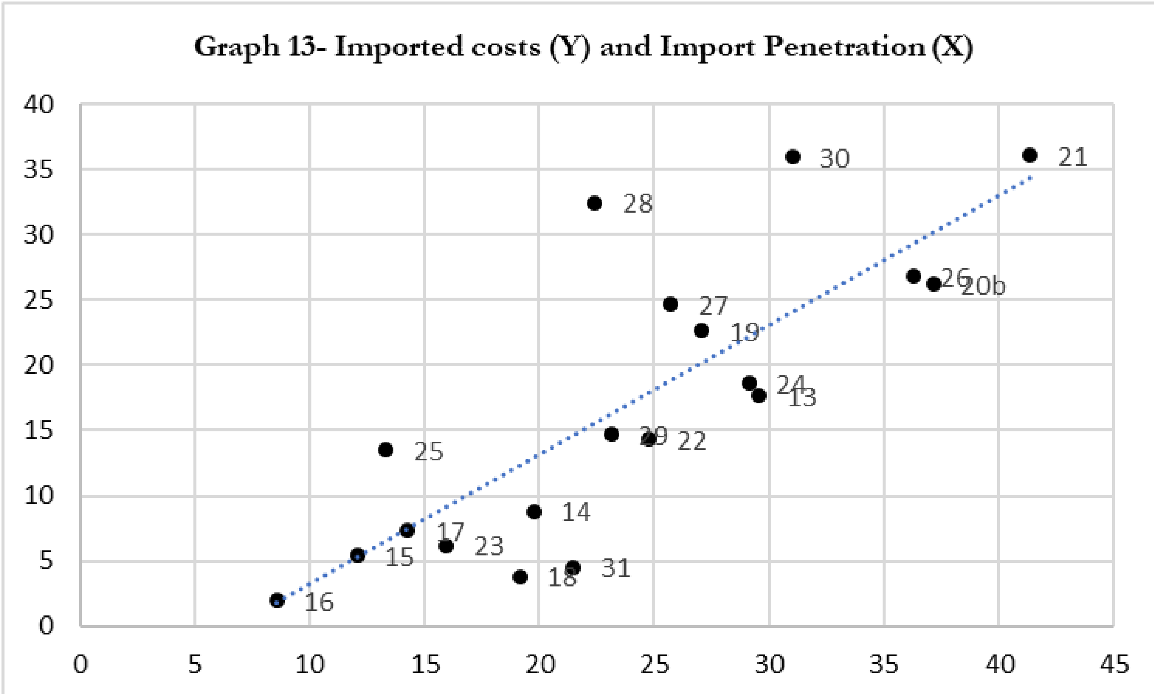
The graphs confirmed the results that the higher is the outward orientation, the higher is the pass-through. The correlogram suggests a positive association between FEVD and export coefficient, indicating that the exchange rate explains more the price changes of sectors more outward-oriented.

9.3. Competition and Costs

A result of the Kaleckian approach, developed earlier, is the association between the magnitude of exchange rate pass-through and the share of imported inputs in costs. The higher is the importance of imports in costs, stronger is the pass-through, *ceteris paribus*. The intuitive implication is that sectors that import more inputs are more affected by the exchange rate and pass more the devaluations into prices to defend markup rate, all else constant. However, Arestis and Milberg (1993) argue that the incomplete exchange rate pass-through occurs because firms absorb exchange rate devaluations reducing markup rate. This is due to the degree of competition among firms (Arestis and Milberg, 1993). Firms with a high share of imported inputs in costs nestled in an industry with fierce competition cannot pass devaluations of exchange rate into prices, absorbing it by means of a reduced markup rate. Taking the import penetration as a measure of competition between national and foreign firms[78], Graphs 13 present the correlogram for the average share of imported inputs in costs and import penetration over the period 2010-2018.

[78]The import penetration is the share of national consumption that is imported. The higher is the sectoral import penetration, the stronger is the competition that national manufacturing sectors face against foreign firms.

Graph 5. 13 – Imported Costs and Import Penetration

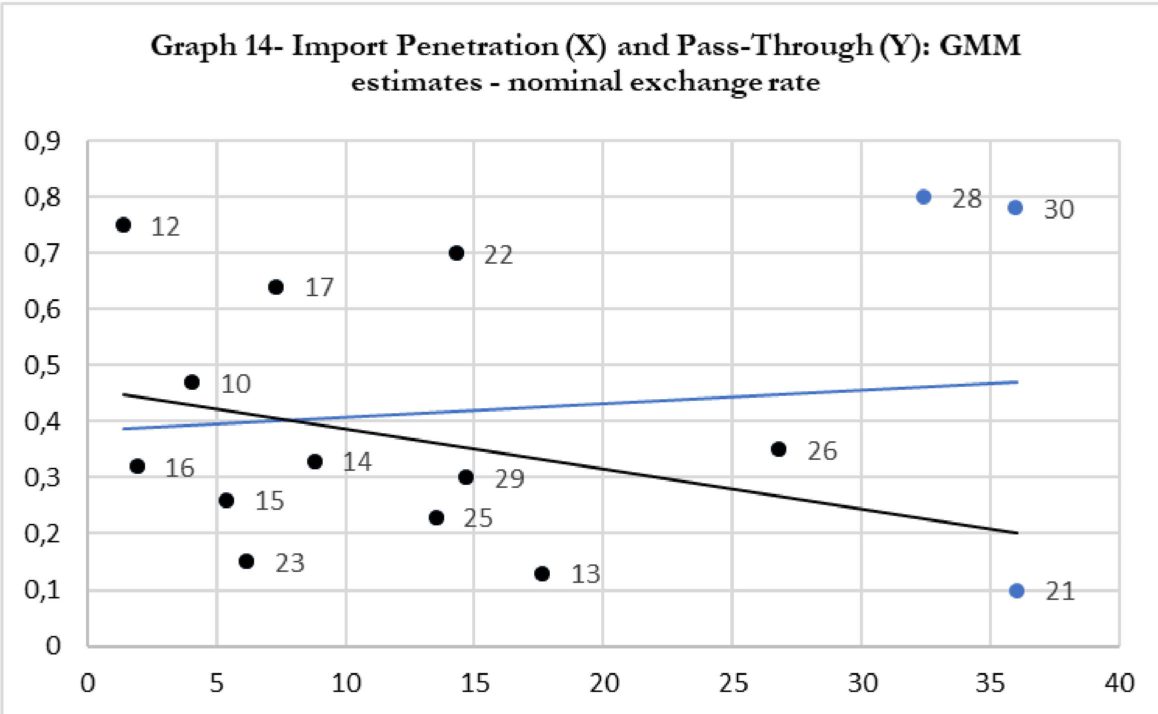


Graph 13 indicates a positive association between the degree of competition among national and foreign firms and the share of imported inputs in costs. A stylized fact derived from it is that sectors that face strong competition with foreign firms have a higher share of imported inputs in costs. As a result, it is expected that firms of those sectors do not pass exchange rate devaluations entirely into prices and absorb it by reducing markup rate, all else constant.[79]

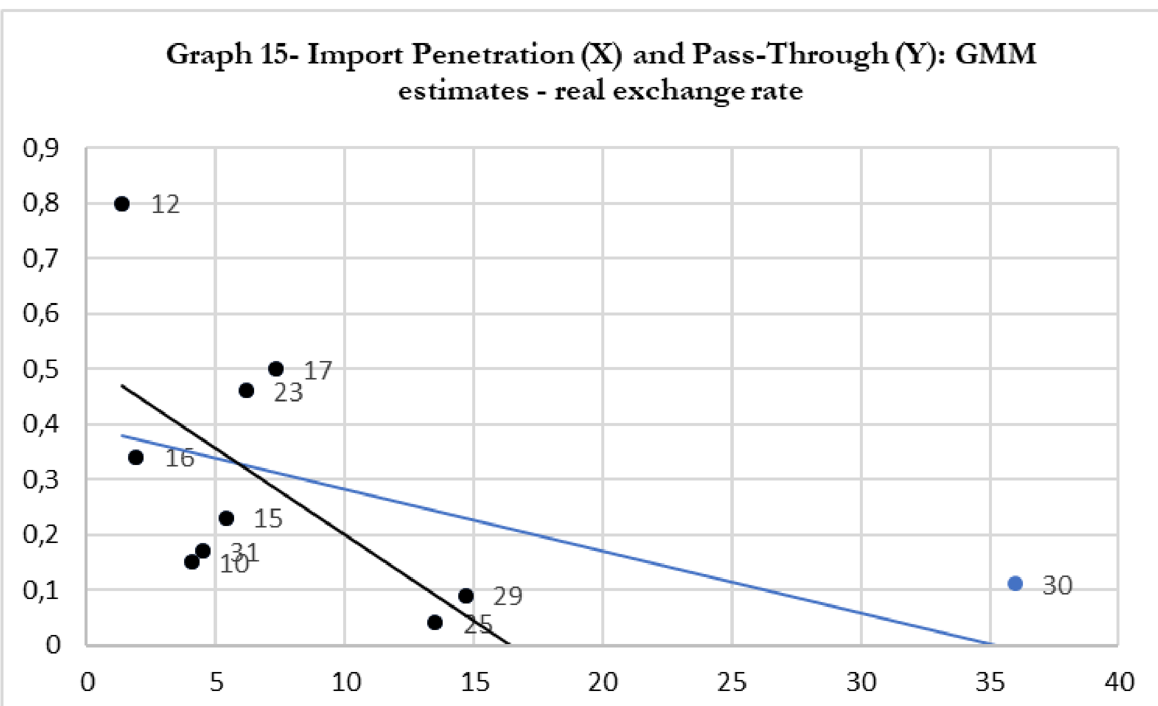
Graphs 14 and 15 present the correlogram for the average import penetration over the period 2010-2018 and the estimated pass-through by GMM (using nominal and effective exchange rate).[80]

[79] Given the peripheric condition and the strong deindustrialization process experienced by the Brazilian economy, it is plausible assuming that foreign firms have higher productivity growth than national firms.
[80] Sectors with extreme values were removed from the correlograms (black line). The trend line of correlogram with all sectors is represented by the one with the blue line.

Graph 5. 14 – Import Penetration and Pass-Through: GMM estimates using the nominal exchange rate

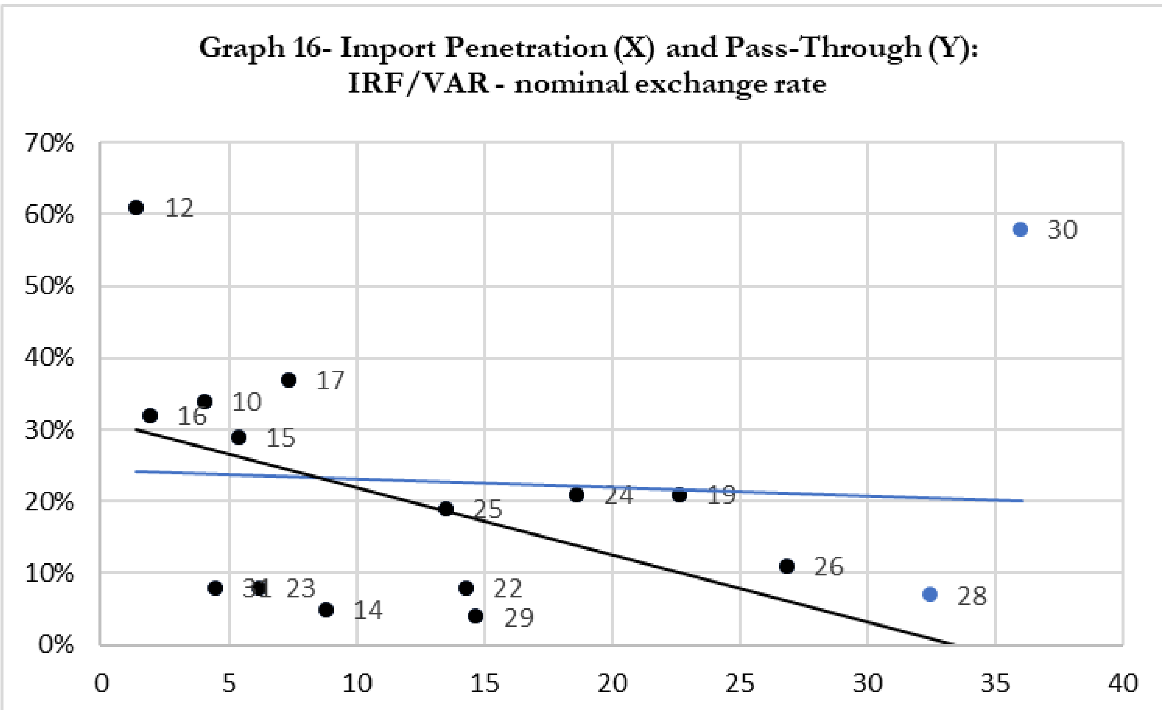


Graph 5. 15 - Import Penetration and Pass-Through: GMM estimates using the real exchange rate

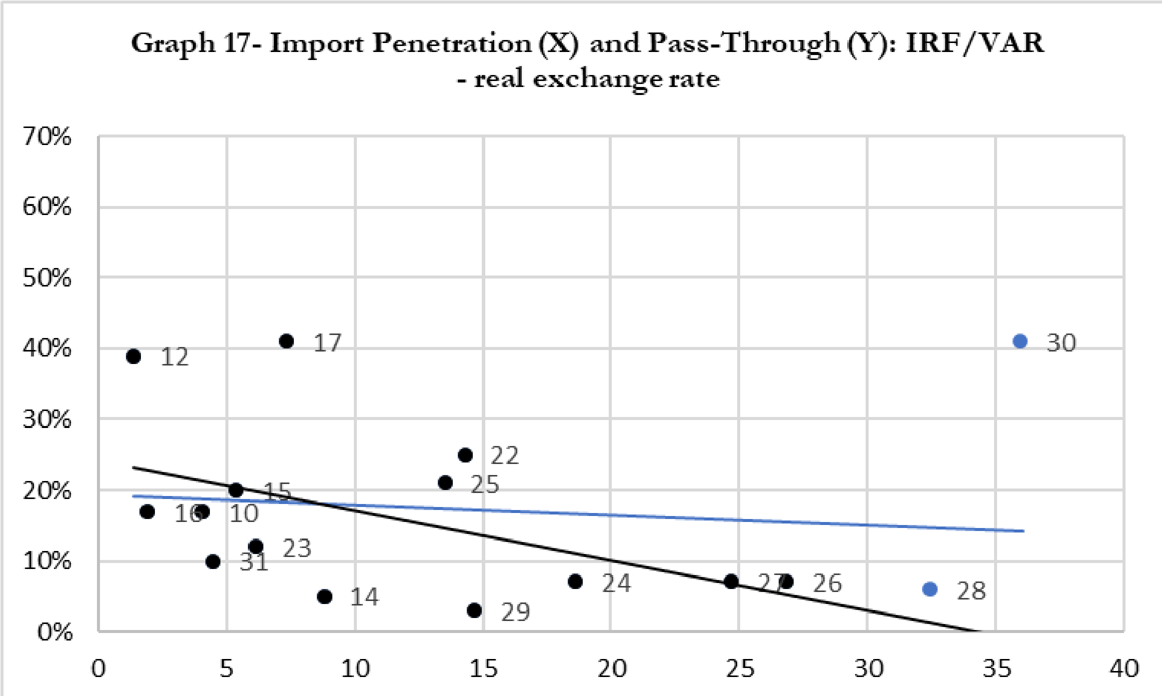


Both graphs suggest a negative association between competition among firms and pass-through. National firms nestled in an industry with a fierce (weak) competition with foreign firms have lower (higher) pass-through. The correlogram for the average import penetration over the period 2010-2018 and the estimated pass-through (standardized) and the FEVD (using nominal and effective exchange rate) are reported in what follows.

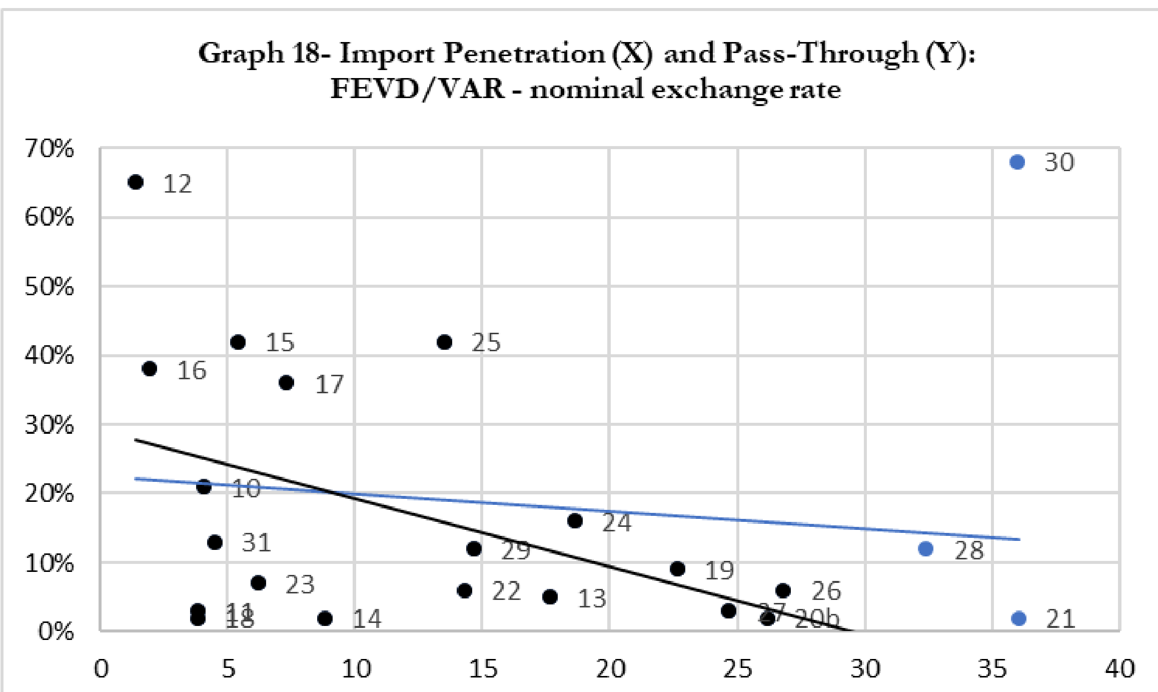
Graph 5. 16 – Import Penetration and Pass-Through: IRF-VAR using the nominal exchange rate



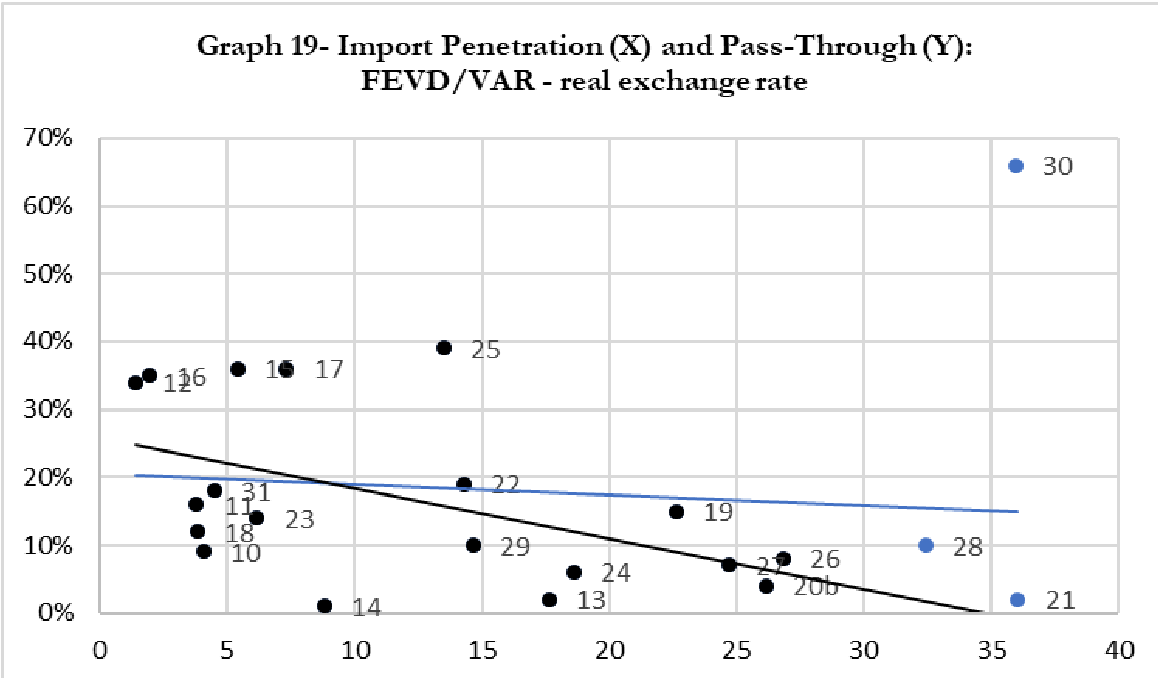
Graph 5. 17 – Import Penetration and Pass-Through: IRF-VAR using the real exchange rate



Graph 5. 18 – Import Penetration and Pass-Through: FEVD/VAR using nominal exchange rate



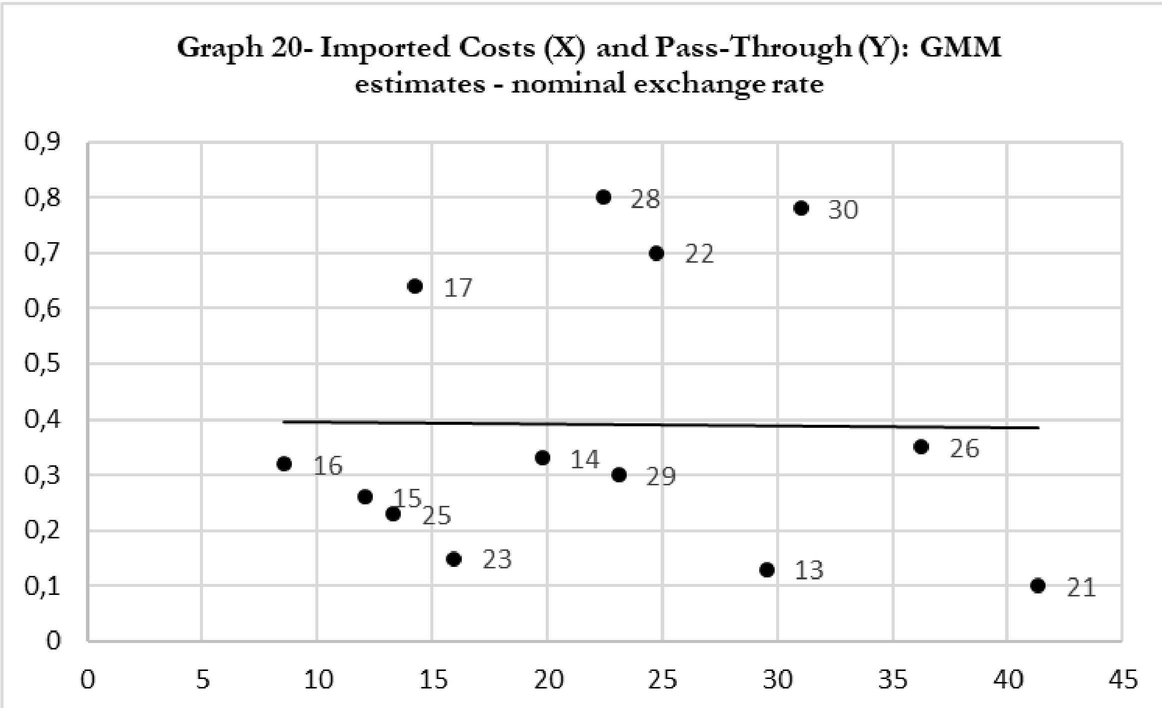
Graph 5. 19 – Import Penetration and Pass-Through: FEVD/VAR using the real exchange rate



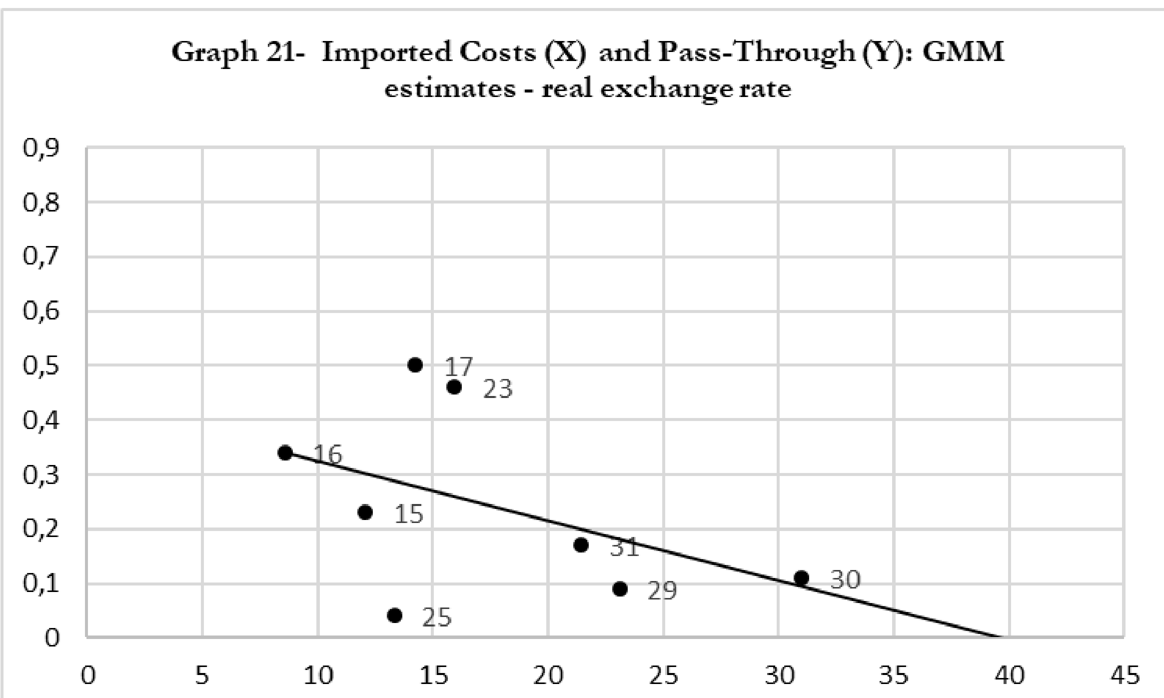
The previous results are confirmed. The correlogram suggests a negative association between pass-through estimated by VAR and competition among national and foreign firms. Such pattern is also valid for FEVD, which indicates that exchange rate explains more the price changes of sectors less exposed to competition with foreign firms.

Graphs 20 and 21 report the correlogram for the average share of imported inputs in costs and the estimated pass-through by GMM using nominal and effective exchange rate.

Graph 5. 20 – Imported Costs and Pass-Through: GMM estimates using the nominal exchange rate

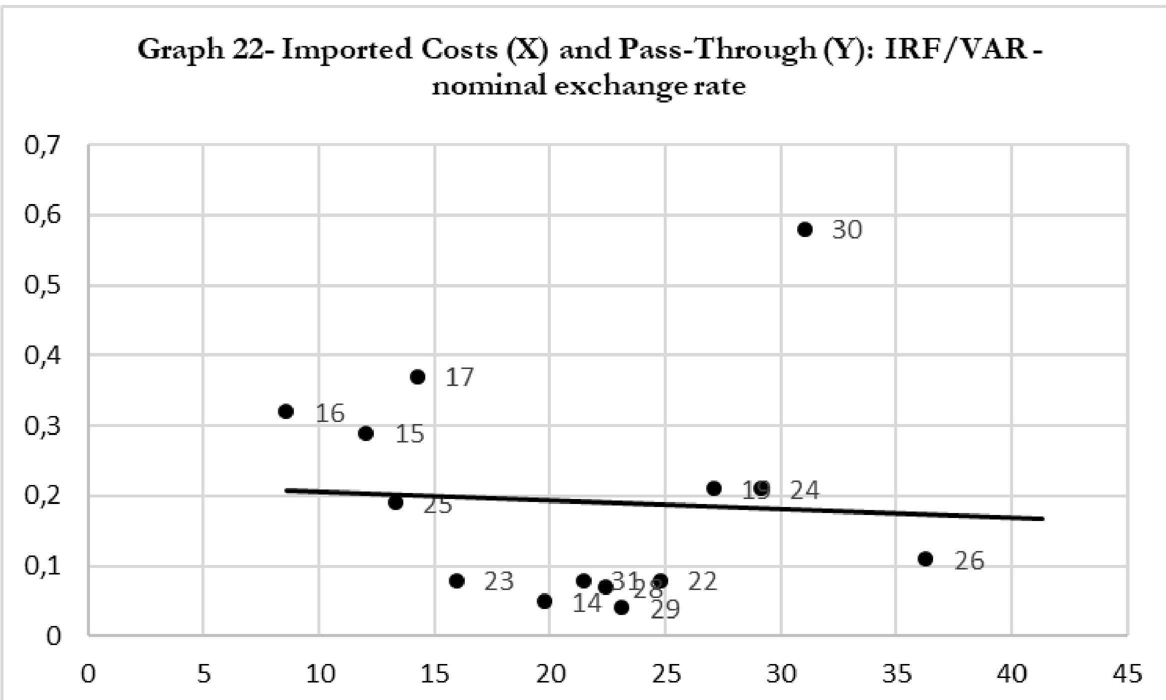


Graph 5. 21 – Imported Costs and Pass-Through: GMM estimates the using real exchange rate

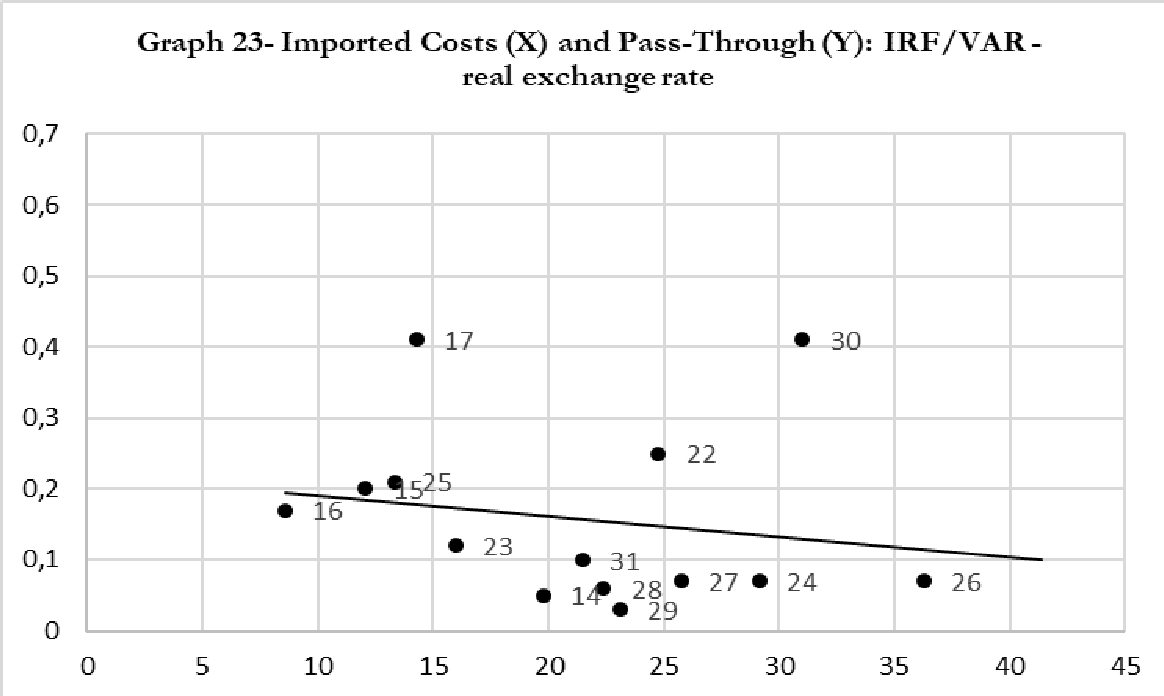


While the correlogram using the pass-through estimated employing the nominal exchange rate produced a horizontal line (which does not allow to identify pattern between the variables). The correlogram using the pass-through estimated employing the effective exchange rate suggests a negative association between imported inputs' share in costs and pass-through. Thus, the higher (lower) is the share of imported inputs in costs, the weaker (stronger) is the pass-through. The correlogram for the average share of imported inputs in costs over the period 2010-2018 and the estimated pass-through (standardized) and the FEVD (using nominal and effective exchange rate) are reported below.

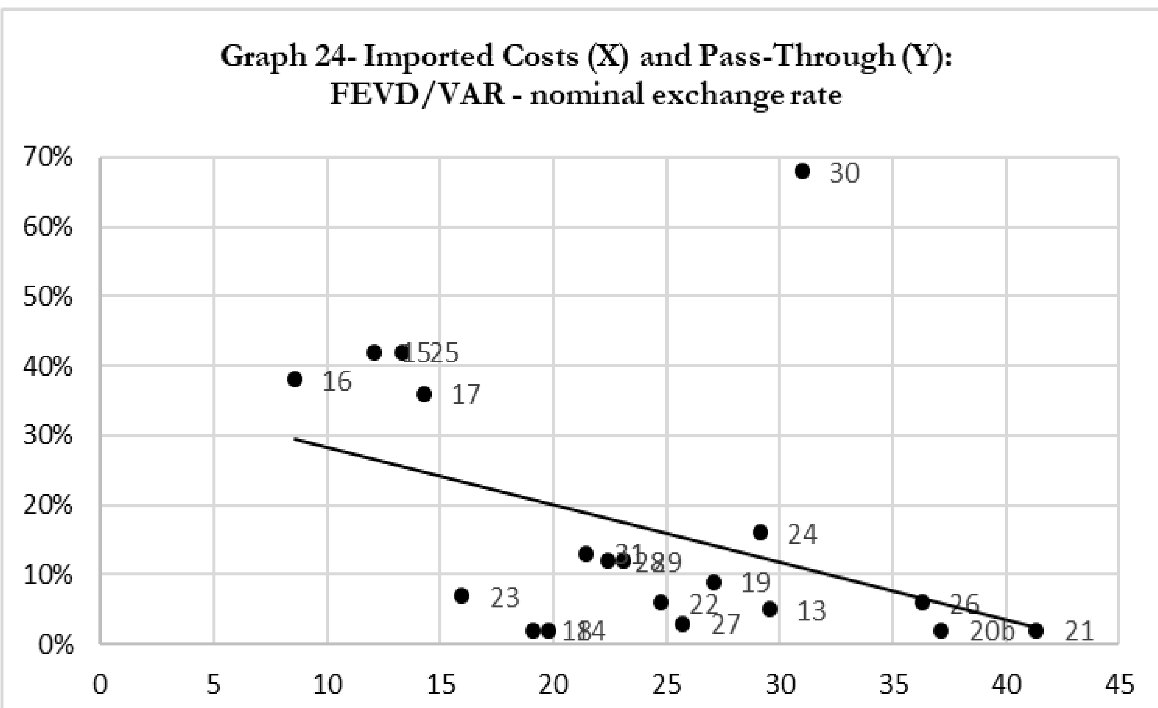
Graph 5. 22 – Imported Costs and Pass-Through: IRF-VAR using the nominal exchange rate



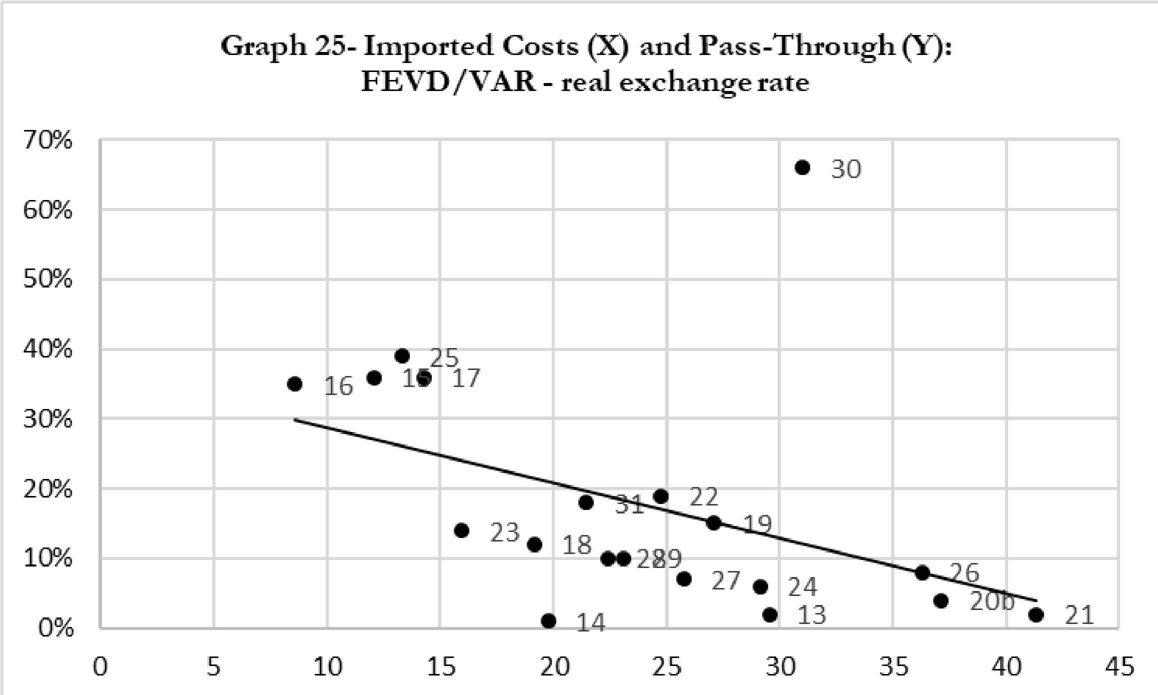
Graph 5. 23 – Imported Costs and Pass-Through: IRF-VAR using the real exchange rate



Graph 5. 24 – Imported Costs and Pass-Through: FEVD-VAR using the nominal exchange rate



Graph 5. 25 - Imported Costs and Pass-Through: FEVD-VAR using the real exchange rate



The correlograms suggest a negative association between pass-through estimated by VAR and the share of imported inputs in costs, even that it is weaker for the pass-through of the nominal exchange rate. Such a negative association also applies to the FEVD and indicates that exchange the rate explains more the price changes of sectors with the least share of imported inputs in costs. Although this result is counter-intuitive, the argument is that the firms with a higher share of imported inputs in costs are nested within an industry more exposed to competition with foreign firms (as Graph 13 has shown). This way, those firms cannot pass on the higher cost due to devaluations of exchange rate into prices, which is absorbed in a reduced markup rate, as Arestis and Milberg (1993) have argued.

Concluding Remarks

The objective of this article was twofold. The first goal was understanding the effect of exchange rate on prices using the Kaleckian cost-push approach. The basic model has indicated that the exchange rate pass-through on prices is associated with firms' cost structure and wage growth. The higher the share of imported inputs (salaries) in costs, the greater is the effects of exchange rate (wage growth) in prices. Furthermore, the necessary condition for a stable inflation, combined with an exchange rate regime for development, is that workers or entrepreneurs accommodate the expanded costs due to a weak national currency via lower real wages/markup rate.

By endogenizing the markup rate to exchange rate, the extended model indicated that the necessary condition for stable inflation over time combined with an exchange rate regime for development is that wages reduce at the same pace that prices change due to exchange rate devaluations, everything else constant. However, by considering the effects of the exchange rate on productive structure, the results indicated that the structural change induced by a weak exchange rate might reinforce/mitigate the distributive effects of exchange rate devaluations. That is, industrialization reduces the dependence on imports. Hence, the exchange rate pass-through on prices falls, which opens the room to increase the markup rate or to mitigate the distributive effects on workers by allowing the real growth in wages with stable inflation over time.

The structuralist notion of neutral inflation was introduced into the extended Kaleckian model. The results indicated that the social conflict between workers and entrepreneurs around the real income potentializes the inflationary effects of exchange rate devaluations on prices. The greater the labor costs are, the stronger the inflation without distributive effects within an economy under an exchange rate regime for development. Numerical simulations evidenced that the exchange rate pass-through on prices is stronger (weaker) in economies in which the sectors under regime of slow (fast) pace of technological progress prevails. In this regard, the strengthening of social conflict because of a higher markup rate induced by exchange rate devaluations or increased salaries is especially determining of exchange rate pass-through in economies with a productive structure that is less advanced technologically. Besides, the adoption of industrial policies that increase the sensibility of structural change to exchange rate and the sensibility of imported inputs to industrial development have shown important in order to reduce the inflationary effects of a weak national currency, alleviating the social conflict in an economy under a regime of exchange rate oriented for developed.

The second goal of this article was to provide time-series evidence on the exchange rate pass-through into the prices of manufacturing sectors for the Brazilian economy over the period from 2010 until 2019. The results demonstrated the prevalence of partial pass-through for devaluations of 1% in the exchange rate and a large variation of pass-through across the sectors. A discussion about the empirical findings in light of stylized facts of Brazilian manufacturing sectors indicated three explanations to the differences in pass-through across the sectors. First, there is a positive association between markup rate and pass-through. Sectors with high market power are more capable of passing on the exchange rate devaluations. Second, evidence indicates price-to-market discrimination of export firms because there exists a positive association between export coefficient and pass-through. Export firms absorb devaluations in the exchange rate, increasing their prices (markup rate). Third, results revealed that firms with a high share of imported inputs in costs, inserted in an industry with fierce competition with foreign firms, cannot devaluations of the exchange rate, absorbing it by means of a reduced markup rate.

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Appendix A- Database

Table 5.A 1 - Variables

Variable	Definition	Source	Sample/Obs.
inflation	Producers Price Index: sales prices received by entrepreneurs free of taxes, tariffs, and freight for 2,100 firms classified according to the Standard Industrial Classification 2.0. This variable is used in monthly values, representing the monthly variation (%) of prices in relation to the preceding month. The seasonal adjustment was taken by authors using ARIMA X13 procedure.	Brazilian Institute of Geography and Statistics (IBGE): https://sidra.ibge.gov.br/home/ipp Accessed at 05/27/2020	2010/January – 2019/December: 120 observations
nexchange	Nominal exchange rate (R$/US$): The price of Brazilian currency in American Dollar. This variable is used in monthly values and in growth rates, representing the variation of Real in relation to Dollar. Positive (negative) values denote devaluations (overvaluations).	Institute for Applied Economic Research (IPEA): http://www.ipeadata.gov.br/Default.aspx Accessed at 05/28/2020	2010/January – 2019/December: 120 observations
rexchange	Sectoral effective exchange rate (R$/US$): Calculated as the weighted average of the bilateral real exchange rate with 23 trade partners considering the respective trade share over the years(R$/U$S). This variable is calculated considering the year 2010 as 100 for each sector classified according to the Standard Industrial Classification 2.0, but it is used in first difference to represent growth rate (%). In the case of regressions for the extractive industry and aggregated PPI, it was used the effective exchange rate (non-sectoral) calculated by IPEA.	Institute for Applied Economic Research (IPEA): http://www.ipeadata.gov.br/Default.aspx Accessed at 05/28/2020	2010/January – 2019/December: 120 observations
demand	Industrial production from Monthly Industrial Survey Production (PIM-PF) for all sectors of Standard Industrial Classification 2.0. This variable is used in monthly values, representing the monthly variation (%) of industrial	Brazilian Institute of Geography and Statistics (IBGE): https://sidra.ibge.gov.br/home/ipp Accessed at 05/29/2020	2010/January – 2019/December: 120 observations

	production in relation to the preceding month. The seasonal adjustment was taken by IBGE.		
oil	Price of Brent Crude (US$) on a monthly basis and growth rate (%).	Federal Reserve Bank of ST. Louis: https://fred.stlouisfed.org/series/POILBREUSDM Accessed at 05/29/2020	2010/January – 2019/December: 120 observations

Source: authors

Table 5.A 2 - Manufacturing Sectors (Standard Industrial Classification 2.0 – CNAE)

Code	Sector
10	Food
11	Beverage
12	Tobacco
13	Textile
14	Clothing and Accessories
15	Leather, Leather articles, Travels Items and Footwear
16	Wood Products
17	Cellulose, Paper and Paper Products
18	Printings and Publishing
19	Coke, Products derived from Petroleum and Biofuels
20b	Soap, Detergents, Cleaning products, Cosmetics, Perfumery and Hygiene Products
20c	Other Chemicals
21	Pharmaceuticals Industry
22	Rubber Products and Plastic Material
23	Non-Metallic Mineral
24	Metallurgy
25	Metal Products, Except Machinery and Equipment
26	Computer Equipment, Electronic and Optical Products
27	Machines, and Electrical Materials
28	Machinery and Equipment
29	Motor Vehicles, Trailers and Semi-trailers
30	Other Transport Equipment
31	Furniture

Table 5.A 3 - Descriptive Statistics

	inflation			**rexchange**			**demand**		
	Average	*Std. deviation*	*Min/Max*	*Average*	*Std. deviation*	*Min/Max*	*Average*	*Std. deviation*	*Min/Max*
10	0.65	1.45	-2.05/ 6.08	0.16	3.78	-13.8/ 11.4	0.06	0.06	-18.3/ 20.8
11	0.49	1.33	-1.88/ 8.17	0.20	3.96	-16.5/ 11.6	0.17	5.04	-17.4/ 31.7
12	0.70	2.48	-5.60/ 9.58	0.31	3.87	-12.99/ 8.37	0.66	13.88	-48.3/ 59.3
13	0.49	0.90	-1.72/ 4.35	0.26	3.71	-13.47/ 13.18	-0.32	3.03	-13.7/ 6.6
14	0.26	1.00	-2.48/ 3.91	0.44	4.09	-15.08/ 14.22	-0.08	4.81	-18.4/ 15.3
15	0.39	1.27	-3.37/ 3.88	0.51	4.16	-15.48/ 16.03	-0.29	3.45	-8.5/ 12.2
16	0.45	1.57	-5.09/ 4.76	0.30	4.10	-13.84/ 15.73	0.13	3.60	-16.2/ 19.8
17	0.48	1.76	-5.15/ 5.60	0.23	3.91	-15.11/ 11.90	0.11	3.14	-13.3/ 19
18	0.20	1.61	-4.82/ 5.43	0.29	3.43	-14.32/ 12.85	0.46	11.68	-28.6/ 42.5
19	0.64	2.35	-9.41/ 7.77	0.17	4.74	-11.08/ 14.22	0.07	3.69	-9.8/ 14.2
20b	0.41	1.07	-2.32/ 3.99	0.35	4.35	-12.85/ 13.76	0.12	3.47	-11.6/ 14.8
20c	0.49	1.96	-4.48/ 5.90	0.20	3.28	-11.56/ 11.50	-0.004	2.34	-6.9/ 7.8
21	0.29	0.92	-2.48/ 3.13	0.35	4.23	-17.26/ 14.95	0.13	8.02	-16.6/ 30.7
22	0.39	0.39	-1.11/ 2.27	0.21	3.52	-14.18/ 12.06	-0.10	2.72	-10.4/ 12.9
23	0.14	0.89	-2.81/ 2.22	0.78	4.76	-18.06/ 15.63	-0.11	2.76	-14.4/ 20.8
24	0.38	1.40	-3.67/ 4.17	0.37	4.65	-15.59/ 15.74	-0.20	2.34	-5.7/ 6.5
25	0.39	1.01	-2.79/	0.28	4.06	-15.03/	-0.16	3.59	-10.3/

Non-sectoral variables	
nexchange	
Average	0.74
Std. deviation	4.56
Min/Max	-10.71/ 16.84
oil	
Average	-0.08
Std. deviation	5.35
Min/Max	-16.27/ 10.48

			3.74			13.82			13.8
26	-0.15	1.20	-3.72/4.39	1.09	5.33	-21.07/19.61	-0.18	5.80	-22.1/26.4
27	0.45	0.87	-1.88/3.88	0.30	3.84	-15.27/12.91	-0.19	4.36	-11.8/16.3
28	0.33	0.67	-1.46/2.77	0.42	4.06	-16.40/13.97	-0.18	4.79	-12.3/11.2
29	0.31	0.39	-0.92/1.51	0.50	4.12	-16.17/16.15	0.02	8.01	-33.2/46.3
30	0.63	2.10	-5.24/7.89	0.70	5.01	-16.93/17.77	-0.08	6.45	-17.6/26.5
31	0.49	0.71	-1.31/3.13	0.33	3.90	-14.07/13.87	-0.08	4.76	-14.7/22.4
Extractive Industry	0.45	0.75	-1.87/2.28	0.35	4.35	-12.83/13.76	-0.10	2.24	-12/14.1
Producer Price Index	0.45	0.79	-1.68/2.7	0.35	4.35	-12.83/13.76	-0.09	2.08	-11/12.9

Notes: all variables are strongly balanced

Table 5.A 4 - Unit Roots Tests: Inflation

	Augmented Dickey-Fuller				Phillips-Perron		
Sector/Specification	*constant*	*no constant*	*with trend*	*drift*	*constant*	*no constant*	*with trend*
10	-5.67***	-5.12***	-5.63***	-5.67***	-50.74***	-43.16***	-51.21***
11	-11.05***	-9.85***	-11.49***	-11.05***	-117.50***	-116.01***	-115.44***
12	-7.13***	-6.79***	-7.13***	-7.13***	-62.59***	-60.00***	-62.81***
13	-5.53***	-4.76***	-5.62***	-5.53***	-53.46***	-38.05***	55.48***
14	-13.10***	-12.14***	-13.18***	-13.10***	-130.42***	137.09***	-128.58***
15	-7.53***	-6.95***	-7.76***	-7.35***	-74.26***	-68.84***	-78.28***
16	-7.99***	-7.67***	-7.97***	-7.99***	-78.17***	-74.08***	-78.84***
17	-7.52***	-7.28***	-7.49***	-7.52***	-75.83***	-71.05***	-76.49***
18	-12.22***	-12.07***	-12.18***	-12.22***	-131.20***	-132.09***	-130.96***
19	-7.44***	-7.08***	-7.50***	-7.44***	-61.24***	-60.58***	-61.33***
20b	-13.51***	-11.55***	-13.46***	-13.51***	-142.98***	-150.52***	-142.99***
20c	-6.73***	-6.56***	-6.72***	-6.73***	-60.41***	-57.73***	-61.12***
21	-11.29***	-10.29***	-11.25***	-11.29***	-120.52***	-120.97***	-120.56***
22	-9.20***	-7.06***	9.45***	9.20***	-125.89***	-85.20***	-129.96***
23	-9.55***	-9.35***	-9.58***	-9.55***	-122.56***	-120.72***	-123.05***
24	-9.20***	-8.74***	-9.29***	-9.20***	-99.69***	-96.61***	-99.21***
25	-9.10***	-8.09***	-9.11***	-9.10***	-93.13***	-88.05***	-93.11***
26	-10.15***	-10.03***	-10.46***	-10.15***	-122.29***	-122.03***	-121.95***
27	-10.45***	-8.51***	-10.42***	-10.45***	-126.85***	-107.70***	-126.41***
28	-10.89***	-8.89***	-11.05***	-10.89***	-130.53***	-115.05***	-129.84***
29	-8.67***	-5.98***	-9.35***	-8.67***	-94.79***	-56.26***	-98.63***
30	-7.29***	-6.90***	-7.26***	-7.29***	-68.03***	-64.17***	-68.04***
31	-10.45***	-7.53***	-10.43***	-10.45***	-112.94***	-88.64***	-13.33***
Extractive Industry	-6.11***	-5.11***	-6.07***	-6.11***	-51.89***	-39.96***	-51.69***
Producer Price Index	-6.25***	-5.31***	-6.22***	-6.25***	-53.21***	-42.49***	-53.13***

Notes: (1) The null hypothesis of both tests is that a unit root is present in the time series, the alternative hypothesis is stationarity; (2) 1% critical value is between parenthesis; (3) *, ** and *** mean statistically significant at 1%, 5% and 10%, respectively; critical values of Augmented Dickey-Fuller at 1% are: -3.50 (constant), -2.95 (no constant), -4.03 (with trend) and -2.35 (drift), critical values of Phillips-Perron at 1% are: -19.86 (constant), -13.33 (no constant) and -27.50 (with trend)

Table 5.A 5 - Unit Roots Tests: Sectoral Effective Exchange Rate

	Augmented Dickey-Fuller				Phillips-Perron		
Sector	*constant*	*no constant*	*with trend*	*drift*	*constant*	*no constant*	*with trend*
10	-8.69***	-8.72***	-8.64***	-8.69***	-89.38***	-89.44***	-89.36***
11	-9.99***	-10.01***	-9.96***	-9.99***	-94.90***	-95.12***	-94.97***
12	-10.60***	-10.59***	-10.62***	-10.60***	-110.61***	-111.14***	-111.01***
13	-8.79***	-8.79***	-8.76***	-8.79***	-89.49***	-89.51***	89.64***
14	-9.22***	-9.17***	-9.18***	-9.22***	-94.35***	-94.37***	-94.38***
15	-8.53***	-8.45***	-8.52***	-8.53***	-87.35***	-87.16***	-87.77***
16	-8.72***	-8.72***	-8.68***	-8.72***	-88.67***	-88.70	-88.74
17	-9.88***	-9.89***	-9.85***	-9.88***	-98.88***	-99.01***	-99.08***
18	-9.41***	-9.40***	-9.37***	-9.41***	-92.20***	-92.39***	-92.18***
19	-9.68***	-9.71***	-9.64***	-9.68***	-86.06***	-86.21***	-86.01***
20b	-8.71***	-8.70***	-8.68***	-8.71***	-85.91***	-85.94***	-85.97***
20c	-9.32***	-9.32***	-9.29***	-9.32***	-86.43***	-86.71***	-86.56***
21	-9.16***	-9.15***	-9.12***	-9.16***	-96.52***	-96.50***	-96.57***
22	-9.12***	-9.13***	-9.08***	-9.12***	-87.86***	-88.01***	-87.96***
23	-9.02***	-8.87***	-8.99***	-9.02***	-93.40***	-93.12***	-93.51***
24	-8.52***	-8.51***	-8.49***	-8.52***	-83.51***	-83.57***	-83.40***
25	-9.52***	-9.52***	-9.47***	-9.52***	-95.85***	-95.97***	-95.84***
26	-8.99***	-8.74***	-8.96***	-8.99***	-86.03***	-85.93***	-86.08***
27	-9.75***	-9.74***	-9.71***	-9.75***	-96.43***	-96.63***	-96.47***
28	-8.89***	-8.85***	-8.85***	-8.89***	-88.90***	-88.92***	-88.86***
29	-8.44***	-8.38***	-8.41***	-8.44***	-85.09***	-84.85***	-85.06***
30	-9.02***	-8.92***	-8.98***	-9.02***	-89.31***	-89.30***	-89.37***
31	-9.02***	-9.00***	-8.98***	-9.02***	-92.10***	-92.17***	-92.19***
Extractive Industry	-8.71***	-8.70***	-8.68***	-8.71***	-85.91***	-85.94***	-85.97***
Producer Price Index	-8.71***	-8.70***	-8.68***	-8.71***	-85.91***	-85.94***	-85.97***

Notes: (1) The null hypothesis of both tests is that a unit root is present in the time series, the alternative hypothesis is stationarity; (2) 1% critical value is between parenthesis; (3) *, ** and *** mean statistically significant at 1%, 5% and 10%, respectively; critical values of Augmented Dickey-Fuller at 1% are: -3.50 (constant), -2.95 (no constant), -4.03 (with trend) and -2.35 (drift), critical values of Phillips-Perron at 1% are: -19.86 (constant), -13.33 (no constant) and -27.50 (with trend)

Table 5.A 6 - Unit Roots Tests: Demand

	Augmented Dickey-Fuller				Phillips-Perron		
Sector	*constant*	*no constant*	*with trend*	*drift*	*constant*	*no constant*	*with trend*
10	-17.32***	-17.39***	-17.25***	-17.32***	-151.24***	-151.26***	151.25***
11	-16.08***	-16.02***	-16.08***	-16.08***	-135.95***	-135.99***	-135.75***
12	-12.38***	-12.40***	-12.34***	-12.38***	-115.23***	-115.55***	-115.23***
13	-13.48***	-13.31***	-13.61***	-13.48***	-139.39***	-141.45***	-137.32***
14	-17.12***	-17.17***	-17.07***	-17.12***	-147.84***	-148.14***	-147.75***
15	-14.80***	-14.75***	-14.77***	-14.80***	-140.25***	-140.87***	-139.78***
16	-16.37***	16.40***	-16.36***	-16.37***	-149.06***	-149.38***	-148.47***
17	-17.83***	-17.85***	-17.75***	-17.83***	-151.23***	-151.67***	-151.22***
18	-13.35***	-13.40***	-13.46***	-13.35***	-115.86***	-115.78***	-116.05***
19	14.80***	14.85***	-14.73***	-14.80***	-135.39***	-135.53***	-135.31***
20b	-14.04***	-14.08***	-13.99***	-14.04***	-117.72***	-117.95***	-117.68***
20c	-13.01***	-13.06***	-12.97***	-13.01***	-115.61***	-115.69***	-115.81***
21	-16.48***	-16.54***	-16.41***	-16.48***	-140.20***	-140.38***	-140.19***
22	-14.00***	14.04***	-13.95***	-14.00***	-131.48***	-131.79***	-131.44***
23	-17.03***	-17.06***	-16.99***	-17.03***	-159.25***	-159.58***	-159.07***
24	-11.05***	-11.45***	-11.45***	-11.50***	-115.75***	-116.31***	-115.80***
25	-15.21***	-15.19***	-15.18***	-15.21***	-154.38***	-155.36***	-153.36***
26	-12.89***	-12.94***	-12.84***	-12.89***	-135.91***	-136.01***	-135.86***
27	-15.62***	-15.64***	-15.56***	-15.62***	-149.41***	-149.86***	-149.36***
28	-15.49***	-15.54***	-15.43***	-15.49***	-143.68***	-143.86***	-143.78***
29	-16.50***	-16.57***	-16.45***	-16.50***	-154.08***	-154.09***	-153.76***
30	-16.16***	-16.23***	-16.27***	-16.16***	-143.72***	-143.75***	-142.06***
31	-16.57***	-16.63***	-16.51***	-16.57***	-159.00***	-159.14***	-159.13***
Extractive Industry	-16.32***	-16.33***	-16.26***	-16.32***	-152.18***	-152.87***	-152.11***
Producer Price Index	-16.53***	-16.53***	-16.45***	-16.52***	-152.37***	-153.08***	-152.43***

Notes: (1) The null hypothesis of both tests is that a unit root is present in the time series, the alternative hypothesis is stationarity; (2) 1% critical value is between parenthesis; (3) *, ** and *** mean statistically significant at 1%, 5% and 10%, respectively; critical values of Augmented Dickey-Fuller at 1% are: -3.50 (constant), -2.95 (no constant), -4.03 (with trend) and -2.35 (drift), critical values of Phillips-Perron at 1% are: -19.86 (constant), -13.33 (no constant) and -27.50 (with trend)

Table 5.A 7 - Unit Roots Tests: Other variables

	Augmented Dickey-Fuller				Phillips-Perron		
	constant	*no constant*	*with trend*	*drift*	*constant*	*no constant*	*with trend*
oil	-7.80***	-7.84***	-7.78***	-7.80***	-73.06***	-73.07***	-73.16***
nexchange	-7.78***	-11.91***	-11.58***	-11.86***	-134.23***	-135.68***	-134.35***

Notes: (1) The null hypothesis of both tests is that a unit root is present in the time series, the alternative hypothesis is stationarity; (2) 1% critical value is between parenthesis; (3) *, ** and *** mean statistically significant at 1%, 5% and 10%, respectively; critical values of Augmented Dickey-Fuller at 1% are: -3.50 (constant), -2.95 (no constant), -4.03 (with trend) and -2.35 (drift), critical values of Phillips-Perron at 1% are: -19.86 (constant), -13.33 (no constant) and -27.50 (with trend)

Appendix B- GMM estimates

Table 5.B 1 - Pass-Through effect (nominal exchange rate): Model 1 using the lags 11-27 of exchange rate variable as instruments

Parameter/ Sector	b_1	b_2	b_3	b_4	b_5	b_6	b_7	b_8	b_9	b_{10}	b_{11}	b_{12}	Hansen's J
10	0.06 (0.06)	0.12** (0.05)	-0.02 (0.09)	-0.19* (0.10)	-0.10 (0.08)	-0.006 (0.07)	0.02 (0.08)	-0.03 (0.07)	0.12* (0.07)	0.14* (0.07)	0.14* (0.07)	0.14** (0.06)	0.88 p-value: 0.92
11	0.03 (0.10)	0.009 (0.04)	0.09 (0.07)	-0.01 (0.11)	0.02 (0.08)	-0.02 (0.06)	-0.06 (0.05)	-0.01 (0.11)	-0.12 (0.13)	0.01 (0.07)	-0.01 (0.05)	0.006 (0.12)	1.90 p-value: 0.75
12	0.42*** (0.12)	0.32** (0.16)	0.03 (0.15)	-0.07 (0.19)	-0.27* (0.15)	0.28** (0.12)	-0.03 (0.12)	-0.02 (0.12)	0.13 (0.12)	-0.09 (0.10)	0.04 (0.09)	-0.04 (0.14)	0.46 p-value: 0.97
13	-0.01 (0.02)	0.05 (0.05)	0.06 (0.04)	0.001 (0.05)	0.01 (0.03)	-0.04 (0.03)	-0.02 (0.03)	0.007 (0.03)	0.007 (0.03)	0.07*** (0.02)	-0.006 (0.02)	0.06*** (0.02)	2.35 p-value: 0.66
14	0.21* (0.10)	-0.02 (0.08)	-0.01 (0.07)	-0.09 (0.09)	0.05 (0.05)	0.11 (0.08)	-0.04 (0.10)	0.01 (0.06)	0.00004 (0.07)	0.02 (0.06)	0.12** (0.06)	0.05 (0.07)	1.22 p-value: 0.87
15	0.23*** (0.03)	0.11 (0.09)	0.09 (0.07)	-0.005 (0.12)	-0.09 (0.06)	0.09** (0.03)	-0.06* (0.03)	-0.05 (0.08)	-0.03 (0.06)	-0.07 (0.06)	-0.02 (0.07)	-0.01 (0.08)	1.96 p-value: 0.74
16	0.32*** (0.08)	0.13 (0.09)	0.11 (0.07)	0.02 (0.12)	-0.08 (0.11)	0.10 (0.07)	-0.08 (0.11)	0.07 (0.08)	0.01 (0.07)	-0.04 (0.09)	-0.03 (0.10)	-0.02 (0.11)	7.63 p-value: 0.106
17	0.33*** (0.12)	0.31* (0.18)	0.10 (0.09)	0.07 (0.18)	-0.07 (0.13)	0.19 (0.11)	0.009 (0.18)	0.03 (0.09)	-0.02 (0.13)	-0.24 (0.16)	-0.09 (0.15)	-0.15 (0.13)	2.25 p-value: 0.68
18	-0.05 (0.12)	-0.01 (0.16)	-0.03 (0.14)	-0.17* (0.09)	0.06 (0.08)	-0.04 (0.14)	-0.03 (0.12)	0.07 (0.09)	0.07 (0.12)	0.06 (0.05)	0.03 (0.06)	0.08 (0.08)	2.93 p-value: 0.56
19	-0.22 (0.23)	0.27 (0.19)	0.34 (0.28)	0.34 (0.36)	0.22 (0.26)	-0.08 (0.29)	0.19 (0.23)	-0.01 (0.24)	-0.16 (0.21)	-0.07 (0.17)	-0.03 (0.19)	-0.20 (0.19)	0.87 p-value: 0.92
20b	-0.06 (0.06)	0.01 (0.10)	-0.08 (0.13)	0.14 (0.21)	-0.12 (0.14)	0.01 (0.07)	0.02 (0.11)	0.11 (0.08)	0.03 (0.10)	0.02 (0.12)	0.10 (0.08)	-0.22* (0.11)	0.99 p-value: 0.91

20c	0.14	0.35***	0.28**	0.11	0.06	0.03	0.09	-0.13	-0.05	-0.06	-0.07	-0.02	2.14
	(0.09)	(0.11)	(0.13)	(0.08)	(0.13)	(0.14)	(0.16)	(0.13)	(0.10)	(0.13)	(0.12)	(0.11)	p-value: 0.70
21	0.01	-0.02	-0.06	0.06	-0.08	-0.05	-0.03	-0.02	0.02	0.04	0.08	0.10*	2.85
	(0.05)	(0.07)	(0.07)	(0.09)	(0.06)	(0.06)	(0.06)	(0.07)	(0.06)	(0.06)	(0.05)	(0.05)	p-value: 0.58
22	0.05	0.03	0.07	-0.007	0.06	0.07**	-0.02	0.03	0.007	0.006	-0.01	0.01	3.62
	(0.03)	(0.03)	(0.04)	(0.03)	(0.05)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.01)	(0.03)	p-value: 0.45
23	-0.01	0.24**	-0.12	0.18	0.01	0.08	0.11	0.05	0.08	-0.09*	0.01	-0.04	0.58
	(0.09)	(0.11)	(0.10)	(0.13)	(0.15)	(0.06)	(0.14)	(0.06)	(0.08)	(0.05)	(0.08)	(0.10)	p-value: 0.96
24	0.06	-0.04	0.15	-0.08	0.05	-0.17	0.21	-0.09	0.11	-0.12	0.08	0.05	0.62
	(0.08)	(0.07)	(0.14)	(0.15)	(0.18)	(0.20)	(0.17)	(0.13)	(0.09)	(0.10)	(0.14)	(0.10)	p-value: 0.62
25	-0.01	0.18***	0.12***	0.02	-0.004	-0.01	0.04	-0.03	-0.05	-0.7**	-0.006	-0.003	3.07
	(0.03)	(0.07)	(0.04)	(0.05)	(0.05)	(0.03)	(0.04)	(0.05)	(0.04)	(0.03)	(0.04)	(0.04)	p-value: 0.54
26	0.003	0.17*	-0.14	-0.07	0.01	-0.001	0.07	0.02	0.18*	-0.01	-0.01	0.009	3.73
	(0.07)	(0.10)	(0.12)	(0.11)	(0.11)	(0.06)	(0.09)	(0.09)	(0.11)	(0.07)	(0.03)	(0.08)	p-value: 0.44
27	0.06	0.08	0.04	0.03	-0.20**	0.16***	-0.04	-0.06	0.03	-0.06	0.02	-0.07	1.46
	(0.06)	(0.10)	(0.09)	(0.12)	(0.08)	(0.04)	(0.09)	(0.11)	(0.06)	(0.06)	(0.08)	(0.08)	p-value: 0.83
28	0.02	0.05	0.08**	0.01	0.01	-0.03	0.009	0.04	-0.01	0.04	-0.07	0.0005	2.51
	(0.06)	(0.03)	(0.03)	(0.06)	(0.06)	(0.07)	(0.07)	(0.05)	(0.03)	(0.02)	(0.04)	(0.05)	p-value: 0.64
29	0.02	0.05**	0.004	0.01	-0.02	0.03**	0.01	-0.004	-0.0009	-0.05***	0.002	-0.01	6.26
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.02)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	p-value: 0.18
30	0.37***	0.31*	0.04	-0.01	-0.14*	0.24***	-0.003	0.01	0.13	-0.12	0.001	-0.04	0.82
	(0.09)	(0.16)	(0.10)	(0.17)	(0.08)	(0.07)	(0.11)	(0.11)	(0.08)	(0.09)	(0.09)	(0.12)	p-value: 0.93
31	0.09***	0.10	0.02	0.03	-0.04	0.04	-0.007	-0.008	0.01	-0.10**	0.03	0.005	1.28
	(0.03)	(0.07)	(0.03)	(0.05)	(0.06)	(0.05)	(0.05)	(0.04)	(0.05)	(0.04)	(0.05)	(0.06)	p-value: 0.86
Extractive	0.04	0.16***	0.04**	0.02	-0.01	0.01	0.02	-0.02	0.03	-0.02	0.02	-0.01	3.84
Industry	(0.02)	(0.05)	(0.02)	(0.06)	(0.04)	(0.03)	(0.05)	(0.04)	(0.02)	(0.02)	(0.03)	(0.03)	p-value: 0.42

Producer Price Index	0.04 (0.03)	0.18*** (0.04)	0.03 (0.03)	0.05 (0.06)	0.01 (0.05)	-0.007 (0.03)	0.03 (0.05)	-0.03 (0.04)	0.02 (0.03)	-0.02 (0.02)	0.03 (0.03)	-0.002 (0.02)	1.43 p-value: 0.83

Notes: (1) The estimated equation is $inflation_t = b_0 + b_1\ nexchange_t + b_2\ nexchange_{t-1} + b_3\ nexchange_{t-2} + b_4\ nexchange_{t-3} + b_5\ nexchange_{t-4} + b_6\ nexchange_{t-5} + b_7\ nexchange_{t-6} + b_8\ nexchange_{t-7} + b_9\ nexchange_{t-8} + b_{10}\ nexchange_{t-9} + b_{11}\ nexchange_{t-10} + b_{12}\ nexchange_{t-11} + e_t$, the constant b_0 is not reported; (2) The number of parameters is 13 and 17 moments are employed (lags 11-27 of exchange rate variable); (2) The HAC standard error are based on Bartlett Kernel with its lags chosen by Newey -West method; (3) *, ** and *** mean statistically significant at 1%, 5% and 10%, respectively.

Table 5.B 2 - Pass-Through effect (nominal exchange rate): Model 1 using the lags 11-28 of exchange rate variable as instruments

Parameter/ Sector	b_1	b_2	b_3	b_4	b_5	b_6	b_7	b_8	b_9	b_{10}	b_{11}	b_{12}	Hansen's J
10	0.06 (0.06)	0.13** (0.05)	-0.01 (0.07)	-0.18* (0.10)	-0.09 (0.06)	-0.008 (0.07)	0.02 (0.06)	-0.04 (0.08)	0.11* (0.07)	0.14** (0.07)	0.14** (0.05)	0.14** (0.06)	1.00 p-value: 0.96
11	0.03 (0.10)	-0.008 (0.04)	0.11* (0.06)	-0.04 (0.10)	0.01 (0.06)	-0.04 (0.06)	-0.06 (0.05)	0.001 (0.10)	-0.14 (0.12)	0.01 (0.07)	-0.03 (0.05)	0.02 (0.09)	2.20 p-value: 0.81
12	0.44*** (0.12)	0.34* (0.18)	-0.001 (0.13)	-0.008 (0.14)	-0.29*** (0.10)	0.31*** (0.14)	-0.03 (0.14)	-0.05 (0.14)	0.16 (0.11)	-0.11 (0.10)	0.06 (0.10)	-0.08 (0.07)	0.54 p-value: 0.99
13	-0.004 (0.04)	0.06 (0.05)	0.02 (0.04)	0.04 (0.05)	-0.0002 (0.05)	-0.05* (0.03)	-0.02 (0.04)	-0.02 (0.04)	0.02 (0.03)	0.06* (0.03)	0.003 (0.03)	0.02 (0.02)	5.59 p-value: 0.34
14	0.19* (0.10)	-0.003 (0.08)	-0.03 (0.05)	-0.07 (0.08)	0.05 (0.04)	0.10 (0.09)	-0.02 (0.09)	0.008 (0.06)	0.01 (0.06)	0.01 (0.04)	0.11** (0.05)	0.02 (0.05)	1.40 p-value: 0.92
15	0.23*** (0.04)	0.12 (0.10)	0.06 (0.04)	0.03 (0.10)	-0.10** (0.05)	0.12*** (0.04)	-0.06 (0.06)	-0.05 (0.08)	-0.004 (0.03)	-0.09 (0.07)	-0.01 (0.07)	-0.06 (0.06)	2.68 p-value: 0.74
16	0.33*** (0.09)	0.16 (0.11)	0.10 (0.07)	0.05 (0.12)	-0.10 (0.09)	0.10 (0.07)	-0.09 (0.12)	0.09 (0.10)	0.04 (0.05)	-0.07 (0.08)	-0.03 (0.12)	-0.07 (0.09)	7.79 p-value: 0.16
17	0.33*** (0.11)	0.32* (0.18)	0.07 (0.10)	0.12 (0.19)	-0.06 (0.12)	0.21 (0.13)	0.01 (0.15)	0.01 (0.08)	0.005 (0.13)	-0.26 (0.17)	-0.08 (0.12)	-0.17 (0.13)	2.04 p-value: 0.84
18	-0.07 (0.11)	0.02 (0.17)	-0.02 (0.12)	-0.16* (0.09)	0.06 (0.07)	-0.03 (0.13)	0.002 (0.11)	-0.006 (0.08)	0.05 (0.08)	0.04 (0.05)	0.04 (0.05)	0.13*** (0.05)	3.54 p-value: 0.61
19	-0.18 (0.22)	0.21 (0.16)	0.34 (0.25)	0.30 (0.40)	0.24 (0.23)	-0.05 (0.31)	0.13 (0.21)	0.09 (0.23)	-0.19 (0.20)	-0.06 (0.21)	-0.05 (0.19)	-0.31 (0.25)	1.06 p-value: 0.95
20b	-0.08 (0.05)	-0.01 (0.07)	-0.05 (0.07)	0.08 (0.13)	-0.10 (0.08)	-0.007 (0.07)	0.01 (0.08)	0.10 (0.07)	0.03 (0.09)	0.05 (0.08)	0.11* (0.06)	-0.11** (0.04)	2.95 p-value: 0.70
20c	0.15* (0.09)	0.36*** (0.12)	0.25** (0.11)	0.13 (0.08)	0.03 (0.10)	0.03 (0.13)	0.08 (0.17)	-0.13 (0.13)	-0.01 (0.09)	-0.06 (0.12)	-0.04 (0.10)	-0.06 (0.10)	2.39 p-value: 0.80

21	0.02	-0.01	-0.09	0.09	-0.09	-0.03	-0.02	-0.01	0.03	0.03	0.08	0.06	3.17
	(0.05)	(0.07)	(0.06)	(0.08)	(0.06)	(0.06)	(0.05)	(0.07)	(0.05)	(0.05)	(0.05)	(0.04)	p-value: 0.67
22	0.05	0.01	0.06	-0.008	0.06	0.07**	-0.04	0.04	0.0007	0.003	-0.01	0.002	3.55
	(0.03)	(0.04)	(0.05)	(0.04)	(0.05)	(0.02)	(0.03)	(0.04)	(0.04)	(0.03)	(0.02)	(0.02)	p-value: 0.61
23	-0.02	0.24*	-0.06	0.15	0.05	0.07*	0.12	0.01	0.04	-0.07*	0.002	0.03	2.23
	(0.08)	(0.14)	(0.07)	(0.14)	(0.10)	(0.04)	(0.15)	(0.07)	(0.07)	(0.04)	(0.07)	(0.05)	p-value: 0.81
24	-0.03	0.20	-0.11	0.11	-0.17	0.09	0.03	-0.09	0.11	-0.10	0.06	-0.05	4.81
	(0.09)	(0.15)	(0.12)	(0.11)	(0.11)	(0.06)	(0.12)	(0.11)	(0.11)	(0.08)	(0.10)	(0.04)	p-value: 0.43
25	-0.01	0.19***	0.12***	0.02	-0.007	-0.02	0.05	-0.04	-0.06	-0.07*	-0.01	0.01	3.10
	(0.02)	(0.06)	(0.04)	(0.05)	(0.05)	(0.03)	(0.04)	(0.03)	(0.05)	(0.03)	(0.05)	(0.04)	p-value: 0.68
26	0.01	0.17*	-0.14	-0.05	0.05	0.0001	0.06	0.02	0.17*	-0.008	-0.01	0.004	4.44
	(0.08)	(0.09)	(0.09)	(0.10)	(0.10)	(0.12)	(0.12)	(0.10)	(0.09)	(0.08)	(0.05)	(0.06)	p-value: 0.48
27	0.07	0.10	0.03	0.06	-0.18**	0.18***	-0.04	-0.09	0.04	-0.06	0.03	-0.08**	2.24
	(0.05)	(0.11)	(0.06)	(0.09)	(0.07)	(0.05)	(0.11)	(0.12)	(0.05)	(0.05)	(0.07)	(0.03)	p-value: 0.81
28	0.01	0.05	0.09***	0.005	0.01	-0.03	0.02	0.04	-0.01	0.04*	-0.07*	0.008	2.46
	(0.05)	(0.03)	(0.03)	(0.06)	(0.04)	(0.07)	(0.07)	(0.05)	(0.03)	(0.02)	(0.04)	(0.03)	p-value: 0.78
29	0.03	0.05**	-0.007	0.02	-0.03	0.04*	0.01	-0.01	0.01	-0.06**	0.01	-0.01	5.53
	(0.02)	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	p-value: 0.35
30	0.38***	0.34*	-0.0001	0.05	-0.17***	0.27***	0.001	-0.01	0.17*	-0.14	0.03	-0.08	0.75
	(0.09)	(0.18)	(0.11)	(0.15)	(0.06)	(0.09)	(0.14)	(0.13)	(0.09)	(0.09)	(0.09)	(0.06)	p-value: 0.97
31	0.10***	0.09	0.03	0.02	-0.02	0.04	-0.01	-0.01	0.005	-0.10**	0.03	0.03	1.71
	(0.03)	(0.08)	(0.03)	(0.03)	(0.04)	(0.05)	(0.05)	(0.04)	(0.05)	(0.04)	(0.04)	(0.04)	p-value: 0.88
Extractive	0.05**	0.16***	0.03	0.04	-0.01	0.03	0.02	-0.01	0.03	-0.03	0.02	-0.03	4.52
Industry	(0.02)	(0.05)	(0.02)	(0.06)	(0.04)	(0.03)	(0.05)	(0.04)	(0.02)	(0.02)	(0.03)	(0.03)	p-value: 0.47
Producer	0.04	0.17***	0.02	0.05	0.01	-0.004	0.03	-0.02	0.01	-0.02	0.03	-0.01	1.55
Price Index	(0.03)	(0.03)	(0.03)	(0.07)	(0.05)	(0.03)	(0.05)	(0.05)	(0.03)	(0.02)	(0.03)	(0.03)	p-value: 0.90

Notes: (1) The estimated equation is $inflation_t = b_0 + b_1\ nexchange_t + b_2\ nexchange_{t-1} + b_3\ nexchange_{t-2} + b_4\ nexchange_{t-3} + b_5\ nexchange_{t-4} + b_6\ nexchange_{t-5} + b_7\ nexchange_{t-6} + b_8\ nexchange_{t-7} + b_9\ nexchange_{t-8} + b_{10}\ nexchange_{t-9} + b_{11}\ nexchange_{t-10} + b_{12}\ nexchange_{t-11} + e_t$, the constant b_0 is not reported; (2) The number of parameters is 13 and 18 moments are employed (lags 11-28 of exchange rate variable); (3) The HAC standard error are based on Bartlett Kernel with its lags chosen by Newey -West method; (3) *, ** and *** mean statistically significant at 1%, 5% and 10%, respectively.

Table 5.B 3 - Pass-Through effect (sectoral effective exchange rate): Model 1 using the lags 11-27 of exchange rate variable as instruments

Variable/ Sector	b_1	b_2	b_3	b_4	b_5	b_6	b_7	b_8	b_9	b_{10}	b_{11}	b_{12}	Hansen's J
10	0.10 (0.07)	0.19 (0.17)	-0.03 (0.27)	-0.18 (0.27)	0.01 (0.28)	-0.05 (0.28)	-0.04 (0.37)	0.03 (0.43)	0.03 (0.33)	0.13 (0.23)	0.02 (0.08)	0.15** (0.07)	0.76 p-value: 0.94
11	0.07 (0.09)	0.06 (0.11)	0.07 (0.04)	-0.01 (0.08)	-0.05 (0.08)	-0.006 (0.08)	-0.06 (0.04)	-0.12* (0.04)	0.01 (0.12)	-0.11 (0.07)	0.06 (0.05)	-0.07 (0.06)	1.63 p-value: 0.80
12	0.30 (0.19)	0.22 (0.21)	-0.13 (0.16)	-0.05 (0.12)	0.24* (0.13)	0.04 (0.13)	-0.20 (0.16)	0.22* (0.11)	0.34*** (0.07)	-0.04 (0.14)	-0.20 (0.17)	-0.08 (0.17)	3.64 p-value: 0.45
13	0.007 (0.04)	0.005 (0.03)	0.04 (0.03)	0.01 (0.04)	-0.01 (0.06)	-0.01 (0.08)	-0.05 (0.10)	0.06 (0.09)	-0.01 (0.11)	0.07 (0.08)	0.007 (0.06)	-0.01 (0.04)	2.70 p-value: 0.60
14	-0.10* (0.06)	0.13 (0.12)	-0.28** (0.12)	0.17 (0.20)	-0.23 (0.26)	0.29 (0.30)	-0.08 (0.32)	0.14 (0.25)	-0.03 (0.24)	0.14 (0.16)	0.09 (0.19)	0.03 (0.08)	1.41 p-value: 0.84
15	0.24*** (0.06)	0.01 (0.15)	0.004 (0.14)	0.03 (0.21)	-0.09 (0.22)	0.20 (0.22)	-0.19 (0.16)	0.15 (0.13)	-0.11 (0.12)	0.009 (0.09)	0.01 (0.07)	-0.04 (0.04)	3.80 p-value: 0.43
16	0.28*** (0.06)	0.04 (0.07)	0.02 (0.08)	-0.02 (0.04)	-0.06 (0.04)	0.06* (0.04)	0.05 (0.10)	0.12** (0.04)	-0.007 (0.05)	-0.02 (0.04)	0.05 (0.05)	-0.01 (0.06)	5.64 p-value: 0.22
17	0.34*** (0.10)	0.07 (0.05)	0.19 (0.12)	-0.04 (0.08)	0.16* (0.08)	0.01 (0.10)	0.16 (0.11)	0.09 (0.14)	0.04 (0.10)	-0.05 (0.07)	0.02 (0.04)	-0.06 (0.06)	1.95 p-value: 0.74
18	0.12 (0.50)	-0.24 (0.48)	-0.01 (0.55)	0.09 (0.40)	-0.21 (0.35)	0.30 (0.40)	-0.47 (0.48)	0.68 (0.59)	-0.49 (0.71)	0.34 (0.66)	-0.10 (0.39)	0.07 (0.29)	0.16 p-value: 0.99
19	-0.23 (0.15)	0.15 (0.16)	0.25 (0.16)	0.09 (0.10)	0.18 (0.13)	0.08 (0.21)	0.07 (0.20)	0.16 (0.20)	0.17 (0.26)	0.01 (0.24)	-0.02 (0.08)	-0.10 (0.10)	3.36 p-value: 0.49
20b	-0.07 (0.12)	-0.15 (0.20)	0.14 (0.23)	-0.21 (0.27)	0.12 (0.32)	-0.14 (0.30)	0.26 (0.29)	-0.16 (0.26)	0.19 (0.23)	-0.03 (0.23)	0.14 (0.13)	-0.16 (0.10)	2.35 p-value: 0.67
20c	0.09 (0.18)	0.47 (0.37)	-0.10 (0.41)	0.49 (0.60)	-0.13 (0.51)	0.42 (0.63)	-0.15 (0.44)	0.15 (0.44)	0.11 (0.28)	-0.09 (0.25)	0.16 (0.18)	-0.05 (0.16)	1.07 p-value: 0.89

21	0.09 (0.06)	-0.15** (0.06)	0.15* (0.08)	-0.02 (0.05)	-0.02 (0.08)	-0.06 (0.07)	-0.09 (0.05)	0.04 (0.05)	-0.14* (0.08)	0.09* (0.05)	0.04 (0.04)	-0.02 (0.05)	2.11 p-value: 0.71
22	-0.01 (0.14)	0.02 (0.16)	-0.08 (0.30)	0.13 (0.33)	-0.10 (0.39)	0.15 (0.39)	-0.14 (0.31)	0.20 (0.30)	-0.01 (0.13)	0.05 (0.11)	0.03 (0.06)	0.004 (0.04)	1.24 p-value: 0.87
23	0.10*** (0.03)	-0.05 (0.03)	0.08 (0.04)	-0.09 (0.04)	0.13 (0.04)	-0.03 (0.07)	0.16* (0.08)	-0.06 (0.09)	0.12* (0.07)	-0.03 (0.07)	0.08* (0.04)	-0.05 (0.04)	3.78 p-value: 0.43
24	0.06 (0.08)	-0.04 (0.07)	0.15 (0.14)	-0.08 (0.15)	0.05 (0.18)	-0.17 (0.20)	0.21 (0.17)	-0.09 (0.13)	0.11 (0.09)	-0.12 (0.10)	0.08 (0.14)	0.05 (0.10)	2.63 p-value: 0.62
25	0.004 (0.03)	0.13* (0.07)	0.04 (0.03)	-0.05 (0.04)	0.004 (0.04)	-0.06 (0.04)	0.06 (0.05)	-0.02 (0.07)	0.02 (0.04)	-0.08** (0.04)	0.03 (0.06)	0.06 (0.06)	1.99 p-value: 0.73
26	0.05 (0.08)	0.01 (0.08)	-0.10 (0.16)	0.03 (0.11)	-0.09 (0.14)	0.09 (0.14)	-0.12 (0.12)	0.15 (0.14)	-0.01 (0.11)	0.09 (0.07)	-0.03 (0.06)	0.07 (0.06)	0.78 p-value: 0.93
27	0.02 (0.06)	0.05 (0.08)	-0.01 (0.12)	0.14 (0.14)	-0.17 (0.15)	0.22 (0.16)	-0.15 (0.15)	0.17 (0.14)	-0.09 (0.12)	0.03 (0.09)	-0.004 (0.08)	-0.08 (0.06)	2.76 p-value: 0.59
28	0.04 (0.05)	-0.02 (0.03)	0.05 (0.06)	-0.09 (0.06)	0.11 (0.10)	-0.13 (0.12)	0.13 (0.12)	-0.05 (0.08)	0.11 (0.08)	-0.05 (0.06)	-0.00004 (0.03)	0.01 (0.03)	5.43 p-value: 0.24
29	0.03 (0.03)	0.03 (0.04)	-0.03 (0.04)	0.002 (0.04)	-0.01 (0.06)	-0.01 (0.07)	0.04 (0.07)	-0.07 (0.07)	0.08 (0.09)	-0.10 (0.06)	0.09* (0.05)	-0.01 (0.02)	1.30 p-value: 0.86
30	0.28*** (0.04)	-0.03 (0.04)	-0.04 (0.08)	-0.12** (0.05)	0.08 (0.06)	-0.01 (0.09)	0.17* (0.10)	0.01 (0.10)	0.14 (0.13)	-0.15** (0.07)	0.17 (0.11)	-0.10** (0.04)	2.75 p-value: 0.60
31	0.11* (0.06)	-0.03 (0.05)	0.05 (0.07)	-0.01 (0.07)	-0.05 (0.11)	0.12 (0.11)	-0.11 (0.08)	0.18*** (0.07)	-0.12** (0.05)	0.03 (0.03)	0.06 (0.08)	-0.02 (0.04)	2.60 p-value: 0.62
Extractive Industry	0.05 (0.04)	0.13*** (0.04)	-0.02 (0.07)	0.07 (0.08)	-0.09 (0.12)	0.10 (0.13)	-0.10 (0.11)	0.13 (0.10)	-0.06 (0.07)	0.09* (0.05)	-0.01 (0.03)	0.05* (0.02)	4.67 p-value: 0.32
Producer Price Index	0.06* (0.03)	0.10*** (0.03)	-0.0001 (0.06)	0.06 (0.06)	-0.06 (0.11)	0.05 (0.11)	-0.05 (0.10)	0.09 (0.07)	-0.06 (0.05)	0.11*** (0.03)	-0.02 (0.02)	0.07** (0.03)	1.49 p-value: 0.82

Notes: (1) The estimated equation is $inflation_t = b_0 + b_1\ rexchange_t + b_2\ rexchange_{t-1} + b_3\ rexchange_{t-2} + b_4\ rexchange_{t-3} + b_5\ rexchange_{t-4} + b_6\ rexchange_{t-5} + b_7\ rexchange_{t-6} + b_8\ rexchange_{t-7} + b_9\ rexchange_{t-8} + b_{10}\ rexchange_{t-9} + b_{11}\ rexchange_{t-10} + b_{12}\ rexchange_{t-11} + e_t$, the constant b_0 is not reported; (2) The number of parameters is 13 and 17 moments are employed (lags 11-27 of exchange rate variable); (2) The HAC standard error are based on Bartlett Kernel with its lags chosen by Newey -West method; (3) *, ** and *** mean statistically significant at 1%, 5% and 10%, respectively.

Table 5.B 4 - Pass-Through effect (sectoral effective exchange rate): Model 2 using the lags 11-28 of exchange rate variable as instruments

Variable/ Sector	b_1	b_2	b_3	b_4	b_5	b_6	b_7	b_8	b_9	b_{10}	b_{11}	b_{12}	Hansen's J
10	0.09 (0.07)	0.15 (0.14)	-0.08 (0.13)	-0.10 (0.11)	-0.06 (0.16)	0.03 (0.16)	-0.14 (0.16)	0.14 (0.11)	-0.03 (0.13)	0.16 (0.09)	0.01 (0.07)	0.13** (0.05)	1.82 p-value: 0.87
11	0.07 (0.11)	0.06 (0.11)	0.08 (0.05)	-0.01 (0.08)	-0.05 (0.07)	-0.008 (0.08)	-0.06 (0.05)	-0.13* (0.07)	0.01 (0.09)	-0.11 (0.07)	0.06 (0.06)	-0.07 (0.06)	1.64 p-value: 0.89
12	0.47** (0.18)	0.06 (0.20)	-0.09 (0.08)	-0.17 (0.15)	0.34** (0.14)	0.10 (0.10)	-0.26** (0.12)	0.12 (0.09)	0.32*** (0.08)	-0.08 (0.18)	-0.08 (0.12)	-0.16 (0.15)	2.88 p-value: 0.71
13	0.02 (0.04)	0.002 (0.03)	0.06* (0.03)	-0.01 (0.03)	0.04 (0.05)	-0.08 (0.07)	0.02 (0.12)	0.00007 (0.08)	0.04 (0.14)	0.05 (0.09)	0.03 (0.06)	-0.001 (0.04)	4.16 p-value: 0.52
14	-0.14 (0.10)	0.16* (0.09)	-0.28** (0.12)	0.18 (0.19)	-0.26 (0.23)	0.30 (0.30)	-0.08 (0.34)	0.15 (0.25)	-0.01 (0.29)	0.11 (0.20)	0.06 (0.15)	0.01 (0.08)	1.66 p-value: 0.89
15	0.23*** (0.08)	0.02 (0.16)	-0.003 (0.16)	0.04 (0.24)	-0.10 (0.26)	0.21 (0.25)	-0.20 (0.18)	0.15 (0.15)	-0.11 (0.12)	0.008 (0.09)	0.01 (0.06)	-0.04 (0.04)	3.78 p-value: 0.58
16	0.26*** (0.05)	0.01 (0.05)	0.01 (0.07)	-0.02 (0.03)	-0.08* (0.04)	0.06* (0.03)	0.05 (0.08)	0.14*** (0.03)	0.001 (0.04)	-0.01 (0.03)	0.06 (0.05)	-0.03 (0.05)	6.15 p-value: 0.29
17	0.33*** (0.10)	0.08* (0.04)	0.18 (0.11)	-0.03 (0.08)	0.15** (0.07)	0.02 (0.10)	0.16* (0.09)	0.10 (0.14)	0.04 (0.10)	-0.03 (0.07)	0.01 (0.03)	-0.06 (0.05)	2.00 p-value: 0.84
18	-0.16 (0.43)	0.03 (0.38)	-0.30 (0.35)	0.19 (0.20)	-0.14 (0.28)	-0.02 (0.30)	0.18 (0.53)	-0.02 (0.58)	0.27 (0.64)	-0.23 (0.54)	0.28 (0.32)	-0.03 (0.17)	3.11 p-value: 0.68
19	-0.15 (0.12)	0.14 (0.13)	0.20 (0.15)	0.12 (0.10)	0.16** (0.07)	0.07 (0.20)	0.10 (0.19)	0.09 (0.20)	0.16 (0.21)	0.16 (0.19)	-0.08 (0.07)	-0.03 (0.07)	4.08 p-value: 0.53
20b	-0.04 (0.12)	-0.17 (0.20)	0.18 (0.23)	-0.24 (0.27)	0.17 (0.34)	-0.18 (0.32)	0.29 (0.36)	-0.19 (0.31)	0.20 (0.29)	-0.01 (0.26)	0.11 (0.15)	-0.13 (0.11)	1.94 p-value: 0.85
20c	0.13 (0.14)	0.33 (0.22)	-0.01 (0.19)	0.38 (0.32)	0.002 (0.22)	0.23 (0.29)	0.007 (0.15)	0.008 (0.25)	0.12 (0.20)	-0.17 (0.15)	0.19 (0.15)	-0.08 (0.11)	1.53 p-value: 0.90

21	0.10 (0.06)	-0.15** (0.06)	0.16* (0.09)	-0.03 (0.04)	-0.02 (0.08)	-0.07 (0.07)	-0.09* (0.05)	0.05 (0.06)	-0.15* (0.08)	0.09 (0.06)	0.04 (0.04)	-0.03 (0.05)	2.12 p-value: 0.83
22	0.002 (0.09)	0.007 (0.10)	-0.05 (0.19)	0.09 (0.21)	-0.04 (0.24)	0.10 (0.25)	-0.10 (0.21)	0.15 (0.20)	-0.003 (0.10)	0.03 (0.08)	0.04 (0.04)	0.01 (0.04)	1.85 p-value: 0.86
23	0.09*** (0.03)	-0.01 (0.03)	0.09 (0.04)	-0.07 (0.04)	0.11** (0.04)	-0.03 (0.07)	0.16** (0.07)	-0.07 (0.07)	0.06 (0.06)	-0.008 (0.05)	0.08* (0.04)	-0.02 (0.03)	4.15 p-value: 0.52
24	0.02 (0.07)	0.01 (0.07)	0.09 (0.11)	-0.03 (0.10)	0.01 (0.16)	-0.09 (0.16)	0.17 (0.17)	-0.08 (0.12)	0.15* (0.08)	-0.14* (0.08)	0.08 (0.12)	0.004 (0.07)	3.68 p-value: 0.59
25	0.01 (0.02)	0.13* (0.07)	0.05 (0.05)	-0.06 (0.06)	0.03 (0.08)	-0.09 (0.07)	0.07 (0.05)	-0.04 (0.04)	0.02 (0.04)	-0.09* (0.04)	0.03 (0.07)	0.08 (0.06)	1.80 p-value: 0.87
26	0.03 (0.08)	0.004 (0.07)	-0.09 (0.14)	0.01 (0.08)	-0.08 (0.11)	0.07 (0.12)	-0.09 (0.09)	0.14 (0.11)	0.005 (0.09)	0.08 (0.06)	-0.02 (0.05)	0.05 (0.05)	1.19 p-value: 0.94
27	0.03 (0.05)	0.03 (0.07)	0.009 (0.10)	0.11 (0.15)	-0.14 (0.15)	0.19 (0.16)	-0.14 (0.15)	0.16 (0.13)	-0.10 (0.12)	0.03 (0.06)	-0.0007 (0.06)	-0.07* (0.04)	3.37 p-value: 0.64
28	0.04 (0.04)	-0.02 (0.04)	0.04 (0.06)	-0.08 (0.07)	0.10 (0.10)	-0.13 (0.13)	0.11 (0.13)	-0.03 (0.09)	0.09 (0.09)	-0.04 (0.05)	-0.01 (0.03)	0.006 (0.03)	4.23 p-value: 0.51
29	0.04* (0.02)	0.03 (0.02)	-0.02 (0.01)	0.01 (0.01)	-0.04** (0.02)	0.03** (0.01)	-0.01 (0.03)	-0.01 (0.03)	0.02 (0.03)	-0.05* (0.03)	0.05** (0.02)	-0.008 (0.01)	3.03 p-value: 0.69
30	0.28*** (0.04)	-0.04 (0.04)	-0.04 (0.09)	-0.12** (0.05)	0.07 (0.06)	-0.003 (0.08)	0.15* (0.07)	0.03 (0.07)	0.12 (0.10)	-0.14** (0.06)	0.17 (0.10)	-0.09* (0.05)	2.61 p-value: 0.75
31	0.12* (0.06)	-0.03 (0.04)	0.05 (0.07)	-0.02 (0.06)	-0.04 (0.11)	0.10 (0.11)	-0.09 (0.08)	0.17** (0.07)	-0.12** (0.05)	0.02 (0.03)	0.07 (0.07)	-0.01 (0.03)	2.91 p-value: 0.71
Extractive Industry	0.03 (0.05)	0.13*** (0.04)	-0.04 (0.07)	0.07 (0.08)	-0.11 (0.12)	0.12 (0.13)	-0.12 (0.12)	0.16* (0.09)	-0.08 (0.07)	0.10* (0.05)	-0.02 (0.03)	0.04 (0.02)	4.06 p-value: 0.54
Producer Price Index	0.05 (0.04)	0.11** (0.04)	-0.02 (0.05)	0.07 (0.05)	-0.09 (0.09)	0.08 (0.10)	-0.08 (0.10)	0.12* (0.07)	-0.08 (0.06)	0.12*** (0.04)	-0.03 (0.03)	0.06** (0.02)	1.75 p-value: 0.88

Notes: (1) The estimated equation is $inflation_t = b_0 + b_1\ rexchange_t + b_2\ rexchange_{t-1} + b_3\ rexchange_{t-2} + b_4\ rexchange_{t-3} + b_5\ rexchange_{t-4} + b_6\ rexchange_{t-5} + b_7\ rexchange_{t-6} + b_8\ rexchange_{t-7} + b_9\ rexchange_{t-8} + b_{10}\ rexchange_{t-9} + b_{11}\ rexchange_{t-10} + b_{12}\ rexchange_{t-11} + e_t$, the constant b_0 is not reported; (2) The number of parameters is 13 and 18 moments are employed (lags 11-28 of exchange rate variable); (2) The HAC standard error are based on Bartlett Kernel with its lags chosen by Newey -West method; (3) *, ** and *** mean statistically significant at 1%, 5% and 10%, respectively.

Table 5.B 5 - Controlling other covariates (nominal exchange rate)

	b_1	b_2	b_3	b_4	b_5	b_6	b_7	Hansen's J
10	0.32 (0.24)	-0.17 (0.13)	0.31** (0.13)	-0.02 (0.09)	0.01 (0.10)	-0.04 (0.07)	-0.07 (0.08)	2.25 p-value: 0.81
11	0.42 (0.47)	0.32 (0.26)	-0.21 (0.15)	-0.18 (0.27)	0.07 (0.08)	0.08 (0.12)	-0.01 (0.17)	1.07 p-value: 0.95
12	-0.07 (0.08)	0.39*** (0.11)	0.04 (0.21)	0.04 (0.08)	-0.07 (0.06)	-0.009 (0.06)	0.01 (0.08)	5.65 p-value: 0.34
13	0.97*** (0.29)	0.06 (0.06)	0.03 (0.06)	0.09 (0.10)	0.06 (0.11)	-0.001 (0.11)	0.01 (0.03)	3.08 p-value: 0.68
14	0.09 (0.30)	-0.05 (0.07)	0.04 (0.07)	-0.07 (0.08)	0.08* (0.04)	-0.01 (0.12)	0.01 (0.07)	5.56 p-value: 0.35
15[a]	0.45** (0.20)	0.17*** (0.06)	0.10 (0.08)	-0.13 (0.12)	0.10 (0.07)	-0.02 (0.08)	0.03 (0.05)	9.88 p-value: 0.12
16	0.05 (0.29)	0.09 (0.12)	0.06 (0.06)	-0.13 (0.08)	-0.04 (0.06)	0.02 (0.13)	-0.03 (0.08)	1.54 p-value: 0.90
17	0.24 (0.26)	0.10 (0.13)	0.33*** (0.09)	-0.08 (0.11)	-0.05 (0.06)	-0.12 (0.15)	-0.01 (0.09)	1.42 p-value: 0.92
18	0.55 (0.38)	0.12 (0.12)	-0.17 (0.18)	-0.03 (0.05)	0.02 (0.02)	-0.15* (0.08)	-0.06 (0.04)	4.30 p-value: 0.52
19	0.62** (0.25)	0.50 (0.46)	-0.05 (0.31)	0.53 (1.02)	-0.07 (0.30)	0.92** (0.35)	-0.37 (0.34)	3.08 p-value: 0.68
20b	-0.21 (0.24)	-0.0004 (0.08)	-0.06 (0.06)	-0.09 (0.08)	0.01 (0.04)	0.02 (0.04)	-0.06 (0.06)	7.45 p-value: 0.18
20c	0.22	-0.25	0.15	0.17	0.17	-0.12	0.18*	1.65

	(0.27)	(0.24)	(0.23)	(0.22)	(0.20)	(0.23)	(0.10)	p-value: 0.89
21	-0.32 (0.42)	0.13 (0.11)	0.005 (0.07)	0.02 (0.04)	-0.0001 (0.01)	-0.02 (0.07)	0.08 (0.09)	1.18 p-value: 0.94
22	0.55** (0.22)	-0.007 (0.07)	-0.05 (0.06)	-0.26 (0.18)	0.007 (0.13)	-0.07 (0.06)	0.01 (0.08)	1.22 p-value: 0.93
23	0.50 (0.36)	0.02 (0.12)	0.03 (0.10)	0.12 (0.09)	0.04 (0.11)	0.06 (0.08)	0.02 (0.04)	3.19 p-value: 0.67
24	0.62 (0.96)	0.43 (0.40)	0.10 (0.27)	0.34* (0.20)	0.20 (0.19)	0.02 (0.14)	0.09 (0.20)	3.93 p-value: 0.55
25	0.30** (0.14)	-0.02 (0.03)	0.18*** (0.06)	0.02 (0.14)	-0.04 (0.12)	0.05 (0.07)	-0.03 (0.05)	0.85 p-value: 0.97
26	-0.22 (0.45)	-0.03 (0.08)	0.13 (0.08)	-0.19 (0.16)	0.01 (0.08)	-0.05 (0.06)	0.05 (0.06)	3.84 p-value: 0.57
27	0.35 (0.22)	-0.04 (0.07)	0.01 (0.09)	-0.006 (0.10)	-0.02 (0.10)	0.02 (0.08)	-0.08 (0.06)	2.92 p-value: 0.71
28	0.61 (0.60)	-0.09 (0.13)	0.06 (0.09)	-0.01 (0.07)	0.08 (0.07)	0.01 (0.04)	0.01 (0.04)	1.66 p-value: 0.89
29	0.16 (0.24)	0.03 (0.02)	0.02 (0.02)	0.04 (0.01)	0.006 (0.005)	-0.02** (0.01)	-0.05 (0.01)	1.56 p-value: 0.90
30	0.03 (0.15)	0.30*** (0.08)	0.19* (0.10)	0.07 (0.12)	-0.01 (0.04)	0.09 (0.08)	-0.10 (0.13)	3.06 p-value: 0.69
31	0.25 (0.35)	0.14 (0.08)	-0.04 (0.05)	0.06 (0.05)	0.15*** (0.05)	0.13* (0.08)	-0.02 (0.06)	1.03 p-value: 0.95
Extractive Industry	0.28*** (0.10)	0.01 (0.03)	0.09** (0.04)	-0.007 (0.07)	-0.003 (0.04)	0.02 (0.05)	-0.005 (0.02)	3.96 p-value: 0.55
Producer Price Index	0.26***	-0.0001	0.09**	0.03	-0.05	0.04	0.005	3.34

	(0.10)	(0.04)	(0.03)	(0.09)	(0.08)	(0.06)	(0.03)	p-value: 0.64

Notes: Notes: (1) The estimated equation is $inflation_t = b_0 + b_1\ inflation_{t-1} + b_2\ nexchange_t + b_3\ nexchange_{t-1} + b_4\ demand_t + b_5\ demand_{t-1} + b_6\ oil_t + b_7\ oil_{t-1} + e_t$, the constant b_0 is not reported; (2) The number of moments employed is 13 (3 lags of each variable); (3) The HAC standard error are based on Bartlett Kernel with its lags chosen by Newey - West method; (3) *, ** and *** mean statistically significant at 1%, 5% and 10%, respectively; [a] performed with one additional lag of exchange rate to assure the validity of instruments.

Table 5.B 6 - Controlling other covariates (effective exchange rate)

	b_1	b_2	b_3	b_4	b_5	b_6	b_7	Hansen's J
10	0.68*** (0.26)	0.48 (0.37)	-0.04 (0.16)	-0.26 (0.25)	0.03 (0.11)	0.08 (0.13)	0.03 (0.20)	1.79 p-value: 0.87
11	-0.07 (0.29)	-0.04 (0.06)	-0.15** (0.06)	0.01 (0.09)	-0.01 (0.06)	0.08 (0.08)	-0.04 (0.09)	6.41 p-value: 0.26
12	-0.26 (0.46)	0.13 (0.40)	0.12 (0.19)	0.21 (0.18)	-0.19* (0.11)	-0.17 (0.28)	0.15 (0.20)	1.42 p-value: 0.92
13	1.06*** (0.30)	0.04 (0.07)	0.01 (0.08)	0.12 (0.15)	0.10 (0.07)	-0.03 (0.09)	0.01 (0.02)	4.45 p-value: 0.48
14	0.30 (0.91)	-0.09 (0.14)	-0.16 (0.18)	-0.10 (0.22)	0.07 (0.06)	0.16 (0.26)	-0.09 (0.13)	4.59 p-value: 0.46
15	0.92*** (0.27)	0.03 (0.14)	-0.12 (0.15)	0.24 (0.17)	0.05 (0.07)	0.06 (0.10)	-0.16** (0.08)	5.16 p-value: 0.39
16	0.44*** (0.16)	0.14 (0.13)	-0.08 (0.13)	-0.11 (0.10)	0.004 (0.04)	0.005 (0.16)	0.02 (0.08)	2.81 p-value: 0.72
17	0.57** (0.22)	0.24*** (0.06)	0.16 (0.12)	0.07 (0.11)	0.01 (0.05)	-0.08 (0.15)	-0.12* (0.07)	1.57 p-value: 0.90
18	0.38 (0.31)	-0.14* (0.07)	-0.11 (0.11)	0.01 (0.05)	0.01 (0.01)	-0.07 (0.11)	-0.08 (0.05)	6.80 p-value: 0.23
19	0.92 (0.92)	-0.38 (0.27)	0.41 (0.51)	0.98 (0.97)	-0.20 (0.27)	0.54 (0.42)	-0.20 (0.29)	1.30 p-value: 0.93
20b	0.003 (0.29)	-0.08 (0.16)	0.10 (0.13)	-0.12 (0.13)	0.03 (0.08)	-0.04 (0.11)	-0.05 (0.09)	5.48 p-value: 0.35
20c	0.38	0.34	-0.18	0.26	0.25	0.31	0.19	1.65

	(0.42)	(0.46)	(0.25)	(0.19)	(0.26)	(0.21)	(0.17)	p-value: 0.89
21	0.09 (0.39)	0.10 (0.16)	0.09 (0.12)	0.03 (0.05)	-0.006 (0.03)	-0.0006 (0.07)	0.17 (0.16)	0.71 p-value: 0.98
22	0.66** (0.31)	-0.10 (0.09)	0.02 (0.07)	-0.25 (0.18)	0.01 (0.19)	-0.15** (0.06)	0.02 (007)	0.75 p-value: 0.98
23	0.05 (0.74)	0.12 (0.18)	0.19 (0.12)	0.14 (0.22)	0.06 (0.07)	-0.18 (0.22)	0.09 (0.15)	2.16 p-value: 0.82
24	0.56 (0.42)	0.24** (0.10)	-0.05 (0.10)	0.23 (0.16)	0.11 (0.20)	0.04 (0.14)	0.07 (0.11)	4.66 p-value: 0.45
25	-0.001 (0.50)	0.26 (0.24)	0.40 (0.40)	-0.36 (0.55)	-0.32 (0.39)	-0.19 (0.25)	0.18 (0.31)	1.43 p-value: 0.92
26	-0.10 (0.29)	0.03 (0.08)	0.05 (0.04)	0.006 (0.07)	-0.02 (0.06)	-0.01 (0.04)	-0.02 (0.04)	8.03 p-value: 0.15
27	0.31 (0.30)	0.11 (0.13)	0.21 (0.19)	0.03 (0.19)	-0.09 (0.13)	-0.10 (0.23)	0.04 (0.10)	1.11 p-value: 0.95
28	-0.19 (0.32)	0.03 (0.07)	0.10 (0.09)	-0.03 (0.06)	0.02 (0.02)	-0.01 (0.05)	0.02 (0.07)	1.55 p-value: 0.90
29	0.41 (0.36)	0.02 (0.03)	-0.02 (0.02)	0.07 (0.02)	0.005 (0.007)	-0.02 (0.01)	-0.05 (0.01)	1.35 p-value: 0.92
30	0.02 (0.21)	0.35*** (0.08)	0.09 (0.11)	0.07 (0.09)	-0.04 (0.03)	0.15 (0.11)	-0.07 (0.11)	1.65 p-value: 0.89
31	1.06 (0.88)	0.07 (0.10)	-0.10 (0.12)	0.16 (0.15)	0.17 (0.11)	0.25 (0.23)	-0.05 (0.09)	2.76 p-value: 0.73
Extractive Industry	0.30* (0.17)	0.19*** (0.06)	0.08** (0.03)	0.03 (0.12)	0.01 (0.05)	0.13** (0.05)	0.01 (0.04)	5.48 p-value: 0.36
Producer Price Index	0.62*** (0.23)	0.25** (0.12)	0.03 (0.04)	-0.17 (0.17)	-0.06 (0.08)	0.17** (0.07)	-0.008 (0.04)	2.50 p-value: 0.77

Notes: Notes: (1) The estimated equation is $inflation_t = b_0 + b_1\ inflation_{t-1} + b_2\ rexchange_t + b_3\ rexchange_{t-1} + b_4\ demand_t + b_5\ demand_{t-1} + b_6\ oil_t + b_7\ oil_{t-1} + e_t$, the constant b_0 is not reported; (2) The number of moments employed is 13 (3 lags of each variable); (3) The HAC standard error are based on Bartlett Kernel with its lags chosen by Newey - West method; (3) *, ** and *** mean statistically significant at 1%, 5% and 10%, respectively.

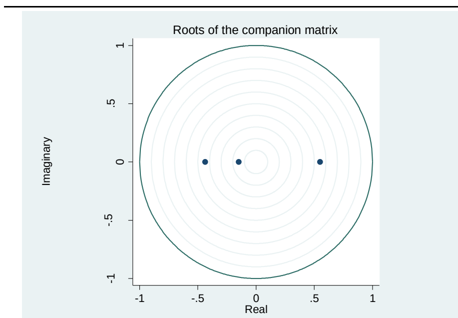
Appendix C- VAR estimates

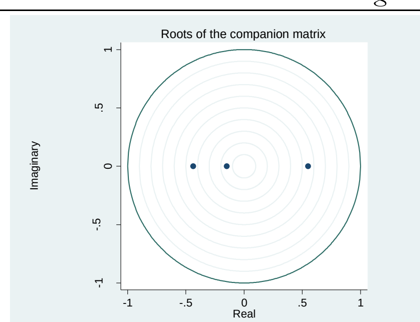
Table 5.C 1 - Cumulative Impulse Response Function of Sector 10: Shock (Exchange rate), Response (Inflation)

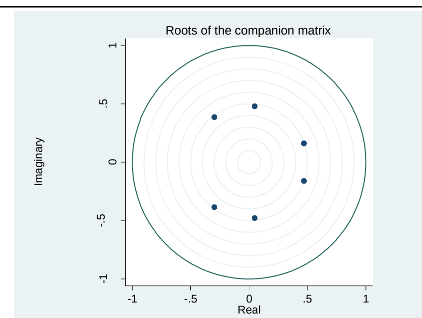
	Nominal Exchange Rate								*Sectoral Effective Exchange Rate*							
	Specification 1				*Specification 2*				*Specification 1*				*Specification 2*			
	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD
0	0.38	0.18	0.58	0	0.38	0.18	0.58	0	0.32	0.14	0.51	0	0.32	0.14	0.51	0
1	0.85	0.48	1.22	0.11	0.85	0.48	1.22	0.11	0.64	0.27	1.02	0.09	0.64	0.27	1.02	0.09
2	1.07	0.58	1.56	0.20	1.07	0.58	1.56	0.20	0.46	-0.08	1.01	0.12	0.46	-0.08	1.01	0.12
3	1.20	0.63	1.77	0.21	1.20	0.63	1.77	0.21	0.19	-0.48	0.87	0.12	0.19	-0.48	0.87	0.12
4	1.26	0.64	1.89	0.21	1.26	0.64	1.89	0.21	0.08	-0.65	0.82	0.15	0.08	-0.65	0.82	0.15
5	1.30	0.64	1.96	0.21	1.30	0.64	1.96	0.21	0.04	-0.72	0.81	0.15	0.04	-0.72	0.81	0.15
6	1.32	0.64	2.01	0.21	1.32	0.64	2.01	0.21	0.02	-0.76	0.81	0.15	0.02	-0.76	0.81	0.15
7	1.33	0.63	2.04	0.21	1.33	0.63	2.04	0.21	0.00	-0.79	0.81	0.15	0.00	-0.79	0.81	0.15
8	1.34	0.63	2.05	0.21	1.34	0.63	2.05	0.21	0.00	-0.80	0.81	0.15	0.00	-0.80	0.81	0.15
9	1.34	0.62	2.06	0.21	1.34	0.62	2.06	0.21	0.00	-0.81	0.81	0.15	0.00	-0.81	0.81	0.15
10	1.35	0.62	2.07	0.21	1.35	0.62	2.07	0.21	0.00	-0.81	0.81	0.15	0.00	-0.81	0.81	0.15
11	1.35	0.62	2.07	0.21	1.35	0.62	2.07	0.21	0.00	-0.81	0.81	0.15	0.00	-0.81	0.81	0.15
12	1.35	0.62	2.07	0.21	1.35	0.62	2.07	0.21	0.00	-0.81	0.81	0.15	0.00	-0.81	0.81	0.15

Nominal Exchange Rate				*Sectoral Effective Exchange Rate*			
Information criterions (lag) – decision: 1			*Stable?*	*Information criterions (lag) – decision: 2*			*Stable?*
AIC: 1	HQIC:1	SBIC: 1	Yes	AIC:2	HQIC:1	SBIC: 1	Yes

Eigenvalues







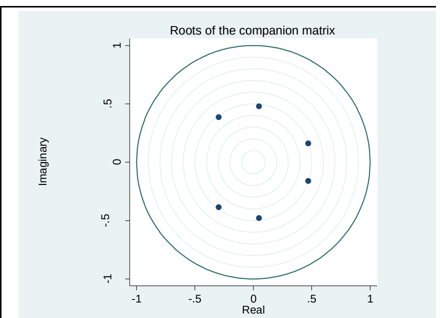
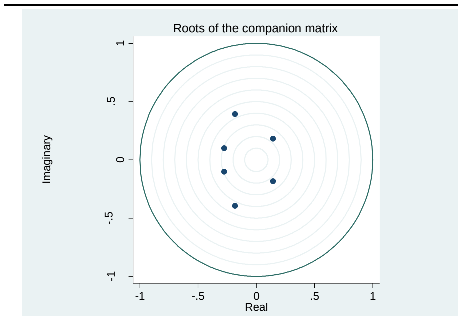
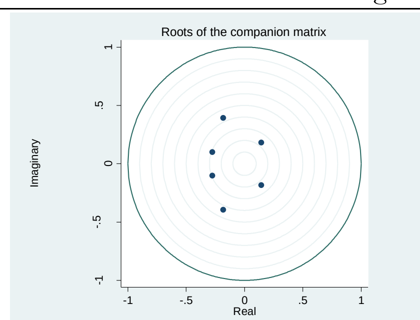


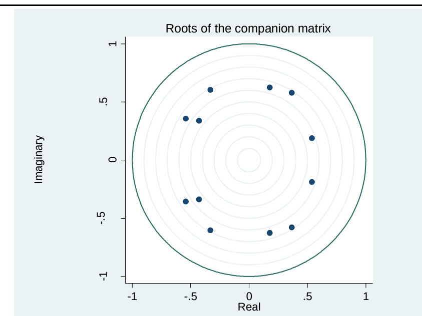
Table 5.C 2 - Cumulative Impulse Response Function of Sector 11: Shock (Exchange rate), Response (Inflation)

	Nominal Exchange Rate								*Sectoral Effective Exchange Rate*							
	Specification 1				*Specification 2*				*Specification 1*				*Specification 2*			
	CIRF	*Confidence Interval*		FEVD	CIRF	*Confidence Interval*		FEVD	CIRF	*Confidence Interval*		FEVD	CIRF	*Confidence Interval*		FEVD
		Lower	Upper			Lower	Upper			Lower	Upper			Lower	Upper	
0	-0.06	-0.29	0.16	0	-0.06	-0.29	0.16	0	-0.39	-0.60	-0.17	0	-0.39	-0.60	-0.17	0
1	0.04	-0.27	0.35	0.00	0.04	-0.27	0.35	0.00	-0.15	-0.44	0.14	0.10	-0.15	-0.44	0.14	0.10
2	0.25	-0.13	0.64	0.00	0.25	-0.13	0.64	0.00	0.06	-0.31	0.43	0.13	0.06	-0.31	0.43	0.13
3	0.23	-0.13	0.61	0.03	0.23	-0.13	0.61	0.03	0.24	-0.18	0.67	0.15	0.24	-0.18	0.67	0.15
4	0.24	-0.13	0.62	0.03	0.24	-0.13	0.62	0.03	0.21	-0.26	0.70	0.16	0.21	-0.26	0.70	0.16
5	0.23	-0.14	0.61	0.03	0.23	-0.14	0.61	0.03	0.13	-0.35	0.62	0.16	0.13	-0.35	0.62	0.16
6	0.23	-0.14	0.61	0.03	0.23	-0.14	0.61	0.03	0.10	-0.38	0.58	0.16	0.10	-0.38	0.58	0.16
7	0.23	-0.14	0.61	0.03	0.23	-0.14	0.61	0.03	0.07	-0.42	0.57	0.16	0.07	-0.42	0.57	0.16
8	0.23	-0.14	0.61	0.03	0.23	-0.14	0.61	0.03	0.10	-0.39	0.59	0.16	0.10	-0.39	0.59	0.16
9	0.23	-0.14	0.61	0.03	0.23	-0.14	0.61	0.03	0.12	-0.37	0.61	0.16	0.12	-0.37	0.61	0.16
10	0.23	-0.14	0.61	0.03	0.23	-0.14	0.61	0.03	0.11	-0.38	0.61	0.16	0.11	-0.38	0.61	0.16
11	0.23	-0.14	0.61	0.03	0.23	-0.14	0.61	0.03	0.11	-0.38	0.61	0.16	0.11	-0.38	0.61	0.16
12	0.23	-0.14	0.61	0.03	0.23	-0.14	0.61	0.03	0.10	-0.38	0.60	0.16	0.10	-0.38	0.60	0.16
Information criterions (lag) – decision: 2						*Stable?*			*Information criterions (lag) – decision: 4*					*Stable?*		
AIC: 2		HQIC:0		SBIC: 0		Yes			AIC: 4		HQIC: 1		SBIC: 0	Yes		

Eigenvalues







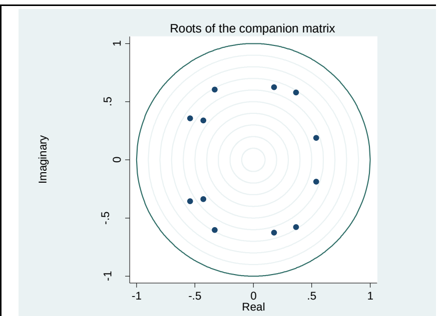
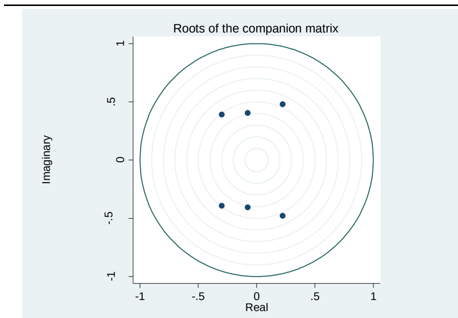
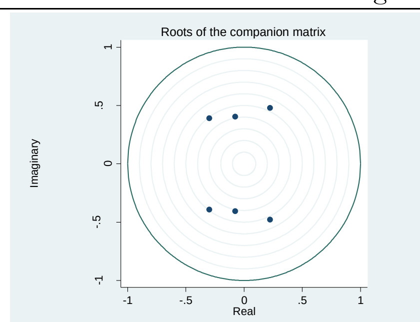


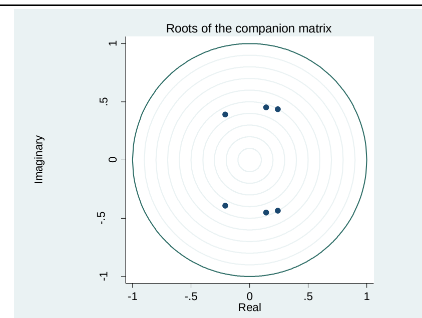
Table 5.C 3 - Cumulative Impulse Response Function of Sector 12: Shock (Exchange rate), Response (Inflation)

	Nominal Exchange Rate								*Sectoral Effective Exchange Rate*							
	Specification 1				*Specification 2*				*Specification 1*				*Specification 2*			
	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD
0	1.60	1.29	1.91	0	1.60	1.29	1.91	0	1.19	0.84	1.53	0	1.19	0.84	1.53	0
1	2.62	2.04	3.21	0.60	2.62	2.04	3.21	0.60	1.83	1.20	2.47	0.32	1.83	1.20	2.47	0.32
2	2.46	1.68	3.23	0.65	2.46	1.68	3.23	0.65	1.65	0.82	2.48	0.33	1.65	0.82	2.48	0.33
3	2.14	1.32	2.96	0.65	2.14	1.32	2.96	0.65	1.37	0.49	2.25	0.33	1.37	0.49	2.25	0.33
4	2.06	1.27	2.84	0.65	2.06	1.27	2.84	0.65	1.29	0.49	2.09	0.34	1.29	0.49	2.09	0.34
5	2.09	1.39	2.78	0.65	2.09	1.39	2.78	0.65	1.34	0.61	2.06	0.34	1.34	0.61	2.06	0.34
6	2.13	1.47	2.80	0.65	2.13	1.47	2.80	0.65	1.38	0.67	2.10	0.34	1.38	0.67	2.10	0.34
7	2.15	1.47	2.82	0.65	2.15	1.47	2.82	0.65	1.39	0.66	2.12	0.34	1.39	0.66	2.12	0.34
8	2.14	1.44	2.83	0.65	2.14	1.44	2.83	0.65	1.38	0.64	2.12	0.34	1.38	0.64	2.12	0.34
9	2.13	1.43	2.83	0.65	2.13	1.43	2.83	0.65	1.37	0.63	2.11	0.34	1.37	0.63	2.11	0.34
10	2.13	1.44	2.82	0.65	2.13	1.44	2.82	0.65	1.37	0.63	2.11	0.34	1.37	0.63	2.11	0.34
11	2.13	1.44	2.82	0.65	2.13	1.44	2.82	0.65	1.37	0.64	2.11	0.34	1.37	0.64	2.11	0.34
12	2.13	1.44	2.82	0.65	2.13	1.44	2.82	0.65	1.38	0.64	2.11	0.34	1.38	0.64	2.11	0.34
Information criterions (lag) – decision: 2						*Stable?*			*Information criterions (lag) – decision: 2*						*Stable?*	
AIC: 2		HQIC: 1		SBIC: 1		Yes			AIC: 2		HQIC: 1		SBIC: 0		Yes	

Eigenvalues







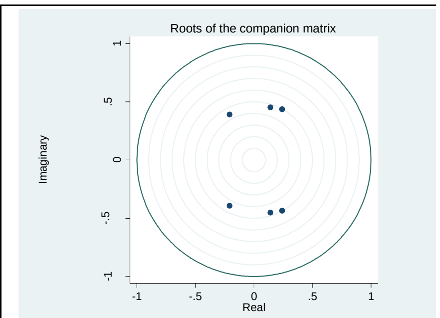
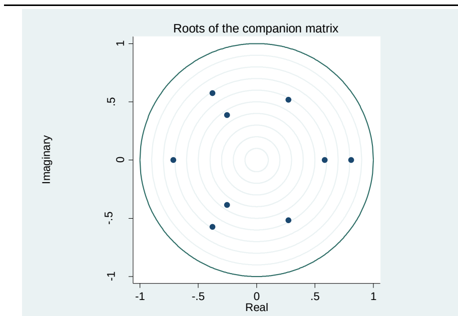
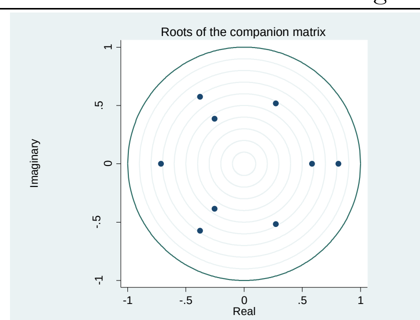


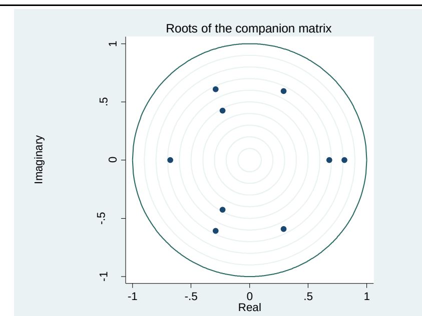
Table 5.C 4 - Cumulative Impulse Response Function of Sector 13: Shock (Exchange rate), Response (Inflation)

	Nominal Exchange Rate								*Sectoral Effective Exchange Rate*							
	Specification 1				*Specification 2*				*Specification 1*				*Specification 2*			
	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD
0	-0.02	-0.15	0.09	0	-0.02	-0.15	0.09	0	-0.06	-0.18	0.05	0	-0.06	-0.18	0.05	0
1	0.08	-0.11	0.28	0.00	0.08	-0.11	0.28	0.00	-0.03	-0.23	0.17	0.00	-0.03	-0.23	0.17	0.00
2	0.20	-0.08	0.48	0.02	0.20	-0.08	0.48	0.02	0.06	-0.22	0.36	0.00	0.06	-0.22	0.36	0.00
3	0.27	-0.10	0.65	0.04	0.27	-0.10	0.65	0.04	0.11	-0.27	0.50	0.02	0.11	-0.27	0.50	0.02
4	0.32	-0.12	0.78	0.04	0.32	-0.12	0.78	0.04	0.11	-0.36	0.59	0.02	0.11	-0.36	0.59	0.02
5	0.37	-0.15	0.90	0.04	0.37	-0.15	0.90	0.04	0.13	-0.41	0.68	0.02	0.13	-0.41	0.68	0.02
6	0.43	-0.15	1.02	0.05	0.43	-0.15	1.02	0.05	0.18	-0.43	0.80	0.02	0.18	-0.43	0.80	0.02
7	0.46	-0.17	1.10	0.05	0.46	-0.17	1.10	0.05	0.21	-0.46	0.89	0.02	0.21	-0.46	0.89	0.02
8	0.50	-0.17	1.18	0.05	0.50	-0.17	1.18	0.05	0.23	-0.49	0.97	0.02	0.23	-0.49	0.97	0.02
9	0.53	-0.19	1.25	0.05	0.53	-0.19	1.25	0.05	0.25	-0.52	1.04	0.02	0.25	-0.52	1.04	0.02
10	0.55	-0.20	1.31	0.05	0.55	-0.20	1.31	0.05	0.27	-0.54	1.09	0.02	0.27	-0.54	1.09	0.02
11	0.57	-0.21	1.35	0.05	0.57	-0.21	1.35	0.05	0.28	-0.56	1.14	0.02	0.28	-0.56	1.14	0.02
12	0.58	-0.22	1.39	0.05	0.58	-0.22	1.39	0.05	0.30	-0.58	1.18	0.02	0.30	-0.58	1.18	0.02
Information criterions (lag) – decision: 3					*Stable?*				*Information criterions (lag) – decision: 3*				*Stable?*			
AIC: 3		HQIC: 1		SBIC: 1	Yes				AIC: 3		HQIC: 1		SBIC: 1	Yes		

Eigenvalues







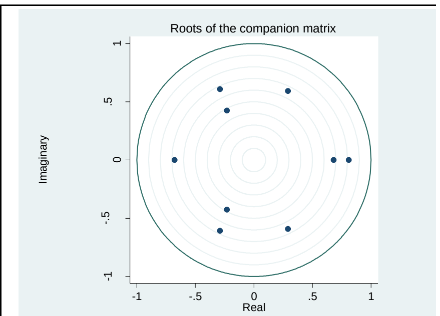
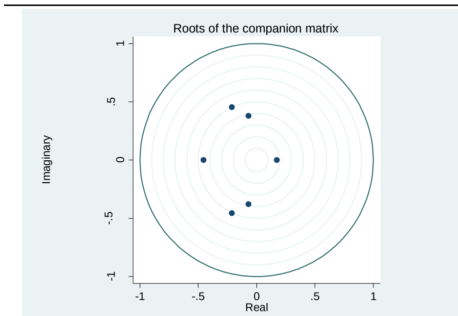


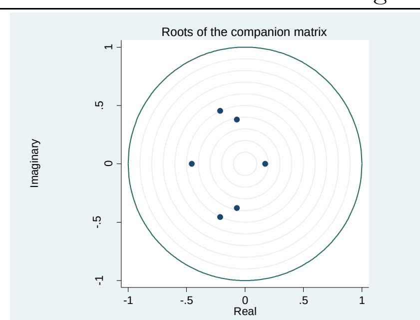
Table 5.C 5 - Cumulative Impulse Response Function of Sector 14: Shock (Exchange rate), Response (Inflation)

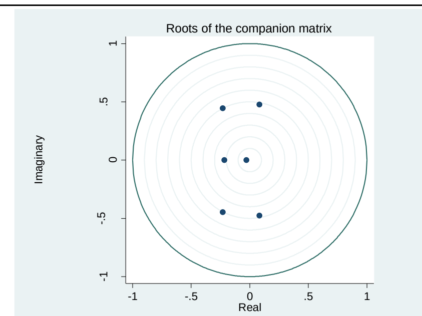
	Nominal Exchange Rate								*Sectoral Effective Exchange Rate*							
	Specification 1				*Specification 2*				*Specification 1*				*Specification 2*			
	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD
0	0.14	-0.01	0.31	0	0.14	-0.01	0.31	0	0.12	-0.04	0.29	0	0.12	-0.04	0.29	0
1	**0.22**	**0.01**	**0.43**	**0.02**	**0.22**	**0.01**	**0.43**	**0.02**	**0.26**	**0.06**	**0.47**	**0.01**	**0.26**	**0.06**	**0.47**	**0.01**
2	0.18	-0.05	0.42	0.03	0.18	-0.05	0.42	0.03	0.19	-0.05	0.43	0.03	0.19	-0.05	0.43	0.03
3	0.17	-0.03	0.37	0.03	0.17	-0.03	0.37	0.03	0.13	-0.08	0.36	0.04	0.13	-0.08	0.36	0.04
4	0.15	-0.04	0.35	0.03	0.15	-0.04	0.35	0.03	0.14	-0.05	0.34	0.04	0.14	-0.05	0.34	0.04
5	0.18	-0.02	0.38	0.03	0.18	-0.02	0.38	0.03	0.16	-0.02	0.36	0.04	0.16	-0.02	0.36	0.04
6	0.17	-0.03	0.37	0.03	0.17	-0.03	0.37	0.03	0.16	-0.03	0.36	0.04	0.16	-0.03	0.36	0.04
7	0.17	-0.03	0.37	0.03	0.17	-0.03	0.37	0.03	0.15	-0.04	0.36	0.04	0.15	-0.04	0.36	0.04
8	0.17	-0.03	0.37	0.03	0.17	-0.03	0.37	0.03	0.16	-0.04	0.36	0.04	0.16	-0.04	0.36	0.04
9	0.17	-0.03	0.37	0.03	0.17	-0.03	0.37	0.03	0.16	-0.03	0.36	0.04	0.16	-0.03	0.36	0.04
10	0.17	-0.03	0.37	0.03	0.17	-0.03	0.37	0.03	0.16	-0.04	0.36	0.04	0.16	-0.04	0.36	0.04
11	0.17	-0.03	0.37	0.03	0.17	-0.03	0.37	0.03	0.16	-0.04	0.36	0.04	0.16	-0.04	0.36	0.04
12	0.17	-0.03	0.37	0.03	0.17	-0.03	0.37	0.03	0.16	-0.04	0.36	0.04	0.16	-0.04	0.36	0.04

Nominal Exchange Rate				Sectoral Effective Exchange Rate			
Information criterions (lag) – decision: 2			*Stable?*	*Information criterions (lag) – decision: 2*			*Stable?*
AIC: 2	HQIC: 0	SBIC: 1	Yes	AIC: 2	HQIC: 1	SBIC: 0	Yes

Eigenvalues







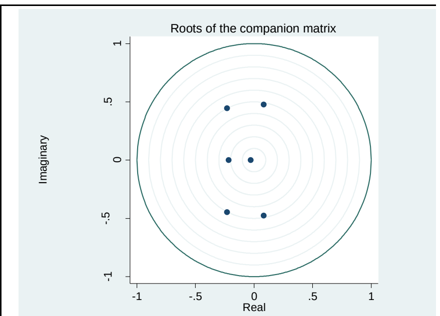
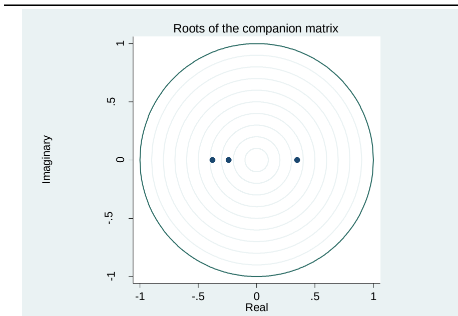
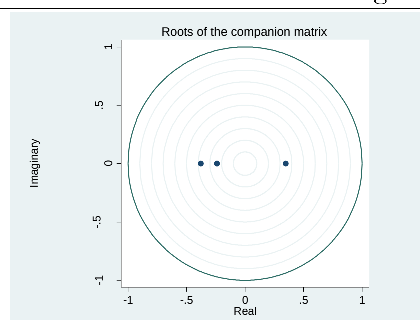


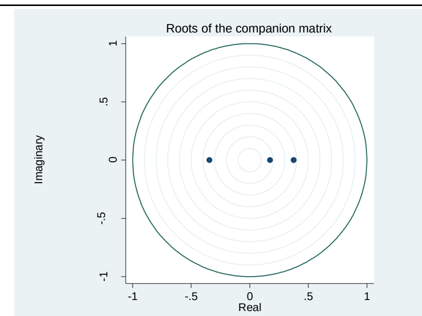
Table 5.C 6 - Cumulative Impulse Response Function of Sector 15: Shock (Exchange rate), Response (Inflation)

	Nominal Exchange Rate								*Sectoral Effective Exchange Rate*							
	Specification 1				*Specification 2*				*Specification 1*				*Specification 2*			
	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD
0	**0.73**	**0.54**	**0.92**	**0**	**0.73**	**0.54**	**0.92**	**0**	**0.72**	**0.53**	**0.91**	**0**	**0.72**	**0.53**	**0.91**	**0**
1	**1.09**	**0.76**	**1.42**	**0.39**	**1.09**	**0.76**	**1.42**	**0.39**	**0.96**	**0.62**	**1.29**	**0.37**	**0.96**	**0.62**	**1.29**	**0.37**
2	**1.19**	**0.80**	**1.59**	**0.42**	**1.19**	**0.80**	**1.59**	**0.42**	**1.04**	**0.60**	**1.48**	**0.36**	**1.04**	**0.60**	**1.48**	**0.36**
3	**1.23**	**0.80**	**1.67**	**0.42**	**1.23**	**0.80**	**1.67**	**0.42**	**1.07**	**0.58**	**1.56**	**0.36**	**1.07**	**0.58**	**1.56**	**0.36**
4	**1.25**	**0.79**	**1.70**	**0.42**	**1.25**	**0.79**	**1.70**	**0.42**	**1.08**	**0.57**	**1.60**	**0.36**	**1.08**	**0.57**	**1.60**	**0.36**
5	**1.25**	**0.79**	**1.71**	**0.42**	**1.25**	**0.79**	**1.71**	**0.42**	**1.09**	**0.56**	**1.61**	**0.36**	**1.09**	**0.56**	**1.61**	**0.36**
6	**1.25**	**0.79**	**1.72**	**0.42**	**1.25**	**0.79**	**1.72**	**0.42**	**1.09**	**0.56**	**1.61**	**0.36**	**1.09**	**0.56**	**1.61**	**0.36**
7	**1.25**	**0.78**	**1.72**	**0.42**	**1.25**	**0.78**	**1.72**	**0.42**	**1.09**	**0.56**	**1.62**	**0.36**	**1.09**	**0.56**	**1.62**	**0.36**
8	**1.25**	**0.78**	**1.72**	**0.42**	**1.25**	**0.78**	**1.72**	**0.42**	**1.09**	**0.56**	**1.62**	**0.36**	**1.09**	**0.56**	**1.62**	**0.36**
9	**1.25**	**0.78**	**1.72**	**0.42**	**1.25**	**0.78**	**1.72**	**0.42**	**1.09**	**0.56**	**1.62**	**0.36**	**1.09**	**0.56**	**1.62**	**0.36**
10	**1.25**	**0.78**	**1.72**	**0.42**	**1.25**	**0.78**	**1.72**	**0.42**	**1.09**	**0.56**	**1.62**	**0.36**	**1.09**	**0.56**	**1.62**	**0.36**
11	**1.25**	**0.78**	**1.72**	**0.42**	**1.25**	**0.78**	**1.72**	**0.42**	**1.09**	**0.56**	**1.62**	**0.36**	**1.09**	**0.56**	**1.62**	**0.36**
12	**1.25**	**0.78**	**1.72**	**0.42**	**1.25**	**0.78**	**1.72**	**0.42**	**1.09**	**0.56**	**1.62**	**0.36**	**1.09**	**0.56**	**1.62**	**0.36**
Information criterions (lag) – decision: 1					*Stable?*				*Information criterions (lag) – decision: 1*					*Stable?*		
AIC: 1		HQIC: 1		SBIC: 0	Yes				AIC: 1		HQIC: 1		SBIC: 0	Yes		

Eigenvalues







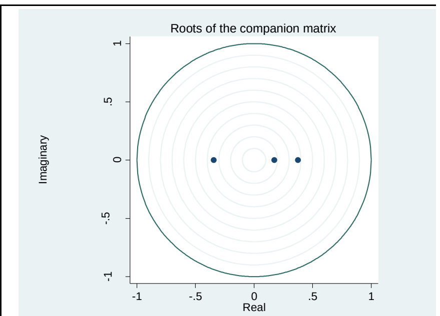
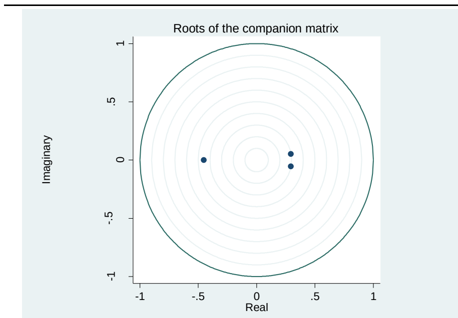
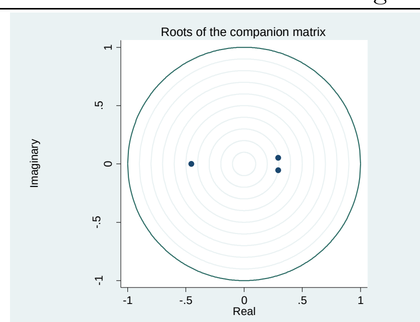


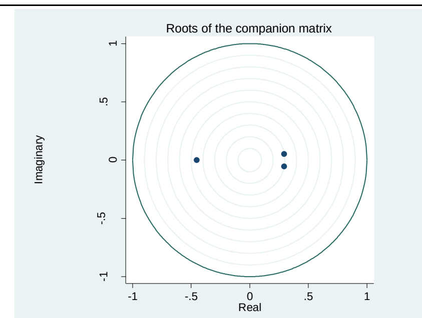
Table 5.C 7 - Cumulative Impulse Response Function of Sector 16: Shock (Exchange rate), Response (Inflation)

	Nominal Exchange Rate								*Sectoral Effective Exchange Rate*							
	Specification 1				*Specification 2*				*Specification 1*				*Specification 2*			
	CIRF	*Confidence Interval*		FEVD	CIRF	*Confidence Interval*		FEVD	CIRF	*Confidence Interval*		FEVD	CIRF	*Confidence Interval*		FEVD
		Lower	Upper			Lower	Upper			Lower	Upper			Lower	Upper	
0	0.89	0.66	1.12	0	0.89	0.66	1.12	0	0.89	0.66	1.12	0	0.89	0.66	1.12	0
1	1.20	0.80	1.59	0.38	1.20	0.80	1.59	0.38	0.95	0.56	1.35	0.40	0.95	0.56	1.35	0.40
2	1.28	0.82	1.73	0.38	1.28	0.82	1.73	0.38	0.91	0.41	1.42	0.35	0.91	0.41	1.42	0.35
3	1.31	0.82	1.79	0.38	1.31	0.82	1.79	0.38	0.88	0.33	1.44	0.35	0.88	0.33	1.44	0.35
4	1.31	0.82	1.81	0.38	1.31	0.82	1.81	0.38	0.87	0.30	1.44	0.35	0.87	0.30	1.44	0.35
5	1.32	0.82	1.82	0.38	1.32	0.82	1.82	0.38	0.86	0.29	1.44	0.35	0.86	0.29	1.44	0.35
6	1.32	0.82	1.82	0.38	1.32	0.82	1.82	0.38	0.86	0.28	1.44	0.35	0.86	0.28	1.44	0.35
7	1.32	0.82	1.82	0.38	1.32	0.82	1.82	0.38	0.86	0.28	1.44	0.35	0.86	0.28	1.44	0.35
8	1.32	0.82	1.82	0.38	1.32	0.82	1.82	0.38	0.86	0.28	1.44	0.35	0.86	0.28	1.44	0.35
9	1.32	0.82	1.82	0.38	1.32	0.82	1.82	0.38	0.86	0.28	1.44	0.35	0.86	0.28	1.44	0.35
10	1.32	0.82	1.82	0.38	1.32	0.82	1.82	0.38	0.86	0.28	1.44	0.35	0.86	0.28	1.44	0.35
11	1.32	0.82	1.82	0.38	1.32	0.82	1.82	0.38	0.86	0.28	1.44	0.35	0.86	0.28	1.44	0.35
12	1.32	0.82	1.82	0.38	1.32	0.82	1.82	0.38	0.86	0.28	1.44	0.35	0.86	0.28	1.44	0.35
Information criterions (lag) – decision: 1					*Stable?*				*Information criterions (lag) – decision: 1*				*Stable?*			
AIC: 1		HQIC: 1		SBIC: 1	Yes				AIC: 1		HQIC: 1		SBIC: 0	Yes		

Eigenvalues







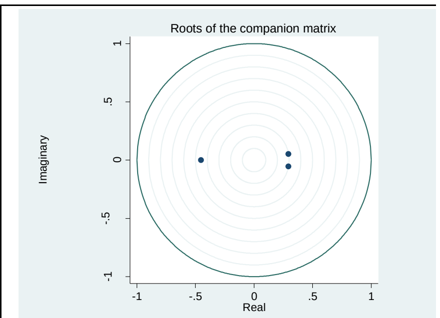
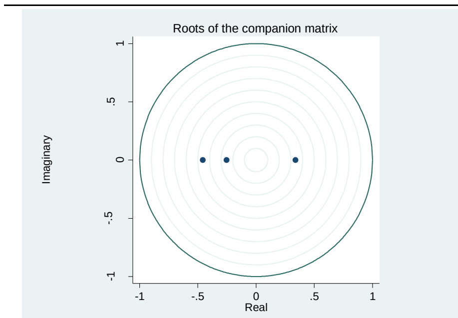
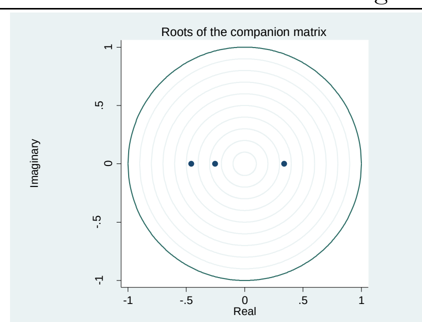


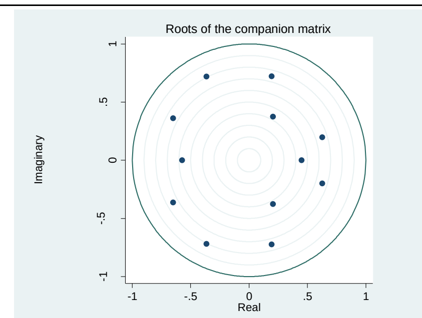
Table 5.C 8 - Cumulative Impulse Response Function of Sector 17: Shock (Exchange rate), Response (Inflation)

	Nominal Exchange Rate								*Sectoral Effective Exchange Rate*							
	Specification 1				*Specification 2*				*Specification 1*				*Specification 2*			
	CIRF	*Confidence Interval*		FEVD	CIRF	*Confidence Interval*		FEVD	CIRF	*Confidence Interval*		FEVD	CIRF	*Confidence Interval*		FEVD
		Lower	Upper			Lower	Upper			Lower	Upper			Lower	Upper	
0	0.88	0.62	1.14	0	0.88	0.62	1.14	0	0.94	0.70	1.18	0	0.94	0.70	1.18	0
1	1.36	0.92	1.80	0.32	1.36	0.92	1.80	0.32	1.26	0.85	1.67	0.40	1.26	0.85	1.67	0.40
2	1.47	0.95	1.99	0.36	1.47	0.95	1.99	0.36	1.23	0.66	1.81	0.40	1.23	0.66	1.81	0.40
3	1.52	0.96	2.09	0.36	1.52	0.96	2.09	0.36	1.12	0.39	1.84	0.37	1.12	0.39	1.84	0.37
4	1.54	0.95	2.12	0.36	1.54	0.95	2.12	0.36	1.26	0.41	2.11	0.36	1.26	0.41	2.11	0.36
5	1.54	0.95	2.14	0.36	1.54	0.95	2.14	0.36	1.32	0.38	2.25	0.36	1.32	0.38	2.25	0.36
6	1.54	0.94	2.14	0.36	1.54	0.94	2.14	0.36	1.31	0.32	2.29	0.36	1.31	0.32	2.29	0.36
7	1.54	0.94	2.15	0.36	1.54	0.94	2.15	0.36	1.36	0.35	2.38	0.36	1.36	0.35	2.38	0.36
8	1.54	0.94	2.15	0.36	1.54	0.94	2.15	0.36	1.34	0.29	2.38	0.36	1.34	0.29	2.38	0.36
9	1.54	0.94	2.15	0.36	1.54	0.94	2.15	0.36	1.34	0.29	2.39	0.36	1.34	0.29	2.39	0.36
10	1.54	0.94	2.15	0.36	1.54	0.94	2.15	0.36	1.38	0.32	2.43	0.36	1.38	0.32	2.43	0.36
11	1.54	0.94	2.15	0.36	1.54	0.94	2.15	0.36	1.37	0.31	2.43	0.36	1.37	0.31	2.43	0.36
12	1.54	0.94	2.15	0.36	1.54	0.94	2.15	0.36	1.36	0.30	2.41	0.36	1.36	0.30	2.41	0.36
Information criterions (lag) – decision: 1						*Stable?*			*Information criterions (lag) – decision: 4*					*Stable?*		
AIC: 1		HQIC: 1		SBIC: 1		Yes			AIC: 4		HQIC: 1		SBIC: 1	Yes		

Eigenvalues







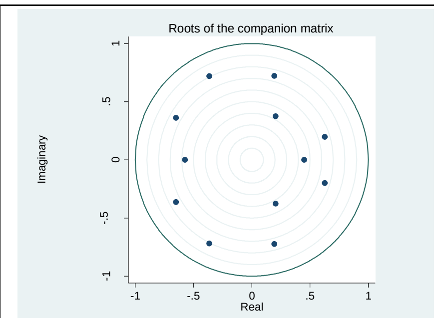
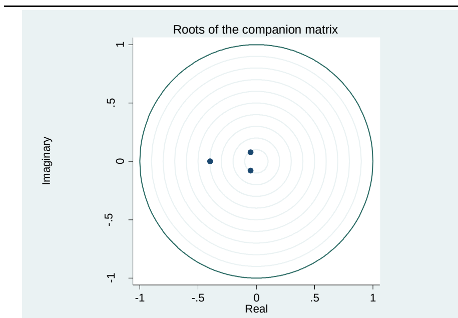
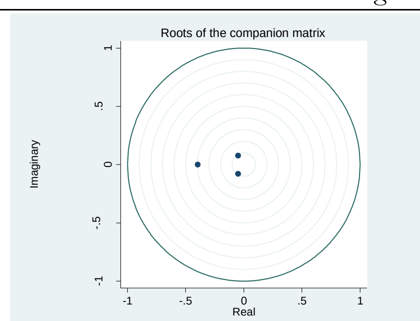


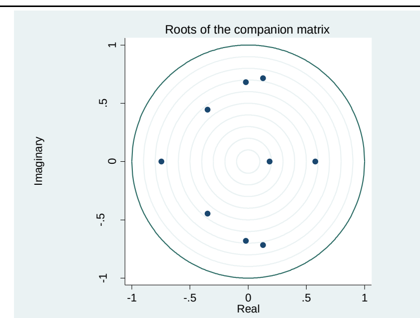
Table 5.C 9 - Cumulative Impulse Response Function of Sector 18: Shock (Exchange rate), Response (Inflation)

	Nominal Exchange Rate								*Sectoral Effective Exchange Rate*							
	Specification 1				*Specification 2*				*Specification 1*				*Specification 2*			
	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD
0	0.08	-0.21	0.38	0	0.08	-0.21	0.38	0	-0.00	-0.28	0.27	0	-0.00	-0.28	0.27	0
1	-0.13	-0.54	0.28	0.00	-0.13	-0.54	0.28	0.00	-0.37	-0.75	0.00	0.00	-0.37	-0.75	0.00	0.00
2	-0.11	-0.51	0.28	0.02	-0.11	-0.51	0.28	0.02	**-0.67**	**-1.13**	**-0.2**	**0.06**	**-0.67**	**-1.13**	**-0.2**	**0.06**
3	-0.11	-0.50	0.28	0.02	-0.11	-0.50	0.28	0.02	-0.53	-1.08	0.00	0.10	-0.53	-1.08	0.00	0.10
4	-0.11	-0.50	0.28	0.02	-0.11	-0.50	0.28	0.02	-0.52	-1.09	0.05	0.11	-0.52	-1.09	0.05	0.11
5	-0.11	-0.50	0.28	0.02	-0.11	-0.50	0.28	0.02	**-0.65**	**-1.23**	**-0.06**	**0.11**	**-0.65**	**-1.23**	**-0.06**	**0.11**
6	-0.11	-0.50	0.28	0.02	-0.11	-0.50	0.28	0.02	**-0.67**	**-1.28**	**-0.06**	**0.11**	**-0.67**	**-1.28**	**-0.06**	**0.11**
7	-0.11	-0.50	0.28	0.02	-0.11	-0.50	0.28	0.02	**-0.62**	**-1.25**	**-0.00**	**0.11**	**-0.62**	**-1.25**	**-0.00**	**0.11**
8	-0.11	-0.50	0.28	0.02	-0.11	-0.50	0.28	0.02	-0.62	-1.26	0.01	0.11	-0.62	-1.26	0.01	0.11
9	-0.11	-0.50	0.28	0.02	-0.11	-0.50	0.28	0.02	**-0.65**	**-1.29**	**-0.00**	**0.11**	**-0.65**	**-1.29**	**-0.00**	**0.11**
10	-0.11	-0.50	0.28	0.02	-0.11	-0.50	0.28	0.02	**-0.66**	**-1.30**	**-0.01**	**0.12**	**-0.66**	**-1.30**	**-0.01**	**0.12**
11	-0.11	-0.50	0.28	0.02	-0.11	-0.50	0.28	0.02	-0.64	-1.29	0.000	0.12	-0.64	-1.29	0.000	0.12
12	-0.11	-0.50	0.28	0.02	-0.11	-0.50	0.28	0.02	-0.64	-1.29	0.003	0.12	-0.64	-1.29	0.003	0.12
Information criterions (lag) – decision: 1					*Stable?*				*Information criterions (lag) – decision: 3*				*Stable?*			
AIC: 1		HQIC: 0		SBIC: 0	Yes				AIC: 3		HQIC: 1		SBIC: 0	Yes		

Eigenvalues







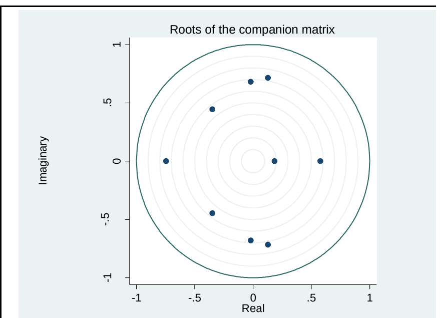
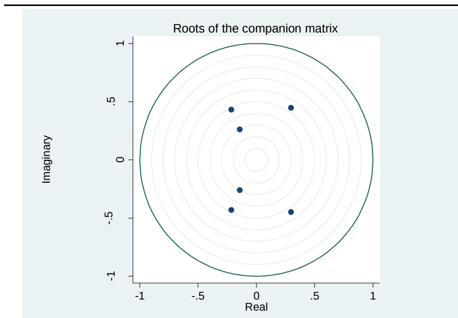
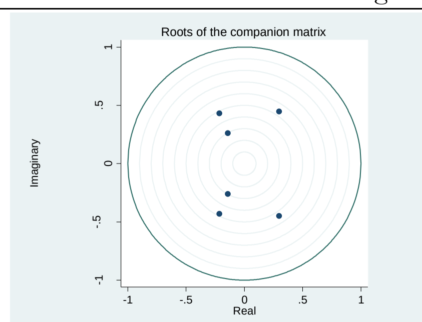


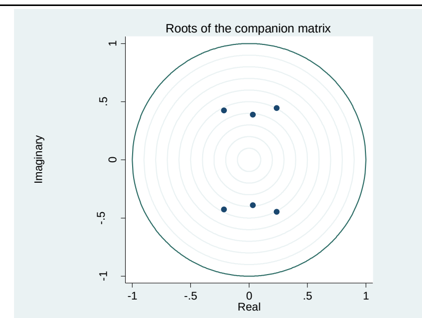
Table 5.C 10 - Cumulative Impulse Response Function of Sector 19: Shock (Exchange rate), Response (Inflation)

	Nominal Exchange Rate								*Sectoral Effective Exchange Rate*							
	Specification 1				*Specification 2*				*Specification 1*				*Specification 2*			
	CIRF	*Confidence Interval*		FEVD	CIRF	*Confidence Interval*		FEVD	CIRF	*Confidence Interval*		FEVD	CIRF	*Confidence Interval*		FEVD
		Lower	Upper			Lower	Upper			Lower	Upper			Lower	Upper	
0	0.00	-0.32	0.34	0	0.00	-0.32	0.34	0	-0.71	-1.03	-0.39	0	-0.71	-1.03	-0.39	0
1	0.52	-0.05	1.10	0	0.52	-0.05	1.10	0	-0.61	-1.17	-0.05	0.15	-0.61	-1.17	-0.05	0.15
2	0.93	0.19	1.67	0.06	0.93	0.19	1.67	0.06	-0.04	-0.78	0.68	0.12	-0.04	-0.78	0.68	0.12
3	0.94	0.16	1.71	0.09	0.94	0.16	1.71	0.09	0.09	-0.68	0.87	0.18	0.09	-0.68	0.87	0.18
4	0.83	0.07	1.58	0.09	0.83	0.07	1.58	0.09	-0.05	-0.77	0.67	0.18	-0.05	-0.77	0.67	0.18
5	0.77	0.06	1.49	0.09	0.77	0.06	1.49	0.09	-0.13	-0.80	0.54	0.18	-0.13	-0.80	0.54	0.18
6	0.77	0.08	1.46	0.09	0.77	0.08	1.46	0.09	-0.12	-0.78	0.54	0.19	-0.12	-0.78	0.54	0.19
7	0.78	0.09	1.46	0.09	0.78	0.09	1.46	0.09	-0.10	-0.77	0.56	0.19	-0.10	-0.77	0.56	0.19
8	0.79	0.10	1.48	0.09	0.79	0.10	1.48	0.09	-0.09	-0.77	0.58	0.19	-0.09	-0.77	0.58	0.19
9	0.79	0.10	1.49	0.09	0.79	0.10	1.49	0.09	-0.09	-0.77	0.58	0.19	-0.09	-0.77	0.58	0.19
10	0.79	0.09	1.49	0.09	0.79	0.09	1.49	0.09	-0.09	-0.77	0.57	0.19	-0.09	-0.77	0.57	0.19
11	0.79	0.09	1.48	0.09	0.79	0.09	1.48	0.09	-0.10	-0.77	0.57	0.19	-0.10	-0.77	0.57	0.19
12	0.79	0.09	1.48	0.09	0.79	0.09	1.48	0.09	-0.10	-0.77	0.57	0.19	-0.10	-0.77	0.57	0.19
Information criterions (lag) – decision: 2						*Stable?*			*Information criterions (lag) – decision: 2*						*Stable?*	
AIC: 2		HQIC: 0		SBIC: 1		Yes			AIC: 2		HQIC: 1		SBIC: 0		Yes	

Eigenvalues







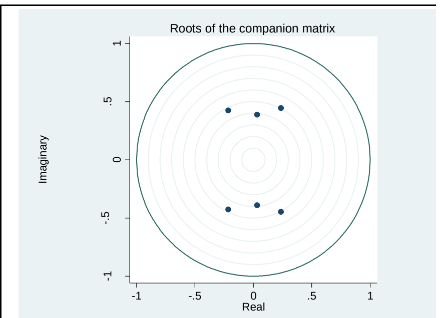


Table 5.C 11 - Cumulative Impulse Response Function of Sector 20b: Shock (Exchange rate), Response (Inflation)

	Nominal Exchange Rate								*Sectoral Effective Exchange Rate*							
	Specification 1				*Specification 2*				*Specification 1*				*Specification 2*			
	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD
0	0.04	-0.12	0.22	0	0.04	-0.12	0.22	0	-0.05	-0.22	0.12	0	-0.05	-0.22	0.12	0
1	0.06	-0.16	0.28	0	0.06	-0.16	0.28	0	-0.07	-0.28	0.14	0	-0.07	-0.28	0.14	0
2	0.20	-0.04	0.46	0	0.20	-0.04	0.46	0	0.12	-0.12	0.37	0	0.12	-0.12	0.37	0
3	0.17	-0.04	0.38	0.02	0.17	-0.04	0.38	0.02	0.15	-0.08	0.38	0.03	0.15	-0.08	0.38	0.03
4	0.17	-0.04	0.38	0.02	0.17	-0.04	0.38	0.02	0.10	-0.11	0.32	0.03	0.10	-0.11	0.32	0.03
5	0.16	-0.05	0.37	0.02	0.16	-0.05	0.37	0.02	0.08	-0.12	0.29	0.04	0.08	-0.12	0.29	0.04
6	0.16	-0.05	0.37	0.02	0.16	-0.05	0.37	0.02	0.09	-0.12	0.30	0.04	0.09	-0.12	0.30	0.04
7	0.16	-0.04	0.38	0.02	0.16	-0.04	0.38	0.02	0.10	-0.11	0.31	0.04	0.10	-0.11	0.31	0.04
8	0.16	-0.05	0.38	0.02	0.16	-0.05	0.38	0.02	0.09	-0.11	0.31	0.04	0.09	-0.11	0.31	0.04
9	0.16	-0.05	0.38	0.02	0.16	-0.05	0.38	0.02	0.09	-0.11	0.31	0.04	0.09	-0.11	0.31	0.04
10	0.16	-0.04	0.38	0.02	0.16	-0.04	0.38	0.02	0.09	-0.11	0.31	0.04	0.09	-0.11	0.31	0.04
11	0.16	-0.04	0.38	0.02	0.16	-0.04	0.38	0.02	0.09	-0.11	0.31	0.04	0.09	-0.11	0.31	0.04
12	0.16	-0.05	0.38	0.02	0.16	-0.05	0.38	0.02	0.09	-0.11	0.31	0.04	0.09	-0.11	0.31	0.04
Information criterions (lag) – decision: 2						*Stable?*			*Information criterions (lag) – decision: 2*					*Stable?*		
AIC: 2		HQIC: 0		SBIC: 1		Yes			AIC: 2		HQIC: 1		SBIC: 0	Yes		

Eigenvalues

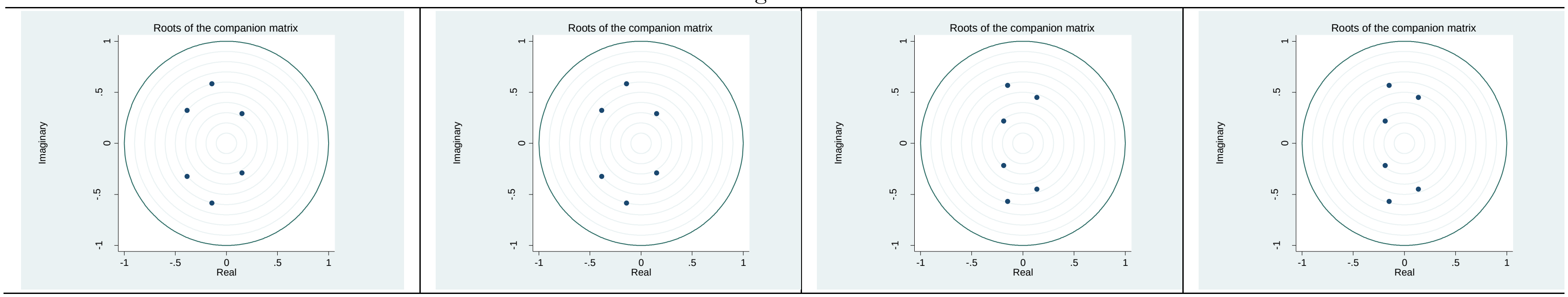
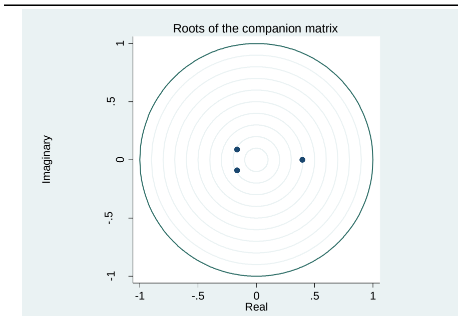
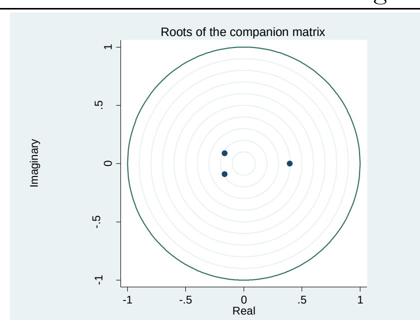


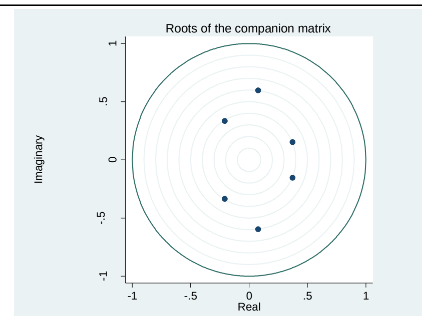
Table 5.C 12 - Cumulative Impulse Response Function of Sector 20c: Shock (Exchange rate), Response (Inflation)

	Nominal Exchange Rate								*Sectoral Effective Exchange Rate*							
	Specification 1				*Specification 2*				*Specification 1*				*Specification 2*			
	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD
0	0.67	0.39	0.94	0	0.67	0.39	0.94	0	0.40	0.13	0.68	0	0.40	0.13	0.68	0
1	1.41	0.91	1.90	0.17	1.41	0.91	1.90	0.17	1.01	0.49	1.52	0.06	1.01	0.49	1.52	0.06
2	1.66	1.02	2.29	0.28	1.66	1.02	2.29	0.28	1.00	0.29	1.71	0.15	1.00	0.29	1.71	0.15
3	1.75	1.04	2.46	0.29	1.75	1.04	2.46	0.29	0.84	0.02	1.66	0.14	0.84	0.02	1.66	0.14
4	1.79	1.04	2.55	0.29	1.79	1.04	2.55	0.29	0.78	-0.05	1.62	0.15	0.78	-0.05	1.62	0.15
5	1.81	1.03	2.58	0.29	1.81	1.03	2.58	0.29	0.81	-0.02	1.64	0.15	0.81	-0.02	1.64	0.15
6	1.81	1.03	2.60	0.29	1.81	1.03	2.60	0.29	0.83	-0.01	1.67	0.15	0.83	-0.01	1.67	0.15
7	1.82	1.03	2.61	0.29	1.82	1.03	2.61	0.29	0.81	-0.03	1.67	0.15	0.81	-0.03	1.67	0.15
8	1.82	1.02	2.61	0.29	1.82	1.02	2.61	0.29	0.80	-0.04	1.66	0.15	0.80	-0.04	1.66	0.15
9	1.82	1.02	2.61	0.29	1.82	1.02	2.61	0.29	0.81	-0.03	1.65	0.15	0.81	-0.03	1.65	0.15
10	1.82	1.02	2.61	0.29	1.82	1.02	2.61	0.29	0.81	-0.02	1.66	0.15	0.81	-0.02	1.66	0.15
11	1.82	1.02	2.61	0.29	1.82	1.02	2.61	0.29	0.81	-0.03	1.66	0.15	0.81	-0.03	1.66	0.15
12	1.82	1.02	2.61	0.29	1.82	1.02	2.61	0.29	0.81	-0.03	1.66	0.15	0.81	-0.03	1.66	0.15
Information criterions (lag) – decision: 1					*Stable?*				*Information criterions (lag) – decision: 2*					*Stable?*		
AIC: 1		HQIC: 1		SBIC: 1	Yes				AIC: 2		HQIC: 1		SBIC: 0	Yes		

Eigenvalues







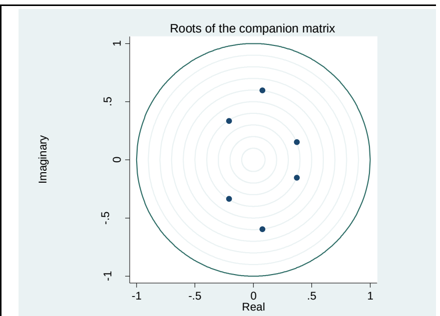


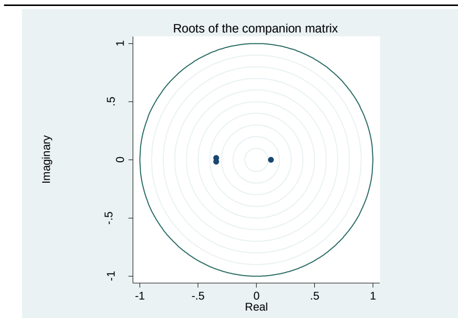
Table 5.C 13 - Cumulative Impulse Response Function of Sector 21: Shock (Exchange rate), Response (Inflation)

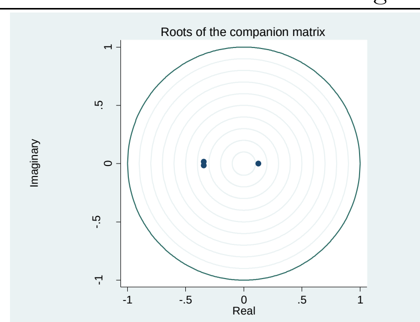
	Nominal Exchange Rate								*Sectoral Effective Exchange Rate*							
	Specification 1				*Specification 2*				*Specification 1*				*Specification 2*			
	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD
0	-0.06	-0.22	0.10	0	-0.06	-0.22	0.10	0	-0.13	-0.30	0.02	0	-0.13	-0.30	0.02	0
1	-0.19	-0.41	0.03	0.00	-0.19	-0.41	0.03	0.00	-0.20	-0.42	0.02	0.02	-0.20	-0.42	0.02	0.02
2	-0.17	-0.38	0.04	0.02	-0.17	-0.38	0.04	0.02	-0.21	-0.45	0.03	0.02	-0.21	-0.45	0.03	0.02
3	-0.17	-0.40	0.04	0.02	-0.17	-0.40	0.04	0.02	-0.21	-0.46	0.03	0.02	-0.21	-0.46	0.03	0.02
4	-0.17	-0.39	0.04	0.02	-0.17	-0.39	0.04	0.02	-0.21	-0.46	0.03	0.02	-0.21	-0.46	0.03	0.02
5	-0.17	-0.40	0.04	0.02	-0.17	-0.40	0.04	0.02	-0.21	-0.46	0.03	0.02	-0.21	-0.46	0.03	0.02
6	-0.17	-0.40	0.04	0.02	-0.17	-0.40	0.04	0.02	-0.21	-0.46	0.03	0.02	-0.21	-0.46	0.03	0.02
7	-0.17	-0.40	0.04	0.02	-0.17	-0.40	0.04	0.02	-0.21	-0.46	0.03	0.02	-0.21	-0.46	0.03	0.02
8	-0.17	-0.40	0.04	0.02	-0.17	-0.40	0.04	0.02	-0.21	-0.46	0.03	0.02	-0.21	-0.46	0.03	0.02
9	-0.17	-0.40	0.04	0.02	-0.17	-0.40	0.04	0.02	-0.21	-0.46	0.03	0.02	-0.21	-0.46	0.03	0.02
10	-0.17	-0.40	0.04	0.02	-0.17	-0.40	0.04	0.02	-0.21	-0.46	0.03	0.02	-0.21	-0.46	0.03	0.02
11	-0.17	-0.40	0.04	0.02	-0.17	-0.40	0.04	0.02	-0.21	-0.46	0.03	0.02	-0.21	-0.46	0.03	0.02
12	-0.17	-0.40	0.04	0.02	-0.17	-0.40	0.04	0.02	-0.21	-0.46	0.03	0.02	-0.21	-0.46	0.03	0.02

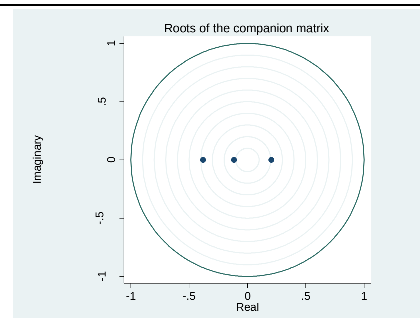
Information criterions (lag) – decision: 1 — *Stable?*
AIC: 1 HQIC: 0 SBIC: 1 — Yes

Information criterions (lag) – decision: 1 — *Stable?*
AIC: 1 HQIC: 1 SBIC: 0 — Yes

Eigenvalues







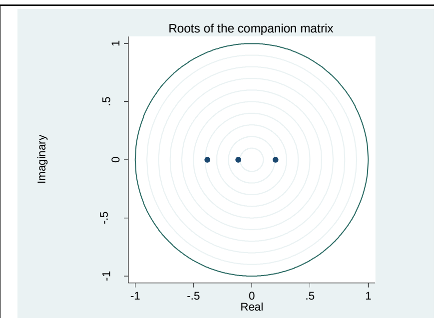
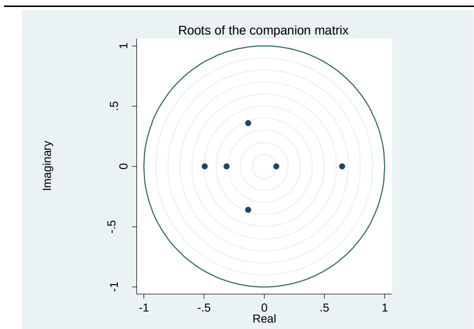
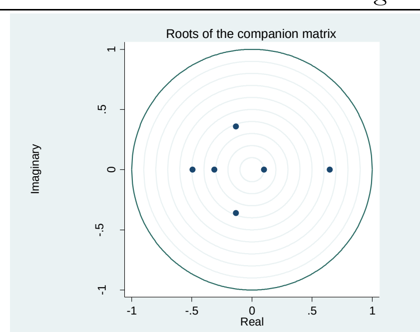


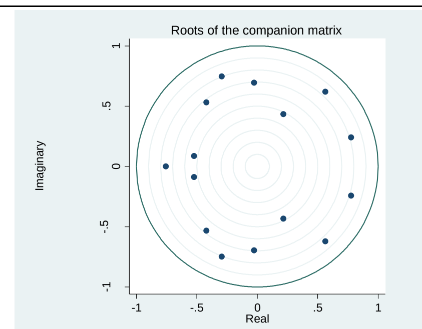
Table 5.C 14 - Cumulative Impulse Response Function of Sector 22: Shock (Exchange rate), Response (Inflation)

	Nominal Exchange Rate								*Sectoral Effective Exchange Rate*							
	Specification 1				*Specification 2*				*Specification 1*				*Specification 2*			
	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD
0	0.11	0.01	0.21	0	0.11	0.01	0.21	0	0.09	0.00	0.19	0	0.09	0.00	0.19	0
1	0.17	0.03	0.32	0.04	0.17	0.03	0.32	0.04	0.17	0.04	0.29	0.0	0.17	0.04	0.29	0.0
2	0.23	0.03	0.43	0.05	0.23	0.03	0.43	0.05	0.27	0.10	0.45	0.07	0.27	0.10	0.45	0.07
3	0.26	0.03	0.48	0.05	0.26	0.03	0.48	0.05	0.38	0.17	0.60	0.08	0.38	0.17	0.60	0.08
4	0.28	0.03	0.53	0.05	0.28	0.03	0.53	0.05	0.54	0.28	0.81	0.12	0.54	0.28	0.81	0.12
5	0.29	0.03	0.56	0.06	0.29	0.03	0.56	0.06	0.60	0.29	0.91	0.18	0.60	0.29	0.91	0.18
6	0.30	0.02	0.58	0.06	0.30	0.02	0.58	0.06	0.65	0.31	1.00	0.19	0.65	0.31	1.00	0.19
7	0.31	0.02	0.59	0.06	0.31	0.02	0.59	0.06	0.69	0.32	1.07	0.19	0.69	0.32	1.07	0.19
8	0.31	0.02	0.60	0.06	0.31	0.02	0.60	0.06	0.70	0.30	1.10	0.19	0.70	0.30	1.10	0.19
9	0.31	0.02	0.60	0.06	0.31	0.02	0.60	0.06	0.69	0.27	1.11	0.19	0.69	0.27	1.11	0.19
10	0.31	0.02	0.61	0.06	0.31	0.02	0.61	0.06	0.70	0.27	1.14	0.19	0.70	0.27	1.14	0.19
11	0.32	0.02	0.61	0.06	0.32	0.02	0.61	0.06	0.69	0.24	1.13	0.19	0.69	0.24	1.13	0.19
12	0.32	0.02	0.61	0.06	0.32	0.02	0.61	0.06	0.67	0.22	1.12	0.19	0.67	0.22	1.12	0.19
Information criterions (lag) – decision: 2					*Stable?*				*Information criterions (lag) – decision: 5*					*Stable?*		
AIC: 2		HQIC: 0		SBIC: 0	Yes				AIC: 5		HQIC: 0		SBIC: 0	Yes		

Eigenvalues







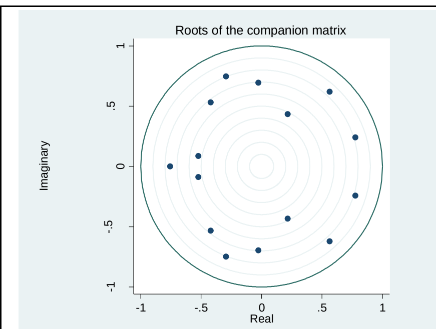
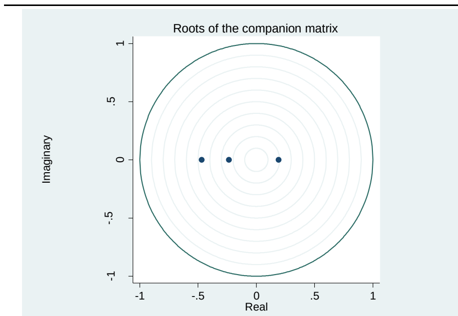
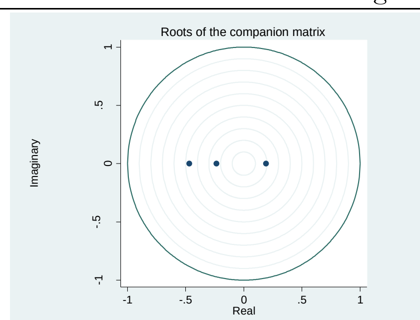


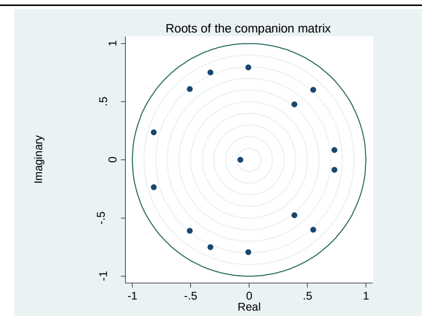
Table 5.C 15 - Cumulative Impulse Response Function of Sector 23: Shock (Exchange rate), Response (Inflation)

	Nominal Exchange Rate								*Sectoral Effective Exchange Rate*							
	Specification 1				*Specification 2*				*Specification 1*				*Specification 2*			
	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD
0	0.19	0.04	0.35	0	0.19	0.04	0.35	0	0.22	0.08	0.37	0	0.22	0.08	0.37	0
1	0.33	0.10	0.56	0.05	0.33	0.10	0.56	0.05	0.29	0.08	0.50	0.07	0.29	0.08	0.50	0.07
2	0.33	0.09	0.58	0.07	0.33	0.09	0.58	0.07	0.43	0.15	0.71	0.08	0.43	0.15	0.71	0.08
3	0.34	0.09	0.59	0.07	0.34	0.09	0.59	0.07	0.54	0.19	0.89	0.10	0.54	0.19	0.89	0.10
4	0.34	0.09	0.59	0.07	0.34	0.09	0.59	0.07	0.69	0.28	1.11	0.12	0.69	0.28	1.11	0.12
5	0.34	0.09	0.59	0.07	0.34	0.09	0.59	0.07	0.70	0.23	1.17	0.14	0.70	0.23	1.17	0.14
6	0.34	0.09	0.59	0.07	0.34	0.09	0.59	0.07	0.70	0.17	1.22	0.14	0.70	0.17	1.22	0.14
7	0.34	0.09	0.59	0.07	0.34	0.09	0.59	0.07	0.74	0.18	1.30	0.14	0.74	0.18	1.30	0.14
8	0.34	0.09	0.59	0.07	0.34	0.09	0.59	0.07	0.69	0.09	1.29	0.14	0.69	0.09	1.29	0.14
9	0.34	0.09	0.59	0.07	0.34	0.09	0.59	0.07	0.70	0.07	1.34	0.14	0.70	0.07	1.34	0.14
10	0.34	0.09	0.59	0.07	0.34	0.09	0.59	0.07	0.68	0.02	1.34	0.14	0.68	0.02	1.34	0.14
11	0.34	0.09	0.59	0.07	0.34	0.09	0.59	0.07	0.70	0.03	1.38	0.14	0.70	0.03	1.38	0.14
12	0.34	0.09	0.59	0.07	0.34	0.09	0.59	0.07	0.71	0.01	1.41	0.14	0.71	0.01	1.41	0.14
Information criterions (lag) – decision: 1						*Stable?*			*Information criterions (lag) – decision: 5*						*Stable?*	
AIC: 1		HQIC: 1		SBIC: 1		Yes			AIC: 5		HQIC: 1		SBIC: 0		Yes	

Eigenvalues







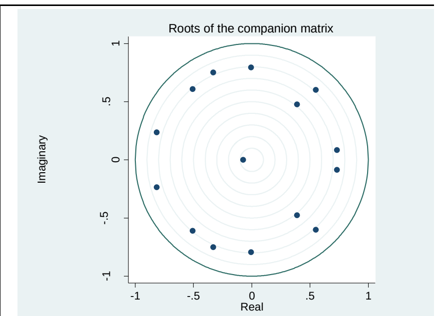
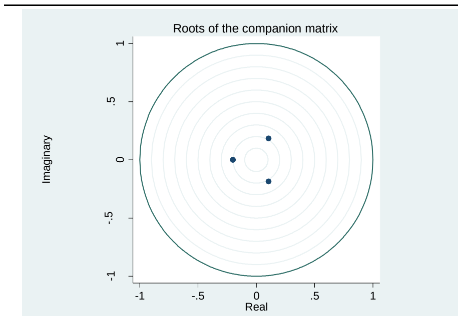
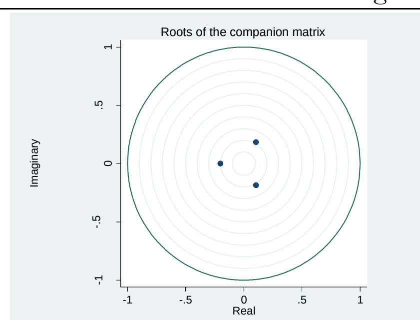


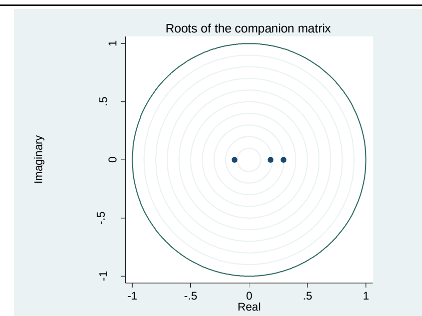
Table 5.C 16 - Cumulative Impulse Response Function of Sector 24: Shock (Exchange rate), Response (Inflation)

	Nominal Exchange Rate								*Sectoral Effective Exchange Rate*							
	Specification 1				*Specification 2*				*Specification 1*				*Specification 2*			
	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD
0	**0.51**	**0.27**	**0.75**	**0**	**0.51**	**0.27**	**0.75**	**0**	**0.34**	**0.09**	**0.59**	**0**	**0.34**	**0.09**	**0.59**	**0**
1	**0.75**	**0.38**	**1.11**	**0.14**	**0.75**	**0.38**	**1.11**	**0.14**	**0.39**	**0.02**	**0.75**	**0.06**	**0.39**	**0.02**	**0.75**	**0.06**
2	**0.76**	**0.39**	**1.14**	**0.16**	**0.76**	**0.39**	**1.14**	**0.16**	0.40	-0.02	0.83	0.06	0.40	-0.02	0.83	0.06
3	**0.76**	**0.39**	**1.12**	**0.16**	**0.76**	**0.39**	**1.12**	**0.16**	0.40	-0.04	0.85	0.06	0.40	-0.04	0.85	0.06
4	**0.75**	**0.39**	**1.12**	**0.16**	**0.75**	**0.39**	**1.12**	**0.16**	0.40	-0.05	0.86	0.06	0.40	-0.05	0.86	0.06
5	**0.75**	**0.39**	**1.12**	**0.16**	**0.75**	**0.39**	**1.12**	**0.16**	0.40	-0.05	0.86	0.06	0.40	-0.05	0.86	0.06
6	**0.75**	**0.39**	**1.12**	**0.16**	**0.75**	**0.39**	**1.12**	**0.16**	0.40	-0.05	0.86	0.06	0.40	-0.05	0.86	0.06
7	**0.75**	**0.39**	**1.12**	**0.16**	**0.75**	**0.39**	**1.12**	**0.16**	0.40	-0.05	0.86	0.06	0.40	-0.05	0.86	0.06
8	**0.75**	**0.39**	**1.12**	**0.16**	**0.75**	**0.39**	**1.12**	**0.16**	0.40	-0.05	0.86	0.06	0.40	-0.05	0.86	0.06
9	**0.75**	**0.39**	**1.12**	**0.16**	**0.75**	**0.39**	**1.12**	**0.16**	0.40	-0.05	0.86	0.06	0.40	-0.05	0.86	0.06
10	**0.75**	**0.39**	**1.12**	**0.16**	**0.75**	**0.39**	**1.12**	**0.16**	0.40	-0.05	0.86	0.06	0.40	-0.05	0.86	0.06
11	**0.75**	**0.39**	**1.12**	**0.16**	**0.75**	**0.39**	**1.12**	**0.16**	0.40	-0.05	0.86	0.06	0.40	-0.05	0.86	0.06
12	**0.75**	**0.39**	**1.12**	**0.16**	**0.75**	**0.39**	**1.12**	**0.16**	0.40	-0.05	0.86	0.06	0.40	-0.05	0.86	0.06
Information criterions (lag) – decision: 1					*Stable?*				*Information criterions (lag) – decision: 1*					*Stable?*		
AIC: 1		HQIC: 0		SBIC: 0	Yes				AIC: 1		HQIC: 0		SBIC: 0	Yes		

Eigenvalues







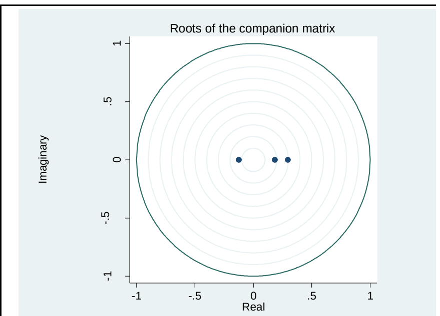
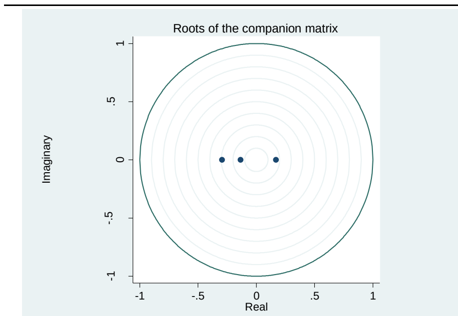
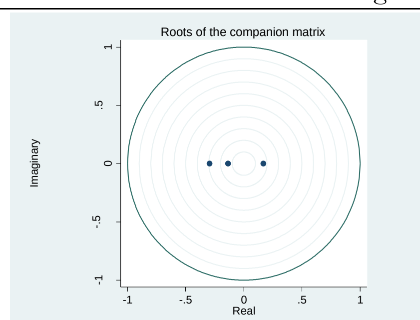


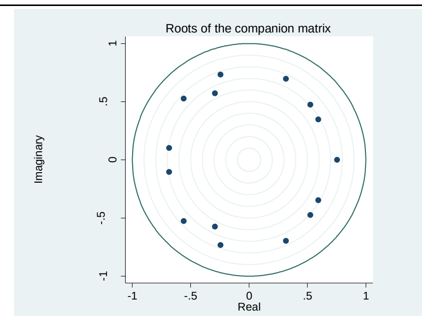
Table 5.C 17 - Cumulative Impulse Response Function of Sector 25: Shock (Exchange rate), Response (Inflation)

	Nominal Exchange Rate								*Sectoral Effective Exchange Rate*							
	Specification 1				*Specification 2*				*Specification 1*				*Specification 2*			
	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD
0	0.05	-0.07	0.19	0	0.05	-0.07	0.19	0	0.10	-0.02	0.22	0	0.10	-0.02	0.22	0
1	0.70	0.48	0.92	0.00	0.70	0.48	0.92	0.00	0.70	0.50	0.91	0.02	0.70	0.50	0.91	0.02
2	0.74	0.46	1.02	0.42	0.74	0.46	1.02	0.42	0.72	0.42	1.00	0.44	0.72	0.42	1.00	0.44
3	0.75	0.45	1.05	0.42	0.75	0.45	1.05	0.42	0.60	0.25	0.95	0.44	0.60	0.25	0.95	0.44
4	0.75	0.45	1.06	0.42	0.75	0.45	1.06	0.42	0.61	0.22	0.99	0.45	0.61	0.22	0.99	0.45
5	0.75	0.45	1.06	0.42	0.75	0.45	1.06	0.42	0.71	0.29	1.14	0.39	0.71	0.29	1.14	0.39
6	0.75	0.44	1.06	0.42	0.75	0.44	1.06	0.42	0.82	0.35	1.29	0.39	0.82	0.35	1.29	0.39
7	0.75	0.44	1.06	0.42	0.75	0.44	1.06	0.42	0.88	0.38	1.38	0.39	0.88	0.38	1.38	0.39
8	0.75	0.44	1.06	0.42	0.75	0.44	1.06	0.42	0.91	0.39	1.42	0.39	0.91	0.39	1.42	0.39
9	0.75	0.44	1.06	0.42	0.75	0.44	1.06	0.42	0.88	0.35	1.42	0.39	0.88	0.35	1.42	0.39
10	0.75	0.44	1.06	0.42	0.75	0.44	1.06	0.42	0.88	0.32	1.44	0.39	0.88	0.32	1.44	0.39
11	0.75	0.44	1.06	0.42	0.75	0.44	1.06	0.42	0.91	0.33	1.49	0.39	0.91	0.33	1.49	0.39
12	0.75	0.44	1.06	0.42	0.75	0.44	1.06	0.42	0.93	0.33	1.52	0.39	0.93	0.33	1.52	0.39
Information criterions (lag) – decision: 1					*Stable?*				*Information criterions (lag) – decision: 5*					*Stable?*		
AIC: 1		HQIC: 0		SBIC: 0	Yes				AIC: 5		HQIC: 1		SBIC: 1	Yes		

Eigenvalues







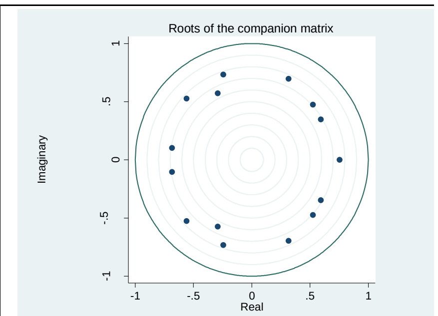
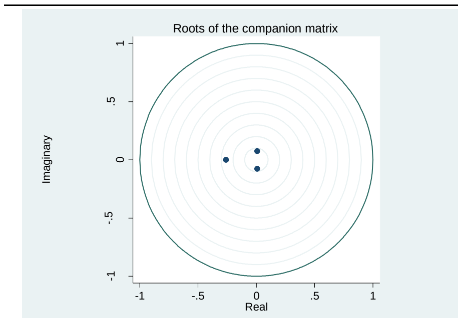


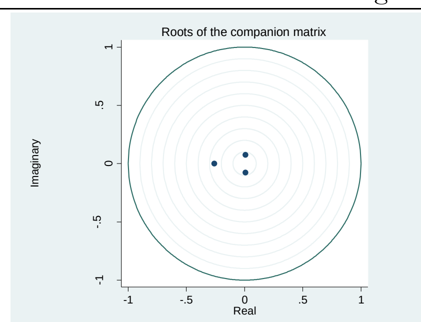
Table 5.C 18 - Cumulative Impulse Response Function of Sector 26: Shock (Exchange rate), Response (Inflation)

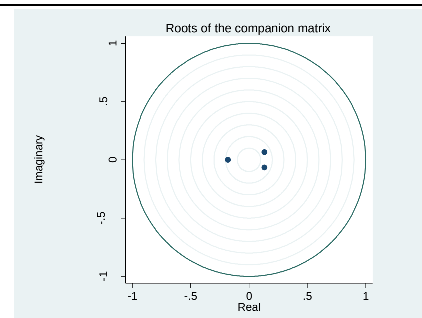
	Nominal Exchange Rate								*Sectoral Effective Exchange Rate*							
	Specification 1				*Specification 2*				*Specification 1*				*Specification 2*			
	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD
0	0.24	0.02	0.45	0	0.24	0.02	0.45	0	0.32	0.10	0.53	0	0.32	0.10	0.53	0
1	0.43	0.13	0.73	0.04	0.43	0.13	0.73	0.04	0.46	0.16	0.77	0.07	0.46	0.16	0.77	0.07
2	0.41	0.11	0.71	0.06	0.41	0.11	0.71	0.06	0.49	0.15	0.84	0.08	0.49	0.15	0.84	0.08
3	0.42	0.12	0.72	0.06	0.42	0.12	0.72	0.06	0.50	0.15	0.85	0.08	0.50	0.15	0.85	0.08
4	0.42	0.12	0.72	0.06	0.42	0.12	0.72	0.06	0.50	0.15	0.85	0.08	0.50	0.15	0.85	0.08
5	0.42	0.12	0.72	0.06	0.42	0.12	0.72	0.06	0.50	0.15	0.85	0.08	0.50	0.15	0.85	0.08
6	0.42	0.12	0.72	0.06	0.42	0.12	0.72	0.06	0.50	0.15	0.85	0.08	0.50	0.15	0.85	0.08
7	0.42	0.12	0.72	0.06	0.42	0.12	0.72	0.06	0.50	0.15	0.85	0.08	0.50	0.15	0.85	0.08
8	0.42	0.12	0.72	0.06	0.42	0.12	0.72	0.06	0.50	0.15	0.85	0.08	0.50	0.15	0.85	0.08
9	0.42	0.12	0.72	0.06	0.42	0.12	0.72	0.06	0.50	0.15	0.85	0.08	0.50	0.15	0.85	0.08
10	0.42	0.12	0.72	0.06	0.42	0.12	0.72	0.06	0.50	0.15	0.85	0.08	0.50	0.15	0.85	0.08
11	0.42	0.12	0.72	0.06	0.42	0.12	0.72	0.06	0.50	0.15	0.85	0.08	0.50	0.15	0.85	0.08
12	0.42	0.12	0.72	0.06	0.42	0.12	0.72	0.06	0.50	0.15	0.85	0.08	0.50	0.15	0.85	0.08

Nominal Exchange Rate				*Sectoral Effective Exchange Rate*			
Information criterions (lag) – decision: 1			*Stable?*	*Information criterions (lag) – decision: 1*			*Stable?*
AIC: 0	HQIC: 0	SBIC: 0	Yes	AIC: 0	HQIC: 0	SBIC: 0	Yes

Eigenvalues







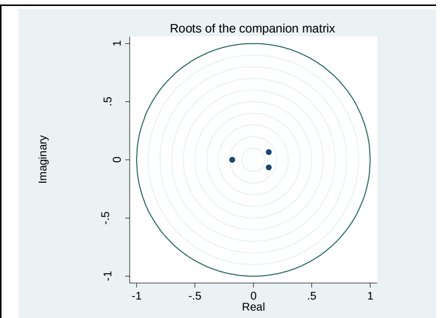


Table 5.C 19 - Cumulative Impulse Response Function of Sector 27: Shock (Exchange rate), Response (Inflation)

	Nominal Exchange Rate								*Sectoral Effective Exchange Rate*							
	Specification 1				*Specification 2*				*Specification 1*				*Specification 2*			
	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD
0	0.12	-0.02	0.27	0	0.12	-0.02	0.27	0	0.12	-0.02	0.27	0	0.12	-0.02	0.27	0
1	0.21	-0.00	0.42	0.02	0.21	-0.00	0.42	0.02	0.31	0.10	0.52	0.04	0.31	0.10	0.52	0.04
2	0.20	-0.00	0.41	0.03	0.20	-0.00	0.41	0.03	0.33	0.10	0.56	0.07	0.33	0.10	0.56	0.07
3	0.20	-0.00	0.41	0.03	0.20	-0.00	0.41	0.03	0.33	0.10	0.55	0.07	0.33	0.10	0.55	0.07
4	0.20	-0.00	0.41	0.03	0.20	-0.00	0.41	0.03	0.33	0.10	0.55	0.07	0.33	0.10	0.55	0.07
5	0.20	-0.00	0.41	0.03	0.20	-0.00	0.41	0.03	0.33	0.10	0.55	0.07	0.33	0.10	0.55	0.07
6	0.20	-0.00	0.41	0.03	0.20	-0.00	0.41	0.03	0.33	0.10	0.55	0.07	0.33	0.10	0.55	0.07
7	0.20	-0.00	0.41	0.03	0.20	-0.00	0.41	0.03	0.33	0.10	0.55	0.07	0.33	0.10	0.55	0.07
8	0.20	-0.00	0.41	0.03	0.20	-0.00	0.41	0.03	0.33	0.10	0.55	0.07	0.33	0.10	0.55	0.07
9	0.20	-0.00	0.41	0.03	0.20	-0.00	0.41	0.03	0.33	0.10	0.55	0.07	0.33	0.10	0.55	0.07
10	0.20	-0.00	0.41	0.03	0.20	-0.00	0.41	0.03	0.33	0.10	0.55	0.07	0.33	0.10	0.55	0.07
11	0.20	-0.00	0.41	0.03	0.20	-0.00	0.41	0.03	0.33	0.10	0.55	0.07	0.33	0.10	0.55	0.07
12	0.20	-0.00	0.41	0.03	0.20	-0.00	0.41	0.03	0.33	0.10	0.55	0.07	0.33	0.10	0.55	0.07
Information criterions (lag) – decision: 1					*Stable?*				*Information criterions (lag) – decision: 1*					*Stable?*		
AIC: 1		HQIC: 0		SBIC: 0	Yes				AIC: 1		HQIC: 0		SBIC: 0	Yes		

Eigenvalues

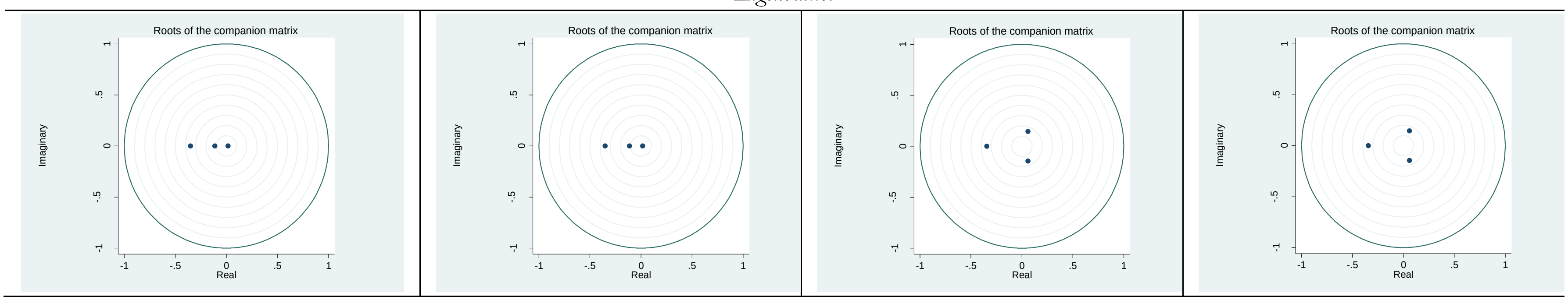
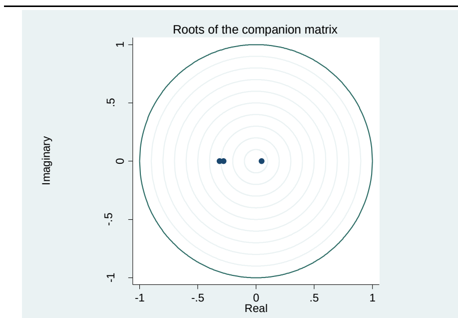


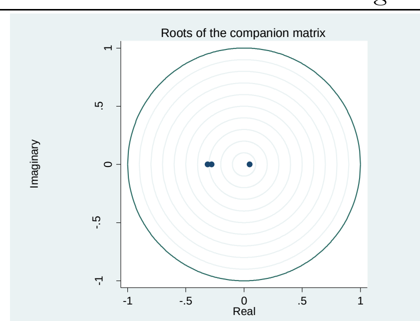
Table 5.C 20 - Cumulative Impulse Response Function of Sector 28: Shock (Exchange rate), Response (Inflation)

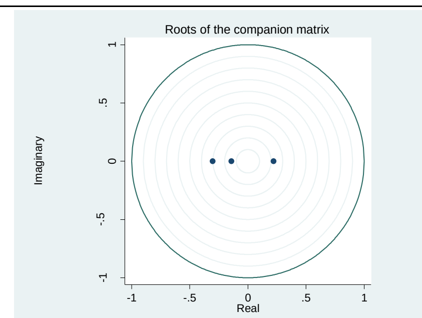
	Nominal Exchange Rate								*Sectoral Effective Exchange Rate*							
	Specification 1				*Specification 2*				*Specification 1*				*Specification 2*			
	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD
0	0.15	0.04	0.27	0	0.15	0.04	0.27	0	0.19	0.07	0.31	0	0.19	0.07	0.31	0
1	0.33	0.17	0.49	0.06	0.33	0.17	0.49	0.06	0.29	0.12	0.45	0.08	0.29	0.12	0.45	0.08
2	0.29	0.13	0.46	0.12	0.29	0.13	0.46	0.12	0.30	0.12	0.49	0.10	0.30	0.12	0.49	0.10
3	0.30	0.14	0.47	0.12	0.30	0.14	0.47	0.12	0.31	0.12	0.50	0.10	0.31	0.12	0.50	0.10
4	0.30	0.14	0.46	0.12	0.30	0.14	0.46	0.12	0.31	0.12	0.50	0.10	0.31	0.12	0.50	0.10
5	0.30	0.14	0.46	0.12	0.30	0.14	0.46	0.12	0.31	0.12	0.50	0.10	0.31	0.12	0.50	0.10
6	0.30	0.14	0.46	0.12	0.30	0.14	0.46	0.12	0.31	0.12	0.50	0.10	0.31	0.12	0.50	0.10
7	0.30	0.14	0.46	0.12	0.30	0.14	0.46	0.12	0.31	0.12	0.50	0.10	0.31	0.12	0.50	0.10
8	0.30	0.14	0.46	0.12	0.30	0.14	0.46	0.12	0.31	0.12	0.50	0.10	0.31	0.12	0.50	0.10
9	0.30	0.14	0.46	0.12	0.30	0.14	0.46	0.12	0.31	0.12	0.50	0.10	0.31	0.12	0.50	0.10
10	0.30	0.14	0.46	0.12	0.30	0.14	0.46	0.12	0.31	0.12	0.50	0.10	0.31	0.12	0.50	0.10
11	0.30	0.14	0.46	0.12	0.30	0.14	0.46	0.12	0.31	0.12	0.50	0.10	0.31	0.12	0.50	0.10
12	0.30	0.14	0.46	0.12	0.30	0.14	0.46	0.12	0.31	0.12	0.50	0.10	0.31	0.12	0.50	0.10

Information criterions (lag) – decision: 1			*Stable?*	*Information criterions (lag) – decision: 1*			*Stable?*
AIC: 1	HQIC: 0	SBIC: 0	Yes	AIC: 1	HQIC: 0	SBIC: 0	Yes

Eigenvalues







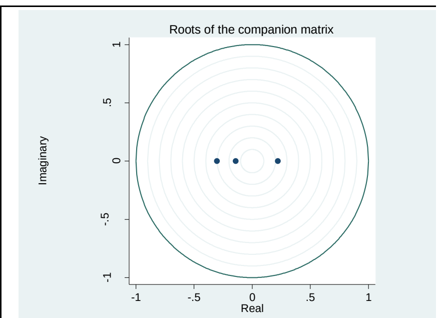
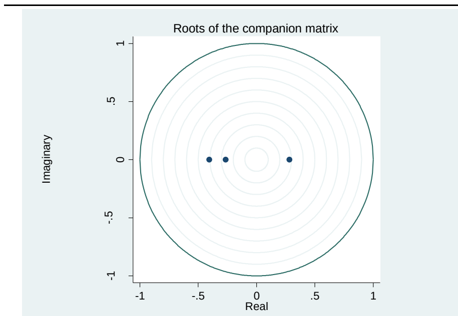


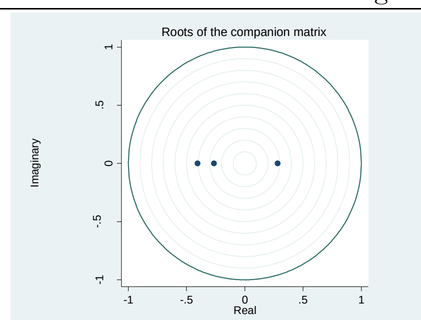
Table 5.C 21 - Cumulative Impulse Response Function of Sector 29: Shock (Exchange rate), Response (Inflation)

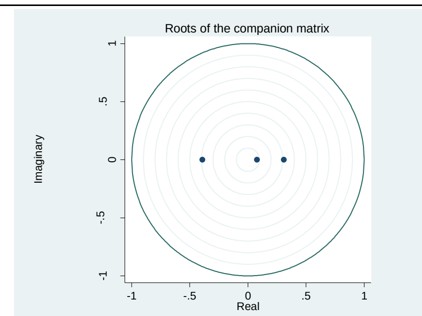
	Nominal Exchange Rate								*Sectoral Effective Exchange Rate*							
	Specification 1				*Specification 2*				*Specification 1*				*Specification 2*			
	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD
0	0.07	0.01	0.14	0	0.07	0.01	0.14	0	0.09	0.03	0.16	0	0.09	0.03	0.16	0
1	0.18	0.08	0.28	0.04	0.18	0.08	0.28	0.04	0.16	0.06	0.27	0.07	0.16	0.06	0.27	0.07
2	0.19	0.08	0.30	0.12	0.19	0.08	0.30	0.12	0.19	0.06	0.31	0.10	0.19	0.06	0.31	0.10
3	0.20	0.08	0.32	0.12	0.20	0.08	0.32	0.12	0.20	0.06	0.33	0.10	0.20	0.06	0.33	0.10
4	0.20	0.08	0.32	0.12	0.20	0.08	0.32	0.12	0.20	0.06	0.34	0.10	0.20	0.06	0.34	0.10
5	0.20	0.08	0.32	0.12	0.20	0.08	0.32	0.12	0.20	0.06	0.34	0.10	0.20	0.06	0.34	0.10
6	0.20	0.08	0.32	0.12	0.20	0.08	0.32	0.12	0.20	0.06	0.34	0.10	0.20	0.06	0.34	0.10
7	0.20	0.08	0.32	0.12	0.20	0.08	0.32	0.12	0.20	0.06	0.34	0.10	0.20	0.06	0.34	0.10
8	0.20	0.08	0.32	0.12	0.20	0.08	0.32	0.12	0.20	0.06	0.34	0.10	0.20	0.06	0.34	0.10
9	0.20	0.08	0.32	0.12	0.20	0.08	0.32	0.12	0.20	0.06	0.34	0.10	0.20	0.06	0.34	0.10
10	0.20	0.08	0.32	0.12	0.20	0.08	0.32	0.12	0.20	0.06	0.34	0.10	0.20	0.06	0.34	0.10
11	0.20	0.08	0.32	0.12	0.20	0.08	0.32	0.12	0.20	0.06	0.34	0.10	0.20	0.06	0.34	0.10
12	0.20	0.08	0.32	0.12	0.20	0.08	0.32	0.12	0.20	0.06	0.34	0.10	0.20	0.06	0.34	0.10

Information criterions (lag) – decision: 1			*Stable?*	*Information criterions (lag) – decision: 1*			*Stable?*
AIC: 1	HQIC: 1	SBIC: 1	Yes	AIC: 1	HQIC: 1	SBIC: 1	Yes

Eigenvalues







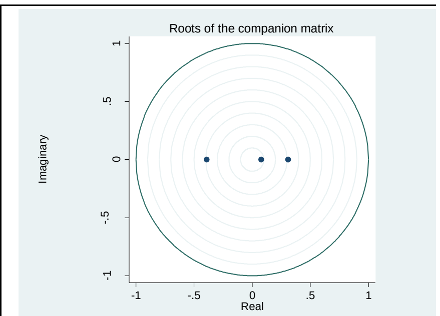
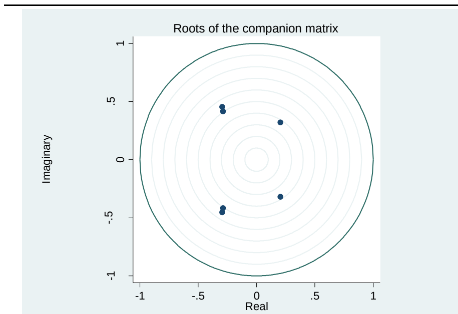
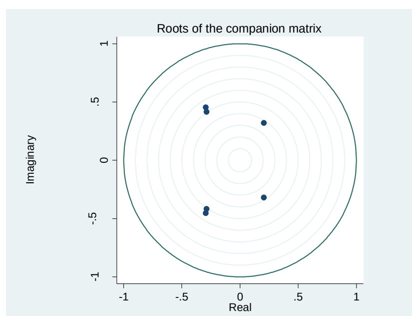


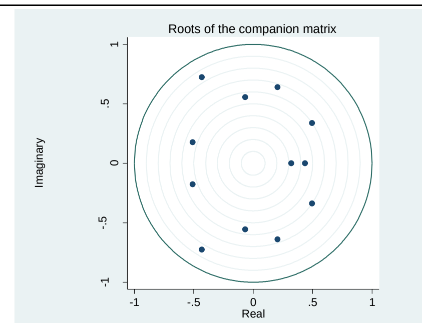
Table 5.C 22 - Cumulative Impulse Response Function of Sector 30: Shock (Exchange rate), Response (Inflation)

	Nominal Exchange Rate								*Sectoral Effective Exchange Rate*							
	Specification 1				*Specification 2*				*Specification 1*				*Specification 2*			
	CIRF	*Confidence Interval*		FEVD	CIRF	*Confidence Interval*		FEVD	CIRF	*Confidence Interval*		FEVD	CIRF	*Confidence Interval*		FEVD
		Lower	Upper			Lower	Upper			Lower	Upper			Lower	Upper	
0	1.39	1.13	1.66	0	1.39	1.13	1.66	0	1.47	1.22	1.72	0	1.47	1.22	1.72	0
1	2.31	1.82	2.79	0.62	2.31	1.82	2.79	0.62	2.14	1.64	2.63	0.72	2.14	1.64	2.63	0.72
2	2.29	1.63	2.96	0.68	2.29	1.63	2.96	0.68	2.01	1.31	2.71	0.70	2.01	1.31	2.71	0.70
3	2.17	1.43	2.92	0.68	2.17	1.43	2.92	0.68	1.87	1.03	2.71	0.67	1.87	1.03	2.71	0.67
4	2.17	1.41	2.94	0.68	2.17	1.41	2.94	0.68	2.08	1.13	3.04	0.67	2.08	1.13	3.04	0.67
5	2.15	1.42	2.89	0.68	2.15	1.42	2.89	0.68	2.20	1.15	3.24	0.66	2.20	1.15	3.24	0.66
6	2.16	1.44	2.88	0.68	2.16	1.44	2.88	0.68	2.24	1.17	3.32	0.66	2.24	1.17	3.32	0.66
7	2.16	1.45	2.88	0.68	2.16	1.45	2.88	0.68	2.28	1.20	3.36	0.66	2.28	1.20	3.36	0.66
8	2.16	1.44	2.88	0.68	2.16	1.44	2.88	0.68	2.24	1.13	3.34	0.66	2.24	1.13	3.34	0.66
9	2.16	1.44	2.88	0.68	2.16	1.44	2.88	0.68	2.22	1.10	3.35	0.66	2.22	1.10	3.35	0.66
10	2.16	1.44	2.88	0.68	2.16	1.44	2.88	0.68	2.26	1.12	3.39	0.66	2.26	1.12	3.39	0.66
11	2.16	1.44	2.88	0.68	2.16	1.44	2.88	0.68	2.24	1.11	3.38	0.66	2.24	1.11	3.38	0.66
12	2.16	1.44	2.88	0.68	2.16	1.44	2.88	0.68	2.24	1.10	3.37	0.66	2.24	1.10	3.37	0.66
Information criterions (lag) – decision: 1						*Stable?*			*Information criterions (lag) – decision: 4*						*Stable?*	
AIC: 2		HQIC: 1		SBIC: 1		Yes			AIC: 4		HQIC: 1		SBIC: 0		Yes	

Eigenvalues







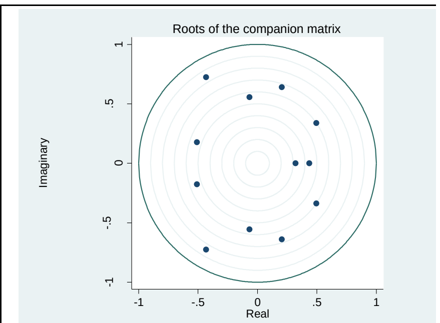
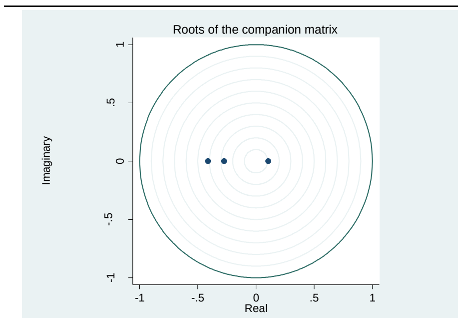
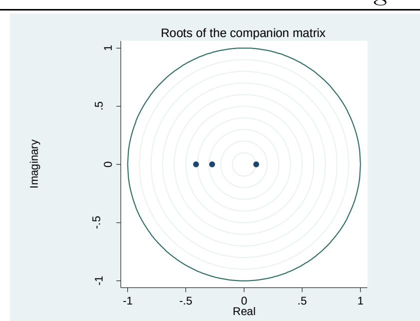


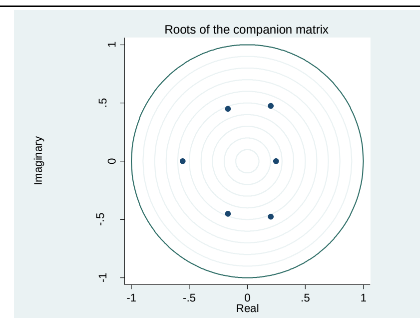
Table 5.C 23 - Cumulative Impulse Response Function of Sector 31: Shock (Exchange rate), Response (Inflation)

	Nominal Exchange Rate								*Sectoral Effective Exchange Rate*							
	Specification 1				*Specification 2*				*Specification 1*				*Specification 2*			
	CIRF	*Confidence Interval*		FEVD	CIRF	*Confidence Interval*		FEVD	CIRF	*Confidence Interval*		FEVD	CIRF	*Confidence Interval*		FEVD
		Lower	Upper			Lower	Upper			Lower	Upper			Lower	Upper	
0	0.18	0.07	0.29	0	0.18	0.07	0.29	0	0.22	0.11	0.33	0	0.22	0.11	0.33	0
1	0.34	0.18	0.50	0.08	0.34	0.18	0.50	0.08	0.32	0.17	0.48	0.12	0.32	0.17	0.48	0.12
2	0.33	0.16	0.49	0.13	0.33	0.16	0.49	0.13	0.45	0.26	0.64	0.15	0.45	0.26	0.64	0.15
3	0.33	0.16	0.50	0.13	0.33	0.16	0.50	0.13	0.43	0.23	0.63	0.17	0.43	0.23	0.63	0.17
4	0.33	0.16	0.50	0.13	0.33	0.16	0.50	0.13	0.38	0.19	0.58	0.17	0.38	0.19	0.58	0.17
5	0.33	0.16	0.50	0.13	0.33	0.16	0.50	0.13	0.38	0.19	0.57	0.18	0.38	0.19	0.57	0.18
6	0.33	0.16	0.50	0.13	0.33	0.16	0.50	0.13	0.39	0.21	0.57	0.18	0.39	0.21	0.57	0.18
7	0.33	0.16	0.50	0.13	0.33	0.16	0.50	0.13	0.39	0.21	0.58	0.18	0.39	0.21	0.58	0.18
8	0.33	0.16	0.50	0.13	0.33	0.16	0.50	0.13	0.39	0.21	0.58	0.18	0.39	0.21	0.58	0.18
9	0.33	0.16	0.50	0.13	0.33	0.16	0.50	0.13	0.39	0.21	0.58	0.18	0.39	0.21	0.58	0.18
10	0.33	0.16	0.50	0.13	0.33	0.16	0.50	0.13	0.39	0.21	0.58	0.18	0.39	0.21	0.58	0.18
11	0.33	0.16	0.50	0.13	0.33	0.16	0.50	0.13	0.39	0.21	0.58	0.18	0.39	0.21	0.58	0.18
12	0.33	0.16	0.50	0.13	0.33	0.16	0.50	0.13	0.39	0.21	0.58	0.18	0.39	0.21	0.58	0.18
Information criterions (lag) – decision: 1						*Stable?*			*Information criterions (lag) – decision: 2*						*Stable?*	
AIC: 1		HQIC: 1		SBIC: 1		Yes			AIC: 2		HQIC: 1		SBIC: 0		Yes	

Eigenvalues







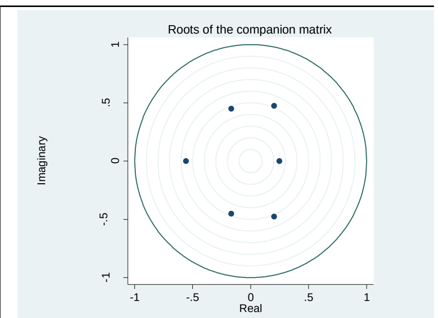
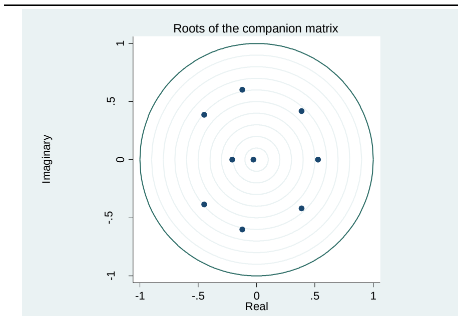
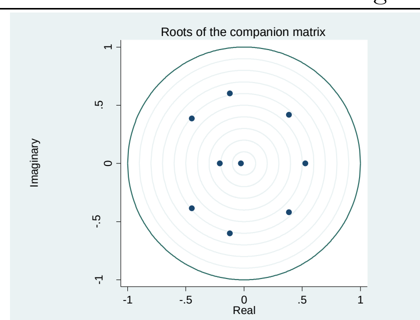


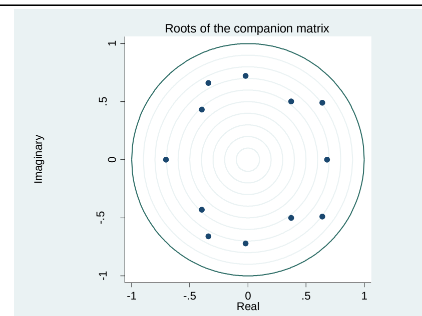
Table 5.C 24 - Cumulative Impulse Response Function of Sector extractive industry: Shock (Exchange rate), Response (Inflation)

	Nominal Exchange Rate								*Sectoral Effective Exchange Rate*							
	Specification 1				*Specification 2*				*Specification 1*				*Specification 2*			
	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD
0	0.36	0.27	0.45	0	0.36	0.27	0.45	0	0.36	0.27	0.44	0	0.36	0.27	0.44	0
1	0.74	0.56	0.93	0.41	0.74	0.56	0.93	0.41	0.67	0.50	0.85	0.44	0.67	0.50	0.85	0.44
2	0.84	0.57	1.10	0.53	0.84	0.57	1.10	0.53	0.73	0.48	0.98	0.50	0.73	0.48	0.98	0.50
3	0.78	0.46	1.11	0.53	0.78	0.46	1.11	0.53	0.64	0.33	0.95	0.49	0.64	0.33	0.95	0.49
4	0.75	0.39	1.11	0.53	0.75	0.39	1.11	0.53	0.65	0.31	1.00	0.50	0.65	0.31	1.00	0.50
5	0.72	0.33	1.10	0.53	0.72	0.33	1.10	0.53	0.67	0.30	1.04	0.46	0.67	0.30	1.04	0.46
6	0.70	0.33	1.08	0.53	0.70	0.33	1.08	0.53	0.64	0.26	1.01	0.45	0.64	0.26	1.01	0.45
7	0.71	0.35	1.06	0.53	0.71	0.35	1.06	0.53	0.63	0.27	0.99	0.44	0.63	0.27	0.99	0.44
8	0.71	0.37	1.06	0.53	0.71	0.37	1.06	0.53	0.66	0.32	1.01	0.44	0.66	0.32	1.01	0.44
9	0.72	0.38	1.06	0.53	0.72	0.38	1.06	0.53	0.67	0.33	1.01	0.44	0.67	0.33	1.01	0.44
10	0.72	0.38	1.06	0.53	0.72	0.38	1.06	0.53	0.68	0.34	1.02	0.44	0.68	0.34	1.02	0.44
11	0.72	0.37	1.06	0.53	0.72	0.37	1.06	0.53	0.68	0.33	1.03	0.44	0.68	0.33	1.03	0.44
12	0.72	0.37	1.06	0.53	0.72	0.37	1.06	0.53	0.69	0.33	1.05	0.44	0.69	0.33	1.05	0.44
Information criterions (lag) – decision:					*Stable?*				*Information criterions (lag) – decision 4*					*Stable?*		
AIC: 3		HQIC: 1		SBIC: 1	Yes				AIC: 4		HQIC: 1		SBIC: 1	Yes		

Eigenvalues







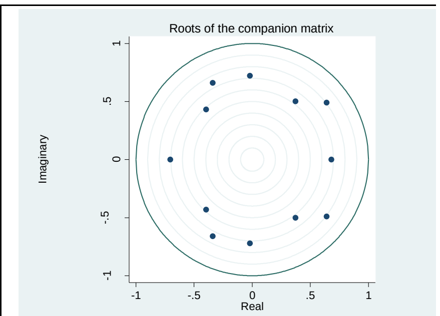
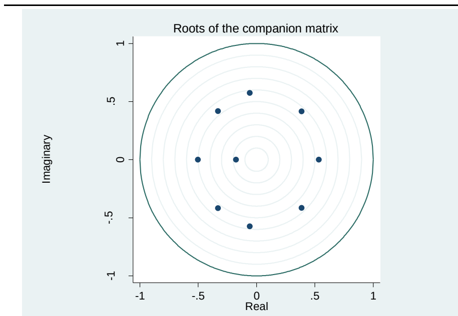
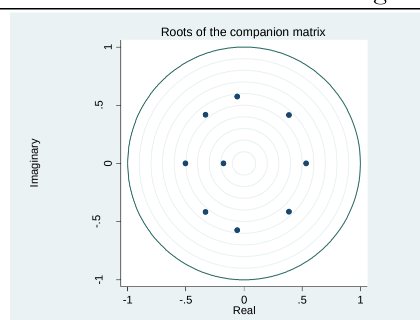


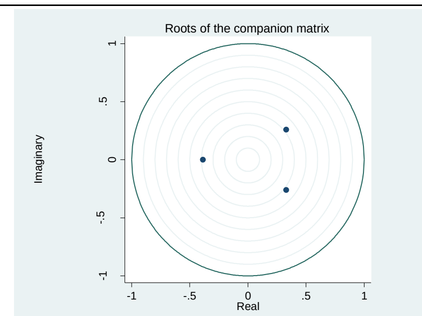
Table 5.C 25 - Cumulative Impulse Response Function of Producer Price Index: Shock (Exchange rate), Response (Inflation)

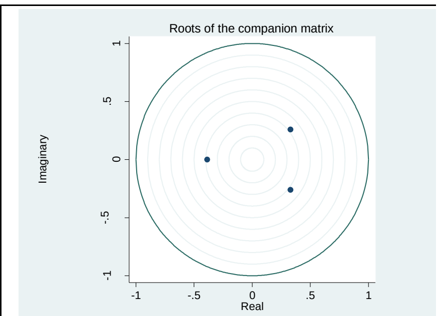
	Nominal Exchange Rate								*Sectoral Effective Exchange Rate*							
	Specification 1				*Specification 2*				*Specification 1*				*Specification 2*			
	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD	CIRF	*Confidence Interval* Lower	Upper	FEVD
0	0.42	0.32	0.51	0	0.42	0.32	0.51	0	0.45	0.34	0.55	0	0.45	0.34	0.55	0
1	0.84	0.65	1.04	0.47	0.84	0.65	1.04	0.47	0.81	0.62	1.00	0.47	0.81	0.62	1.00	0.47
2	0.94	0.67	1.22	0.60	0.94	0.67	1.22	0.60	0.98	0.71	1.24	0.57	0.98	0.71	1.24	0.57
3	0.90	0.56	1.23	0.60	0.90	0.56	1.23	0.60	1.02	0.70	1.33	0.59	1.02	0.70	1.33	0.59
4	0.86	0.48	1.24	0.60	0.86	0.48	1.24	0.60	1.02	0.69	1.35	0.59	1.02	0.69	1.35	0.59
5	0.83	0.43	1.22	0.59	0.83	0.43	1.22	0.59	1.01	0.67	1.35	0.59	1.01	0.67	1.35	0.59
6	0.82	0.43	1.21	0.59	0.82	0.43	1.21	0.59	1.00	0.67	1.34	0.59	1.00	0.67	1.34	0.59
7	0.83	0.46	1.19	0.59	0.83	0.46	1.19	0.59	1.00	0.67	1.33	0.59	1.00	0.67	1.33	0.59
8	0.83	0.48	1.19	0.59	0.83	0.48	1.19	0.59	1.00	0.67	1.33	0.59	1.00	0.67	1.33	0.59
9	0.83	0.48	1.19	0.59	0.83	0.48	1.19	0.59	1.00	0.67	1.33	0.59	1.00	0.67	1.33	0.59
10	0.84	0.48	1.19	0.59	0.84	0.48	1.19	0.59	1.00	0.67	1.33	0.59	1.00	0.67	1.33	0.59
11	0.83	0.48	1.19	0.59	0.83	0.48	1.19	0.59	1.00	0.67	1.33	0.59	1.00	0.67	1.33	0.59
12	0.83	0.47	1.19	0.59	0.83	0.47	1.19	0.59	1.00	0.67	1.33	0.59	1.00	0.67	1.33	0.59
Information criterions (lag) – decision: 3					*Stable?*				*Information criterions (lag) – decision: 1*					*Stable?*		
AIC: 3		HQIC: 1		SBIC: 1	Yes				AIC: 1		HQIC: 1		SBIC: 1	Yes		

Eigenvalues









SIXTH ESSAY - Real Exchange Rate and Growth: identifying transmission channels

Abstract

This article provides empirical evidence about the influence of pursuing a competitive real exchange rate over the behavior of income distribution (functional and personal), investment, consumption, net exports, social capabilities, and Total Factor Productivity. The study is developed using a panel database of 151 countries over the period 1990-2017. The findings indicate that a competitive real exchange rate spurs, directly, the capital accumulation, social capabilities, Total Factor Productivity, and net exports at the expense of worst functional income distribution and lower consumption. The article also provides evidence that a competitive real exchange rate indirectly expands the net exports by lowering labor costs. A further result is that a devalued real exchange rate is negatively correlated with income inequality in terms of income's Gini. Moreover, the findings suggest that the real exchange rate's effects tend to be stronger in economies from Africa, Asia, and Latin America.

Key words: Real Exchange Rate, Growth, Income Distribution, Investment, Consumption, Net Exports, Social Capabilities, Total Factor Productivity.

1- Introduction

There is ample literature documenting the consequences of a competitive real exchange rate (RER, henceforth) on the long-run growth. Pursuing a competitive RER accelerates the pace of economic growth in the long-run (Cottani et al. 1990, Dollar, 1992, Razin, 1997, Aguirre and Calderón, 2005, Rodrik, 2008, Berg, 2010, Bahlla, 2012, among others).

Literature suggests that one transmission channel from RER towards economic growth occurs via its effects over the investment. The argument is that a competitive RER spurs the profit-rate of tradable sectors (Rodrik, 2008, Bahlla, 2012), redistributing the income from a class with a low propensity to save (workers) towards a class with greater propensity to save (firms) (Bahmani-Oskooe and Hajilee, 2010, Gluzmann et al., 2012, Guzman et al., 2018). The greater profit-rate, induced by the competitive RER, boosts the growth by inciting the firms to invest.

In other words, pursuing a competitive RER is a strategy to induce long-run growth because it increases capital accumulation (with reverberant effects over the technological progress and labor productivity). The cost of this strategy is to accept a lower consumption/real wage and more income inequality, at present, to boost the investment capacity of the economy and, possibly, the economic growth in the long-run.

The article's purpose is to investigate possible channels of influence from the RER into economic growth. First, the article studies whether, or not, pursuing a competitive RER is associated with changes in income distribution (personal and functional) and with changes in the allocation of GDP between consumption or saving/investment. Second, the article measures the influence of a competitive RER and labor costs over the net exports. Third, the article examines whether a competitive RER is associated with social capability and Total Factor Productivity. In the light of the literature's suggestion that the effects of a competitive RER are more important for developing countries, the article examines whether this assertion is valid for the study's variables of interest in the case of economies from Africa, Latin America, and Asia.

The study has used cross-country database panel data for 151 countries over the period between 1990 and 2017. The results suggest that a competitive RER is associated with a worse functional income distribution in favor of profit-share, and better personal income distribution. Moreover, the findings evidence that a competitive RER reduces consumption to the detriment of a greater investment/saving, whilst a competitive RER expands the net export directly by making the exports (imports) cheaper (more expansive) and indirectly by reducing the labor costs. The results also indicate that social capability and productivity growth are associated with other elements than labor, capital, and human capital, in this case, with the adoption of a competitive RER. At last, the regressions indicate that the effects of a competitive RER tend to be stronger in countries from Africa, Latin America, and Asia.

After this introduction, the article is organized as follows. Section 2 discusses the transmission channels through which the RER affects economic growth, mainly about its capital accumulation effects. Section 3 presents the empirical strategy (database, estimation model, and method). Section 4 presents the results. Section 5 ends the article with a final discussion about the article's empirical findings in light of the discussions of Section 2.

2- RER and Growth: a brief discussion about the transmission channels

One of the most important contributions to the existing literature, in terms of identifying the transmission channels by which the RER influences economic growth, is Rodrik's (2008) article. His argument is the RER impacts the size of tradable sectors within the productive structure, mainly the manufacturing sectors, at detriment of the non-tradable sectors (services), which boosts the economic growth. The link between a competitive RER and this structural change is its expansionary effects over tradable sectors' profitability.

Rodrik (2008) provides two explanations to the influence of competitive RER on growth:

(1) The bad institutions explain, in parts, poor economic growth. Bad institutions damage the capital accumulation because of the social issues related to contractual incompleteness, hold-up problems, corruption, lack of property rights, and poor contract enforcement cut the ability of entrepreneurs to benefit from their investment (Rodrik, 2008). Moreover, Rodrik (2008) argues that such a problem imposes a higher tax on tradable modern sectors because of its more complexity. A competitive RER can offset this problem by increasing the profitability, and then the investment, of tradable sectors. In this case, a competitive RER is the second-best mechanism to boost economic growth (Rodrik, 2008).

(2) The tradable sectors, mainly in developing countries, are more likely to suffer from market failures: learning and coordination externalities, credit market imperfections and wage premiums, leading to a suboptimal level of output and investment. In this case, pursuing a competitive RER is a substitute for industrial policy (Rodrik, 2008).

In Rodrik's (2008) view, a competitive RER boosts the economic growth via the induction of production, capital accumulation, and technological progress of tradable sectors. Such influence is more relevant in developing countries because it remedies its bad institutions.

Other authors emphasize the importance of pursuing a competitive RER to spur growth, especially in the context of countries with bad institutions. Acemoglu (2003) claims that a non-competitive RER is associated with the high volatility of economic growth, and that this is an indication of faulty institutions, as a non-competitive RER favors the maintaining of the elites in power. Johnson et al. (2007) show that the poor countries can escape from the institutional weaknesses and the poverty inherited from the colonial history, as the Asian countries have been experiencing since the 1960s, by adopting the export-led strategy to promote the manufacturing exports. For that, avoiding RER overvaluations is essential (Johnson et al., 2007).

Gluzmann et al. (2012), in the light of the abundant empirical evidence about the positive influence of a competitive RER on economic growth, investigated the channel transmission channels from the RER into the economic performance. The authors found a positive effect of RER devaluations over investment, saving, and employment. Gluzmann et al. (2012) point out an additional channel to Rodrik's (2008) discussion. More specifically, RER devaluations reduce the real wages, transferring income from a class with a lower propensity to save to a class with a greater propensity to save (Gluzmann et al., 2012). In other words, RER devaluations increase the national saving by transferring income from workers to financially constrained firms, which enhances the capacity of investment in the economy (Gluzmann et al., 2012).

Bahlla (2012) claims that an important channel from RER to economic growth is its capital accumulation effects. Bahlla (2012)'s argument is that the RER changes the profitability of investments by directly affecting the labor's cost. An overvalued RER discourages the investment due to its positive (negative) effect on the labor's cost (profitability) (Bahlla, 2012). In contrast, a competitive RER, by reducing (increasing) the labor's cost (profitability), spurs investment and, then, the economic growth (Bahlla, 2012). Furthermore, the author argues that a competitive RER compensates some poor countries' problems: real interest rates, bureaucratic costs, investment environment, and corruption.

However, it should be stressed that the "path towards prosperity and development" by the adoption of a competitive RER is not painless.

Bahmani-Oskooe and Hajilee (2010) argue that a competitive RER positively influences the firms' profits by redistributing income from workers to firms (if wages are not readjusted *pari passu* the inflationary acceleration induced by RER's devaluation), and negatively by making the imported inputs more expensive. Therefore, the effects of a competitive RER over the capital accumulation depend on which channel prevails (Bahmani-Oskooe and Hajilee, 2010).

Guzman et al. (2018) point out that a competitive RER is associated with a trade-off between its effects on income distribution and economic performance. Pursuing a competitive RER means to accept a lower real wage and income, in the present, by promising a better standard of living in the future (Guzman et al., 2018). Put differently, a developing strategy based on a competitive RER means to lower the consumption (and real wage) to increase saving and, then, the economy's investment capacity, at present. If the investment, in fact, materializes, the society achieves more considerable economic growth with all the fruits of a faster pace of capital accumulation: technological progress and labor productivity. However, it turns out, that all individual does not pay the price of a competitive RER in the present, and it is not clear whose life will be better, after the economic growth (Guzman et al, 2018).

Ribeiro et al. (2020) studied the net influence of RER on economic growth considering two conflicting partial effects of a competitive RER: (i) its positive influence over technological progress, which fosters the economic growth, and (ii) its negative influence over the real wage and, then, positive influence over the income inequality, which damages the economic growth. The authors' findings for developing countries indicate that, in fact, RER devaluations increase the income inequality in terms of wage-share of GDP and the level of relative technological capabilities, influencing the economic growth indirectly via those channels. However, such an indirect effect of RER devaluation is negative (Ribeiro et al., 2020).

In a nutshell, the main argument of the discussed literature in this section is that the institutions are an important driver of long-run growth. Moreover, competitive RER can offset bad institutions' deleterious effects, inherited from history, of poor countries over its economic performance. The bad institutions act as lock-in point of poor economies within a specialized productive structure in few goods and low labor productivity, creating a trajectory of poor long-run growth. Pursuing a competitive RER is a manner to break the circular and cumulative process of poverty associated with bad institutions trap. A competitive RER contributes to change the growth path of society, encouraging capital accumulation and technological progress (to the detriment of worse income distribution and a lower (greater) consumption (saving) in the present), to, possibly, reach a more developed economy in the future.

3- Empirical Strategy and Database

The empirical strategy consists of estimating econometric regressions to explain the growth rate[81] of wage-share of GDP w_{ti}, the income's Gini $gini_{ti}$, investment i_{ti}, consumption c_{ti}, net exports nx_{ti}, social capabilities sc_{ti} and the TFP tfp_{ti} for 151 countries over the period between 1990 and 2017.[82] All dependent variables come from the Penn World Table 9.1, except for Gini's variable income that comes from Solt (2020). The estimated regression is:

$$y_{ti}=\alpha+\beta_1 Mis_{t-1,i}+ \beta_2 controls+f_t+f_i+ u_{it} \quad (1)$$

where the variable y_{ti} represents the dependent variables. The f_t and f_i are a time fixed effect (5-year) and country fixed effects. The variable *Mis* represents the measure of RER misalignment, employed lagged to avoid the simultaneity's problem.

The variable *Mis* is calculated by the authors following the procedure of Rodrik (2008). For this purpose, the variable real exchange rate *LRER* comes from the World Bank[83]:

$$LRER_{it}= L(PPP_{it}/XRAT_{it}) \quad (2)$$

where *i* and *t* stand for the country and time (5-year) index, respectively. The variables PPP_{it} and $XRAT_{it}$ are the conversion factor and the bilateral nominal exchange rate (national currency units per U.S. dollar). In the case that *LRER* is greater than zero, the value of the national currency is more appreciated than the purchasing power parity. Nonetheless, if the *LRER* is lower than zero, the valor of the national currency is more depreciated than the purchasing power parity. The equilibrium value of *LRER* is calculated taking into account the Balassa Samuelson effect by estimating a regression of *LRER* on the *per capita* GDP (LPIBCAPITA):

$$LRER_{it}= \alpha + \beta LPIBCAPITA_{it} + f_t + u_{it} \quad (3)$$

The Hausman test indicated that the most appropriate estimating model of equation (3) is the Random Effect. The estimates of Rodrik (2008) indicated a Balassa Samuelson effect around 0.24, while our estimate provided a Balassa Samuelson effect around 0.19.

Following the procedure of Rodrik (2008), in which the variable *Mis* is obtained by subtracting the predicted values of equation (3) from the indeed value of *LRER*, negative (positive) values of the variable *Mis* indicate that the RER is undervalued (overvalued) in relation

[81] The growth rate is represented by the variables in log-difference. The variable *gini* was employed in the logarithm of the level.

[82] See Table 1 in the appendix to check the list of countries. It should be noted that the number of countries can change in some regressions because of the availability of data. Table 2 in the appendix presents the database.

[83] *L* denotes that variables are in logarithm form.

to its equilibrium value. Therefore, a negative signal of β_1 in the equation (1) indicates that the RER devaluations (overvaluations) have an expansionary (contractionary) effect on the dependent variable. In contrast, a positive signal of β_1 indicates that the RER devaluations (overvaluations) have contractionary (expansionary) effects.

Regarding the control variables, it has opted to control only the inflation rate in the regressions performed to explain the wage-share of GDP and the income's Gini. The argument is that the inflation rate is associated with the income distribution as long it allows to redistribute the national income from workers to entrepreneurs and vice-versa.

The wage-share of GDP was introduced (in log-difference) as a controlling variable in addition to the inflation rate in the regressions performed to explain the remaining dependent variables. The argument is that the wage-share of GDP is a proxy for firms' mark-up of firms or for the labor costs (Bahduri and Marglin, 1989). Roughly, as greater is the growth rate of wage share of GDP/labor costs, lower tends to be the funds to finance the firms' investment and the national goods' international competitiveness. As greater is the labor costs, lower is the investment and the net exports. This is due to the increasing of consumption to the detriment of saving (or real wages in detriment of profits) and the loss of international competitiveness.

As the functional income distribution may be associated with the labor-saving technological progress: as greater is the wage-share in GDP, greater is the entrepreneurs' efforts to invest in new technologies. Therefore, the wage share in GDP is introduced, as a controlling variable, into the regressions performed to explain the social capability and TFP.

The regressions are estimated using the econometric methodology of Roodman (2009) in a dynamic panel model represented by a System of equations, in which both levels as differences of independent variables are used as instruments (Blundell and Bond, 1998). The parameters are estimated by the *Generalized Method of Moments* (GMM), which deals with the endogeneity issue. In the case in which the null hypothesis of the Arellano and Bond's test for autocorrelation of order 2 in the error term and the null hypothesis of the Sargan/Hansen test are not rejected, the set of the internal instrument is valid, which eliminates the possibility of bias produced by the existence of endogeneity (Roodman, 2009).

4- Results of Empirical Estimates

The estimates are presented in what follows. The regressions fitted well. Both the Arellano and Bond's test for autocorrelation of order (2) in the error term as the test of Sargan/Hansen for the validity of instruments do not reject the null hypothesis.[84]

Two further specifications are performed. The first specification tests if the RER effects are different for Asian, African, and Latin American countries. For this purpose, equation (1) is estimated for this restricted sample of countries. The second specification is a robustness check: equation (1) is estimated using the lagged value of *LRER* instead of *Mis*. The complete output of regressions is presented in the Tables in appendix B.

4.1- Income Distribution

The estimates performed to explain the wage-share in GDP are reported in Table 1. The results suggest that the estimated coefficient of the variable *Mis* is statistically significant, at least, at 10% and positive in the regressions for the full sample of countries as for the restricted sample of countries. The result of column (2) indicates that devaluations of RER around 10% reduce the growth rate of wage-share in GDP by 0.40% over a five-year period. Simultaneously, the result of column (4) suggests that devaluations of RER around 10% reduce the growth rate of wage-share in GDP by 0.90% for the restricted sample of countries. The further regressions, employing the variable *LRER* instead of *Mis*, do not provide suggestive evidence that the variable *LRER* is statistically significant to explain the functional income distribution.

Put differently, the estimates evidence that pursuing a competitive RER increase the mark-up rate, affecting the income distribution between workers and entrepreneurs. This effect tends to be stronger in economies from Africa, Asia, and Latin America.

The regressions performed to explain the income's Gini are reported in Table 2. Both measures of RER are statistically significant only in estimates that control the inflation rate. The results go in the opposite direction than those from Table 1. Pursuing a competitive RER is associated with better personal income distribution. The regression of columns 3 and 4 suggests that the estimated parameter of the variable *Mis* is statistically significant, at least at 5%, positive

[84] As the Sargan test is sensitive to the presence of heteroskedasticity (the null hypothesis tends to be rejected), the robust matrix of variance-covariance robust for heteroskedasticity is used when Sargan test rejects the null hypothesis (Roodman, 2009). Therefore, the Sargan test should be evaluated in the case of the use of the matrix of variance-covariance non robust for heteroskedasticity, while the Hansen test should be checked if the matrix of variance-covariance robust for heteroskedasticity is used (Roodman, 2009).

and around 0.04. Devaluations of RER around 10% improve the personal income distribution by 0.4%. The regressions using *LRER* in columns 5, 6, 7 confirm this econometric evidence.

4.2- Investment

Table 3 reports the estimates performed to explain the investment. The regressions are robust and tell the same story: pursuing a competitive RER spurs the investment.

The result of column (2) indicates that devaluations of RER around 10% increase the investment by 1.6% over a five-year period for the complete sample of countries. The estimates of column 4 suggest that the RER effects over the economies of Africa, Asia, and Latin America are stronger: a 10% more devalued RER increases the investment by 2.2%. The additional regressions using *LRER* confirm the positive effects of RER devaluations on investment and its stronger effects in economies from Africa, Asia, and Latin America.

Interestingly, columns (4) and (7) indicate that both RER measures are statistically significant at 1% in the regressions using the restricted sample of countries, whilst these variables are statistically significant at 10% or 5% in the regressions for the complete list of countries. This result is suggestive that the RER is more statistically "robust" as a driver of the capital accumulation in countries from economies of Africa, Asia, and Latin America.

4.3- Consumption

The estimates performed to explain the consumption are presented in Table 4. The output is robust and suggests that pursuing a competitive RER is associated with a smaller consumption as a share of GDP. From another perspective, as the saving is the share of national income that is not consumed, it suggests that devaluations of RER increase the saving. The regressions presented in column (2) point that a 10% more devalued RER reduces the consumption by 2.1% for the complete sample of countries over a five-year period. This effect is stronger for economies of Africa, Asia, and Latin America: a 10% devalued real exchange rate reduces consumption by 4.5%. The regressions using the variable *LRER* confirmed it.

4.4.- Net Exports

Table 5 reports the regressions performed to measure the RER effects on the net exports. The estimates presented in column (1) indicate that pursuing a competitive RER increases the net exports. Such a result is limited because it is valid only for the restricted sample of countries.

The regressions performed using the restricted sample of countries indicate that the RER is statistically significant to explain the performance of net exports in all estimates. The output is robust and indicates that devaluations of RER around 10% increase the net exports by 3.6% (column 3) and 3.3% (column 4). The regressions using the variable *LRER* confirm these results, suggesting that RER devaluations around 10% increase the net exports by 2.3% (column 5).

Despite the direct effect of RER on net exports, the regressions provide an additional result. Increases in labor costs are negatively associated with the net exports' performance. The labor costs parameter is statistically significant in all regressions (except for the estimate presented in column (6)) and negative. The estimate presented in column (2) suggests that this variable's parameter is -0.36: an increase of 1% in wage-share reduces the growth rate of net exports by 0.36%. Moreover, the performance of net exports of economies from Africa, Asia, and Latin America is more sensitive to changes in labor costs: an increase of 1% in this variable reduce the net exports by 1.44% (column (4)) and 1.39% (column (7)).

4.5- Social Capability and Total Factor Productivity

Table 6 presents the regressions performed to measure the RER effect on the social capability, represented by the TFP (USA=100). The results are robust. All estimated parameters are statistically significant at 1%. Pursuing a competitive RER reduces the gap between USA economy's social capability and the domestic economy. The estimates using the variable *Mis* suggest that RER devaluations of 10% reduce the gap between the USA economy's social capability and the domestic economy by 6% over a five-year period. The regressions employing the variable *LRER* confirm it. The regressions using the restricted sample of countries do not provide much evidence that the RER influences its TFP's performance.

Table 7 reports the regressions estimated to account for the influence of RER on the TFP, represented by the TFP at constant national prices (2011=100). The estimates provide empirical evidence that pursuing competitive RER influences the TFP positively. Specifically, the results indicate that the estimated parameter of *Mis* and *LRER* is statistically significant only in the regressions performed using the complete sample of countries. The parameter of *Mis* is statistically significant at 10% and around -0.10: RER devaluations of 10% increase, roughly, the productivity growth by 1% over a five-year period. The parameter of *LRER* is statistically significant at 1% and equals -0.14: RER devaluations of 10% increase the productivity growth by roughly 1.4%.

5- Concluding Remarks: connecting theory and evidence

The goal of this article was to investigate the channels of influence of RER on growth. For this purpose, a series of regressions were performed to measure how pursuing a competitive RER impacts the income distribution (personal and functional), the allocation of GDP between consumption or saving/investment and the behavior of net exports, social capability, and Total Factor Productivity. The article also provides a series of regressions to test whether the effects of pursuing a competitive RER are stronger for economies from Africa, Latin America, and Asia.

The article's results provide evidence in support of the transmission channel from RER onto growth, pointed by literature. The investigation indicates that pursuing a competitive RER favors the saving/investment to the detriment of consumption and wage share of GDP, corroborating the previous findings. The results confirm that pursuing a competitive RER increases the profit-rate (to the detriment of real wage), transferring income from workers to firms, which spurs the investment, as Gluzmann et al. (2012), Bahlla (2012), Bahmani-Oskooe and Hajile (2010) and Guzman at al. (2018) argue. The findings also indicate that pursuing a competitive RER exerts a positive impact on net exports. This effect occurs directly by making the exports (imports) cheaper (more expensive) and indirectly by reducing the labor costs.

It is worth highlighting that the effect of pursuing a competitive RER over consumption, saving/investment, and net exports (the direct as the indirect effect) is stronger for economies from Africa, Latin America, and Asia. A possible explanation for this result, in addition to the Rodrik's (2008) argument, is that those countries have a rudimentary financial system. In this way, the expansionary effects of a competitive RER over the profitability are more important to generate the required funds to finance new investments. Alternative explanations derive from the more financial constraint due to (i) the bad institutions that impose a higher tax, which discourages new investments and makes the national goods less competitive (Rodrik, 2008); (ii) the labor is a great share of costs in a manner that the effects of pursuing a competitive RER over profitability and net exports, by reducing the real wage, are stronger.

Finally, the study provides evidence that social capability and Total Factor Productivity are associated with other elements than labor, capital, and human capital. Specifically, pursuing a competitive RER expands the social capabilities and the Total Factor Productivity of the economies, on average. However, the analysis revealed that the RER does not exert an extraordinary influence on these variables in countries from Africa, Latin America, and Asia. A possible explanation is that the influence of RER over the social capabilities and the Total Factor Productivity is associated with aspects of the supply-side. Societies with better institutions, a good entrepreneur environment, a developed national system of innovation, human capital, etc., are more inclined to absorb the benefits of pursuing a competitive RER, transforming it into the development of social capabilities and technological progress.

This article's findings have important policy implications: a competitive RER may foster important long-run growth drivers, such as capital accumulation, net exports, social capabilities, and technological progress. A development strategy of pursuing a competitive RER may spur the long-run growth – especially in developing countries locked within a bad institutions trap. However, it is worth stressing that such strategy imposes a considerable cost in terms of lower real wages and consumption, in the present, with the promise of achieving a more developed society in the future, even that it is not clear if the economic development's fruits will be shared between all individuals, as Guzman et al. (2018) argue.

In contrast, the study delivers evidence that pursuing a competitive RER is associated with better personal income distribution. Future works should provide more evidence on this topic to investigate the possible transmission channels through which a competitive RER may contribute to a more equalitarian society.

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Appendix A

Table 6.A 1- List of Countries – Complete Sample

Country	Country	Country	Country	Country	Country
Angola	Chile	Ghana	Korea	Norway	Slovak Republic
Albania	China	Guinea-Bissau	Kuwait	Nepal	Slovenia
United Arab Emirates	Cote d'Ivoire	Equatorial Guinea	Lao PDR	New Zealand	Sweden
Armenia	Cameroon	Greece	Lebanon	Oman	Eswatini
Antigua and Barbuda	Colombia	Grenada	Sri Lanka	Pakistan	Seychelles
Australia	Comoros	Guatemala	Lesotho	Panama	Chad
Austria	Cabo Verde	Guyana	Lithuania	Peru	Togo
Burundi	Costa Rica	Hong Kong	Luxembourg	Philippines	Thailand
Belgium	Cyprus	Honduras	Latvia	Papua New Guinea	Tajikistan
Benin	Czech Republic	Croatia	Morocco	Poland	Turkmenistan
Burkina Faso	Germany	Haiti	Moldova	Portugal	Tonga
Bangladesh	Dominica	Hungary	Madagascar	Paraguay	Trinidad and Tobago
Bulgaria	Denmark	Indonesia	Maldives	Qatar	Tunisia
Bahrain	Dominican Republic	India	Mexico	Romania	Turkey
Bosnia and Herzegovina	Algeria	Ireland	North Macedonia	Russia	Tanzania
Belarus	Ecuador	Iceland	Mali	Rwanda	Uganda
Belize	Egypt	Israel	Malta	Saudi Arabia	Ukraine
Bolivia	Spain	Italy	Mongolia	Sudan	Uruguay
Brazil	Estonia	Jamaica	Mauritania	Senegal	United States
Barbados	Ethiopia	Japan	Mauritius	Singapore	Vietnam
Brunei Darussalam	Finland	Kazakhstan	Malaysia	Solomon Island	Samoa
Bhutan	Fiji	Kenya	Namibia	Sierra Leone	Yemen
Central African Republic	France	Kyrgyz Republic	Niger	El Salvador	South Africa
Canada	Gabon	Cambodia	Nigeria	Serbia	
Switzerland	United Kingdom	Kiribati	Netherlands	Sao Tome and Principe	

Table 6.A 2- Variables – Definition, Source and Observations

Variable	Definition	Source	Obs.
LRER	Bilateral real exchange rate (Price level ratio of PPP conversion factor to market exchange rate: $RER_{t,i} = PPP_{t,i} / XRAT_{t,i}$): negative/positive values indicate that real exchange rate is undervalued/overvalued.	World Bank	878
LPIBCAPITA	Real GDP per capita (PPP)	World Bank	877
w	Wage-share as % of GDP (employed in log-diff)	Penn World Table 9.1	570
gini	Income's Gini: estimate of Gini index of inequality in equivalized household disposable income (post-tax, post-transfer) at 1% of uncertainty in estimate (in the Bayesian sense)	Solt (2020)	703
i	Investment as % of GDP (employed in log-diff)	Penn World Table 9.1	710
c	Consumption as % of GDP (employed in log-diff)	Penn World Table 9.1	710
nx	Net exports (exports minus imports) as % of GDP (employed in log-diff)	Penn World Table 9.1	710
sc	Social Capability: TFP level at current PPPs (USA=1) (employed in log-diff)	Penn World Table 9.1	530
tfp	TFP at constant national prices (2011=1) (employed in log-diff)	Penn World Table 9.1	530
inflation	Consumer prices %	World Bank	842
Mis	Measure of RER misalignment using LPIBCAPITA	Author	876

Notes: (1) L = variable in logarithm; (2) Negative (positive) values of exchange rate misalignment measures indicate that the real exchange rate is undervalued (overvalued) relative to the equilibrium level

Appendix B

Table 6.B 1- Exchange Rate Misalignment and Income distribution (wage-share of GDP)

Dependent variable: wage-share w	(1)[a]	(2)[a]	(3)[a,b]	(4)[a,b]	(5)	(6)	(7)[b]
w_{t-1}	0.32	0.02	0.14	0.04	0.15	0.04	0.04
	(0.19)	(0.14)	(0.21)	(0.15)	(0.15)	(0.12)	(0.10)
Mis	0.09**	0.04*	0.08**	0.09***			
	(0.04)	(0.02)	(0.03)	(0.03)			
LRER					-0.01	0.03	-0.02
					(0.06)	(0.03)	(0.03)
Inflation		0.001***		0.0009***		0.004**	0.008***
		(0.0003)		(0.0002)		(0.002)	(0.0006)
AR (2)	0.12	0.39	0.23	0.30	0.22	0.14	0.20
Hansen /Sargan	0.16	0.23	0.12	0.21	0.38	0.29	0.79
Hansen-Diff	0.61	0.61	0.41	0.25	0.67	0.23	0.83
Groups	114	114	70	70	114	114	70
Instruments	16	31	16	31	11	15	15

Notes: (1) The dependent variable is Growth Rate of Wage-Share of GDP represented by w_t; (2) estimates using two-step System GMM with Time Dummies; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) [a] denotes the use of Robust Standard Errors (between parentheses), and [b] denotes a different sample of countries, which is compounded by African, Asian and Latin American ones; (5) The constant is not presented.

Table 6.B 2- Exchange Rate Misalignment and Income distribution (income's Gini)

Dependent variable: income's Gini	(1)	(2)	(3)[b]	(4)[a,b]	(5)	(6)	(7)[b]
$gini_{t-1}$	0.98***	0.98***	0.58***	0.80***	0.99***	1.01***	0.78***
	(0.03)	(0.02)	(0.10)	(0.05)	(0.03)	(0.02)	(0.06)
Mis	0.03	0.05***	0.007	0.04**			
	(0.03)	(0.01)	(0.02)	(0.02)			
LRER					0.02*	0.03***	0.04**
					(0.01)	(0.01)	(0.02)
Inflation		0.0003		0.0001**		-0.001***	0.001*
		(0.0008)		(0.0008)		(0.0006)	(0.0009)
AR (2)	0.66	0.13	0.10	0.08	0.11	0.17	0.09
Hansen /Sargan	0.45	0.15	0.15	0.45	0.52	0.18	0.31
Hansen-Diff	0.48	0.13	0.19	0.21	0.28	0.09	0.22
Groups	126	123	80	79	126	124	79
Instruments	18	22	23	39	21	24	39

Notes: (1) The dependent variable is the logarithm of income's Gini represented by *gini;* (2) estimates using two-step System GMM with Time Dummies; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) [a] denotes the use of Robust Standard Errors (between parentheses), and [b] denotes a different sample of countries, which is compounded by African, Asian and Latin American ones; (5) The constant is not presented.

Table 6.B 3- Exchange Rate Misalignment and Investment

Dependent variable: investment i	(1)[a]	(2)[a]	(3)[b]	(4)[b]	(5)[a]	(6)[a]	(7)[b,c]
i_{t-1}	0.15	0.24*	0.09***	0.11***	0.17	0.20	0.14
	(0.11)	(0.12)	(0.03)	(0.03)	(0.12)	(0.14)	(0.09)
Mis	-0.17*	-0.16**	-0.11*	-0.22***			
	(0.10)	(0.07)	(0.06)	(0.07)			
LRER					-0.32**	-0.21**	-0.39***
					(0.13)	(0.09)	(0.09)
Inflation	-0.005***	-0.005***	-0.005***	-0.006***	-0.007***	-0.006***	-0.006***
	(0.001)	(0.0009)	(0.0002)	(0.0003)	(0.001)	(0.001)	(0.0008)
w_{t-1}		0.08		-0.05		0.05	0.96**
		(0.43)		(0.14)		(0.64)	(0.45)
AR (2)	0.13	0.14	0.35	0.54	0.15	0.17	0.93
Hansen /Sargan	0.25	0.35	0.11	0.27	0.10	0.36	0.67
Hansen-Diff	0.76	0.58	0.56	0.41	0.32	0.25	0.64
Groups	140	114	95	70	140	114	70
Instruments	34	39	34	38	29	32	19

Notes: (1) The dependent variable is the Growth Rate of investment represented by i_t; (2) estimates robust two-step System GMM with Time Dummies; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) [a] denotes the use of Robust Standard Errors (between parentheses), [b] denotes a different sample of countries, which is compounded by African, Asian and Latin American ones, [c] denotes that the instruments are collapsed; (5) The constant is not presented.

Table 6.B 4- Exchange Rate Misalignment and Consumption

Dependent variable: consumption c	(1)[a]	(2)[a]	(3)[a,b]	(4)[a,b]	(5)[a]	(6)[a]	(7)[a,b]
c_{t-1}	0.49***	0.50***	0.28	0.35***	0.38***	0.39***	0.16*
	(0.17)	(0.09)	(0.19)	(0.05)	(0.07)	(0.08)	(0.09)
Mis	0.22**	0.21**	0.39***	0.45***			
	(0.08)	(0.08)	(0.09)	(0.09)			
LRER					0.05**	0.14*	0.23**
					(0.02)	(0.07)	(0.09)
Inflation	0.01***	0.01***	0.003***	0.007***	0.002***	0.01***	0.003***
	(0.004)	(0.004)	(0.0006)	(0.001)	(0.0003)	(0.003)	(0.0005)
w_{t-1}		-0.44		-0.33		-0.40	0.03
		(0.41)		(0.28)		(0.28)	(0.33)
AR (2)	0.89	0.78	0.69	0.39	0.93	0.66	0.27
Hansen/ Sargan	0.54	0.17	0.15	0.50	0.12	0.24	0.17
Hansen-Diff	0.97	0.33	0.37	0.45	0.35	0.40	0.43
Groups	140	114	95	70	140	114	70
Instruments	20	24	29	24	35	31	30

Notes: (1) The dependent variable is Growth Rate of investment represented by c_t; (2) estimates robust two-step System GMM with Time Dummies; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) [a] denotes the use of Robust Standard Errors (between parentheses), and [b] denotes a different sample of countries, which is compounded by African, Asian and Latin American ones; (5) The constant is not presented.

Table 6.B 5- Exchange Rate Misalignment and Net Exports

Dependent variable: net exports nx	(1)	(2)	(3)[a,b]	(4)[b]	(5)	(6)	(7)[b]
nx_{t-1}	-0.07**	-0.05**	-0.09	-0.15***	-0.09**	-0.04*	-0.13***
	(0.03)	(0.02)	(0.07)	(0.03)	(0.04)	(0.02)	(0.03)
Mis	-0.14**	-0.04	-0.36**	-0.33***			
	(0.05)	(0.03)	(0.15)	(0.03)			
LRER					-0.0003	-0.0003	-0.23***
					(0.03)	(0.02)	(0.03)
Inflation	-0.002***	-0.009***	-0.002***	-0.002***	-0.001***	-0.007***	-0.002***
	(0.0003)	(0.0003)	(0.0008)	(0.0002)	(0.0003)	(0.0003)	(0.0002)
w_{t-1}		-0.36***		-1.44***		0.15	-1.39***
		(0.09)		(0.15)		(0.10)	(0.16)
AR (2)	0.75	0.97	0.94	0.92	0.80	0.99	0.98
Hansen /Sargan	0.23	0.30	0.58	0.73	0.19	0.39	0.88
Hansen-Diff	0.28	0.48	0.96	0.48	0.78	0.30	0.24
Groups	140	114	95	70	140	114	70
Instruments	35	39	35	39	35	39	38

Notes: (1) The dependent variable is Growth Rate of investment represented by nx_t; (2) estimates using two-step System GMM with Time Dummies; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) [a] denotes the use of Robust Standard Errors (between parentheses), and [b] denotes a different sample of countries, which is compounded by African, Asian and Latin American ones; (5) The constant is not presented.

Table 6.B 6- Exchange Rate Misalignment and Social Capability - TFP (USA=100)

Dependent variable: social capability sc	(1)	(2)	(3)[b]	(4)[b]	(5)	(6)	(7)[a]
sc_{t-1}	0.14	0.11	0.14**	0.10	0.07	0.08	0.08
	(0.10)	(0.10)	(0.06)	(0.06)	(0.11)	(0.11)	(0.13)
Mis	-0.64***	-0.64***	-0.69***	-0.66***			
	(0.03)	(0.03)	(0.07)	(0.08)			
LRER					-0.54***	-0.54***	-0.62***
					(0.03)	(0.03)	(0.16)
Inflation	-0.02***	-0.02***	-0.01***	-0.01***	-0.02***	-0.02***	-0.01***
	(0.003)	(0.003)	(0.002)	(0.002)	(0.004)	(0.004)	(0.002)
w_{t-1}		0.06		-0.03		0.23	0.18
		(0.30)		(0.38)		(0.28)	(0.38)
AR (2)	0.23	0.26	0.13	0.13	0.23	0.22	0.12
Hansen /Sargan	0.72	0.76	0.68	0.67	0.86	0.32	0.74
Hansen-Diff	0.87	0.87	0.54	0.47	0.38	0.70	0.86
Groups	106	106	65	65	106	106	65
Instruments	17	18	17	18	17	18	18

Notes: (1) The dependent variable is Growth Rate of investment represented by sc_t; (2) estimates using two-step System GMM with Time Dummies; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) [a] denotes the use of Robust Standard Errors (between parentheses), and [b] denotes a different sample of countries, which is compounded by African, Asian and Latin American ones; (5) The constant is not presented.

Table 6.B 7- Exchange Rate Misalignment and TFP at constant national prices (2011=1)

Dependent variable: TFP tfp	(1)[a]	(2)[a]	(3)[a,b]	(4)[a,b]	(5)[a]	(6)[a]	(7)[a]
tfp_{t-1}	0.44***	0.37***	0.29	0.36	0.34	0.23	0.38*
	(0.10)	(0.12)	(0.20)	(0.22)	(0.24)	(0.16)	(0.20)
Mis	-0.10*	-0.13**	0.11	0.09			
	(0.05)	(0.05)	(0.07)	(0.07)			
LRER					-0.14***	-0.14***	0.07
					(0.03)	(0.04)	(0.07)
Inflation	0.001**	0.001	0.003***	0.003***	0.004	0.0005	0.003***
	(0.0007)	(0.0008)	(0.0006)	(0.0005)	(0.003)	(0.001)	(0.0006)
w_{t-1}		-0.01		0.05		-0.15	-0.04
		(0.16)		(0.14)		(0.13)	(0.21)
AR (2)	0.68	0.76	0.72	0.89	0.88	0.63	0.97
Hansen /Sargan	0.22	0.20	0.63	0.48	0.47	0.12	0.48
Hansen-Diff	0.58	0.59	0.83	0.62	0.44	0.38	0.89
Groups	106	106	65	65	17	30	29
Instruments	32	30	30	34	106	106	65

Notes: (1) The dependent variable is Growth Rate of investment represented by tfp_t; (2) estimates using two-step System GMM with Time Dummies; (3) *, ** and *** indicate significance at 10%, 5% and 1%; (4) [a] denotes the use of Robust Standard Errors (between parentheses), and [b] denotes a different sample of countries, which is compounded by African, Asian and Latin American ones; (5) The constant is not presented.

Conclusions

This thesis's leading objective was to study the effects of pursuing a competitive RER on the economy, in theoretical and empirical terms. Although the thesis is compounded by six essays independent of each other – with specific objectives and different subjects of analysis, the common goal of the essays was to understand the influence of exchange rate, as an economic policy oriented for the economic development, on the economy.

The economic growth-approach of this thesis was built up using the Kaldorian framework, with an emphasis on the cumulative and circular causation models. For this purpose, the first essay, "Kaldorian Growth Models: a critical discussion", has been investigated the fundamentals of long-run growth in Kaldorian tradition, in accordance with the export-led growth model of Kaldor-Dixon-Thirlwall and with Thirlwall's law, in order to underpin the second essay with a theoretical background. The first essay has aimed to comprehend the manner through which the supply-side is introduced in Kaldorian growth models and its implications to explain the RER influence on growth. The first essay showed that both Kaldorian approaches have specificities and limitations to explain the RER influence on the long-run growth. In the case of the Kaldor-Dixon-Thirlwall model (*natural growth rate*):

i- Economic growth is a path-dependent process, determined by the circular and cumulativeness of the Kaldor-Verdoorn mechanism. The supply-side responds automatically to changes in demand. The only restriction to growth is the lack of demand growth. As a result, the strong emphasis on initial conditions implies a pre-determined growth-path between the countries. There does not exist catching up, or falling behind, between the countries;

ii- Some scholars have endogenized the parameters of the productivity equation in relation to elements of the supply side in order to reduce the strong emphasis on initial conditions;

iii- The absence of explicitly modelling of capital accumulation/technological progress is problematic for, supposed, an endogenous growth theory;

iv- The temporary effect of RER devaluations is always expansionary, which is because the exports are the only source of demand growth.

In the case of Thirlwall's law (*actual growth rate*):

i- The growth performance, or the circular and cumulativeness of the Kaldor-Verdoorn mechanism, is constrained by the equilibrium in the balance of payment. The growth rate consistent with the equilibrium in the balance of payment is given by the ratio between the income-elasticity of exports and imports multiplied by changes in the world's income;

ii- Kaldorian scholars assume that the actual growth rate of an economy is given by Thirlwall's law. In the long-run, the natural growth rate adapts to the economy's growth rate, consistent with the equilibrium in balance of payment. However, some scholars have argued that this is a simple, and limited, way to explain economic growth. Thirlwall's law, therefore, provides the maximum growth rate of output, but it does not explain the economic growth indeed (the circular and cumulative mechanism of Kaldor-Verdoorn mechanism);

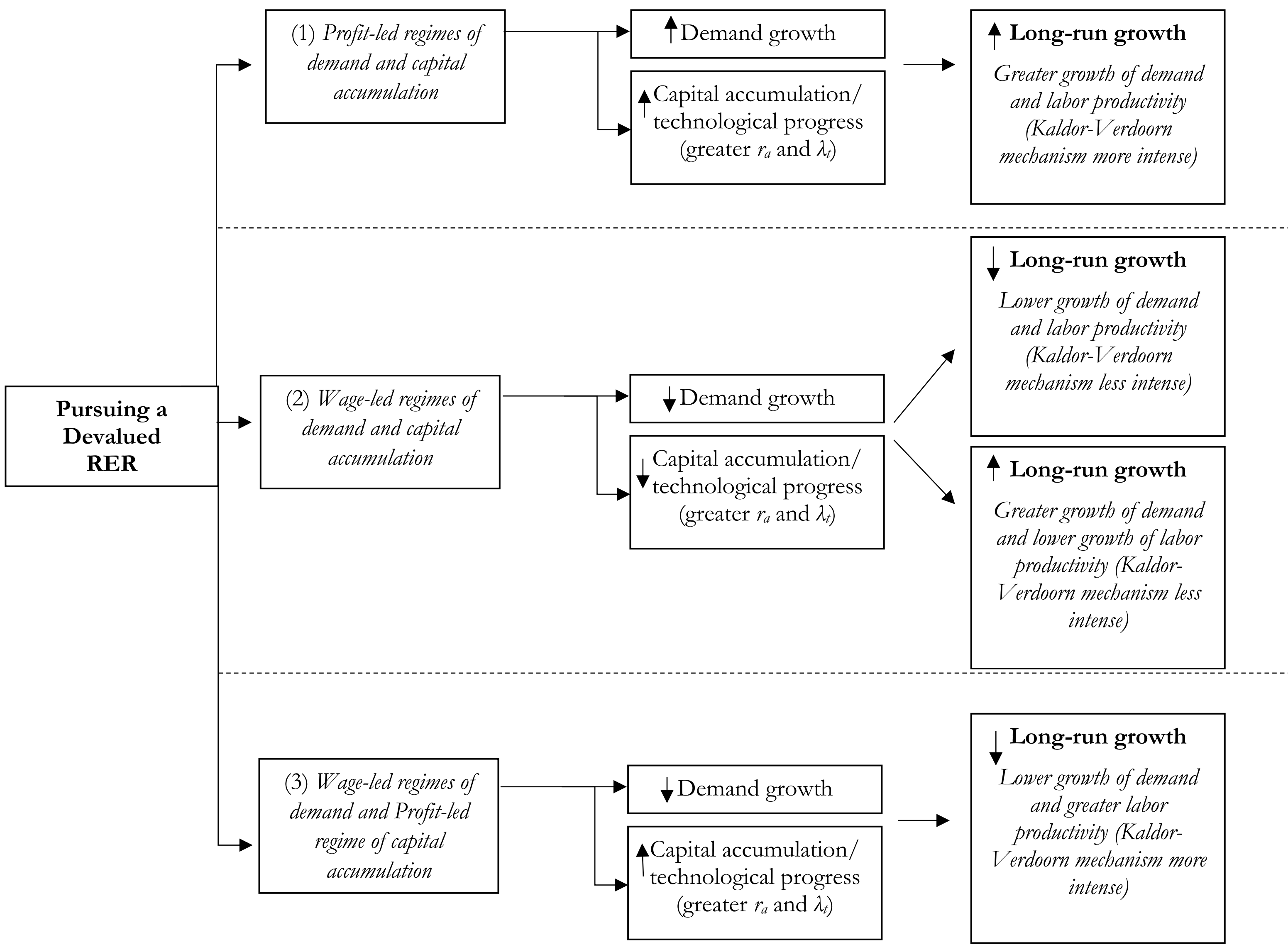
iii- By assuming the validity of the *law of one price* suggests that i- the terms of trade do not matter in determining the growth rate of economy consistent with the equilibrium in the balance of payment; ii- the Kaldor-Verdoorn mechanism is dismissed (labor productivity does not play any role in explaining the growth); iii- the Prebisch-Singer hypothesis, and its expression embodied in the income-elasticities difference between northern/industrialized countries and southern/non-industrialized countries- which comes from elements of supply-side, is ignored;

iv- The fundamentals of economic growth are the determinants of income-elasticity. Usually, the Kaldorian scholars account for the growth effects of RER in terms of its influences over the productive structure and, then, on the sectoral composition of income-elasticity.

In light of the discussion provided by the first essay, the second essay, "Endogenous Productivity Regime and the Impact of Devaluations of Real Exchange Rate on Economic Growth", has developed a theoretical model of cumulative and circular causation. The model has sought to understand the influence of RER on long-run growth via the natural growth rate of the economy – given by the interaction between the labor productivity growth and demand growth, rather than via the actual growth rate – given by Thirlwall's law. For that, the model has been endogenized the parameters of productivity regime regarding the capital accumulation/technological progress induced, or not, by a competitive RER. In doing so, the RER influences the intensity of the Kaldor-Verdoorn mechanism, i.e., the feedback interaction between labor productivity growth and demand growth and, then, the long-run growth.

Figure 01, below, summarizes the findings of the theoretical model:

Figure7. 1- Devaluations of RER and Long-run Growth: a summary of theoretical results



The theoretical model developed in this thesis indicated that, by making endogenous the Kaldor-Verdoorn mechanism regarding the RER, pursuing a competitive RER increases the long-run growth of economies under profit-led regimes of demand and capital accumulation. The more intense circular and cumulative process between demand growth and labor productivity growth reinforces the greater demand growth induced by a more competitive RER. Interestingly, in economies under wage-led regimes of demand and capital accumulation, pursuing a competitive RER produces ambiguous long-run growth effects. The effect may be expansionary or contractionary, depending on the combinations of parameters. In contrast, in economies under wage-led regimes of demand and a profit-led capital accumulation regime, pursuing competitive RER damages the long-run growth. The more intense Kaldor-Verdoorn mechanism reinforces the lower demand growth induced by a more competitive RER.

The third essay "Exchange Rate and Growth: Empirical Evidence (1995-2018)" has investigated the influence of RER on the long-run growth between 1995 and 2018, using various measures of RER misalignments (with many combinations of fundamentals; Balassa-Samuelson effect, net foreign assets, terms of trade and labor costs) and different specifications. The results indicated that as greater (lower) is the labor costs, the more expensive (cheaper) are the national goods in the international market. The growth regressions are very robust and tell the same story: the RER is not neutral for long-run growth. Pursuing a competitive (non-competitive) RER spurs (damage) the long-run growth. A 10% more devalued RER increases, roughly, the long-run growth by 2% over a five-year period, or 0.14% annually. In addition, the results also deliver evidence that the Washington Consensus claims (any type of exchange rate misalignment is a hindrance for growth) are not valid, as well as that the growth effects of RER follow a non-linear pattern.

A series of estimated regressions indicated that the magnitude of the influence of RER on long-run growth is associated with the income level of countries. Such influence is stronger for countries with per capita income lower than U$S 24,725. At last, the results also evidenced that the RER helps to explain the more rapid growth of Asian economies in relation to the weak growth of Latin America and Africa. Pursuing a competitive RER contributed to the catching up of Asian countries, while pursuing a non-competitive RER damaged the long-run growth of Latin America. However, even with a competitive RER, African countries have grown poorly. This suggests that pursuing a competitive RER is more an assisting condition than a sufficient condition for long-run growth, as Eichengreen (2008) claims.

The fourth essay, "Exchange Rate and Structural Change: a study using aggregated and sectoral data", assessed the RER influence on structural change of 151 countries over 1995-2018. The results evidenced that the RER matters for the structural change. In aggregated terms, the estimates indicated that pursuing a competitive RER is associated with a structural change toward tradable sectors, especially in the direction of manufacturing sectors (in terms of the composition of GDP and employment). These results are especially valid (stronger) for low-income countries and high-economic complexity countries. Put differently, pursuing a competitive RER works as a second-best mechanism to offset the bad institutions - as Rodrik (2008) claims, and, on the other hand, structural change toward modern/manufacturing sectors requires the adoption of other policies linked with knowledge, good institutions, etc. to potentialize the structural change induced by a competitive RER. In this regard, the estimates also suggested that pursuing a competitive RER is associated with a productive structure more complex (more diversified and with more knowledge embedded).

The results confirmed the influence of RER on the productive structure in sectoral terms. On average, at the cross-country level, pursuing a competitive RER boosts the growth rate of manufacturing sectors' job creation. However, estimating an individual effect for developing countries has suggested that a competitive RER has an expansionary (contractionary) effect on employment growth of Brazil, Indonesia, Korea, and Mexico (India), which is valid to most manufacturing sectors of these countries. The essay indicated that a possible explanation for this pattern relies upon the outward orientation and the import composition as a share of costs of each country. At the cross-sectoral level, the estimates suggested that the influence of RER is stronger for sectors more financially constrained; in this case, the sectors under the regime of a slow pace of technological progress. The argument is that those sectors have a great share of labor in costs and, then, a short retained profit and a limited capacity to expand activities. Pursuing a competitive RER enhances the retained profit (by enlarging exports), alleviating the social conflict between workers and capitalists and expanding the manufacturing activities.

The fifth essay, "Exchange Rate and Prices: An Extended Kaleckian Approach for Brazilian Manufacturing Sectors (2010-2019)", studies the inflationary effects of pursuing a competitive RER. This study was built up employing the cost-push approach of Kaleckian tradition and the notion of neutral inflation of Latin American structuralist approach. The contribution of this essay was twofold, both theoretical as empirical. The theoretical model indicated that:

i- As higher is the share of imported inputs (salaries) in costs, greater are the effects of changes in the exchange rate on prices;

ii- By making the mark-up rate endogenous to exchange rate, a necessary condition for stable inflation over time, in a context of pursuing a competitive RER, is that wages reduce at the same pace that prices increase due to exchange rate devaluations, ceteris paribus;

iii- By considering the effects of pursuing a competitive RER on productive structure, the structural change toward manufacturing sectors may mitigate the distributive effects of exchange rate devaluations. The industrialization, induced by the competitive RER, reduces the dependence on imports and the exchange rate pass-through onto prices;

iv- By introducing the structuralist notion of neutral inflation, the model showed that the conflict distributive between workers and entrepreneurs around the real income potentializes the inflationary effects of exchange rate devaluations. As greater are labor costs, the stronger the inflation is without distributive effects within an economy in which a devalued RER is pursued.

The empirical estimates suggested the existence of partial pass-through from devaluations of exchange rate onto prices in Brazil over the period 2010-2019. The exchange rate pass-through showed quite different across the manufacturing sectors. The essay provided three explanations to the sectoral differences regarding the sectoral exchange pass-through:

i- As greater is the markup rate, higher is the exchange rate pass-through: sectors with high market power are more capable of passing on the greater costs induced by exchange rate;

ii- Price-to-market discrimination of export firms: export firms absorb the exchange rate devaluations increasing its prices (markup rate);

iii- Firms with a significant share of imported inputs in costs, inserted in an industry with fierce competition, are not capable of passing on devaluations of exchange rate onto prices.

The sixth essay, "Real Exchange Rate and Growth: identifying transmission channels", performed regressions to investigate possible transmission channels from a competitive RER onto growth. The main goal was to investigate how pursuing a competitive RER affects the allocation of internal income of economies.

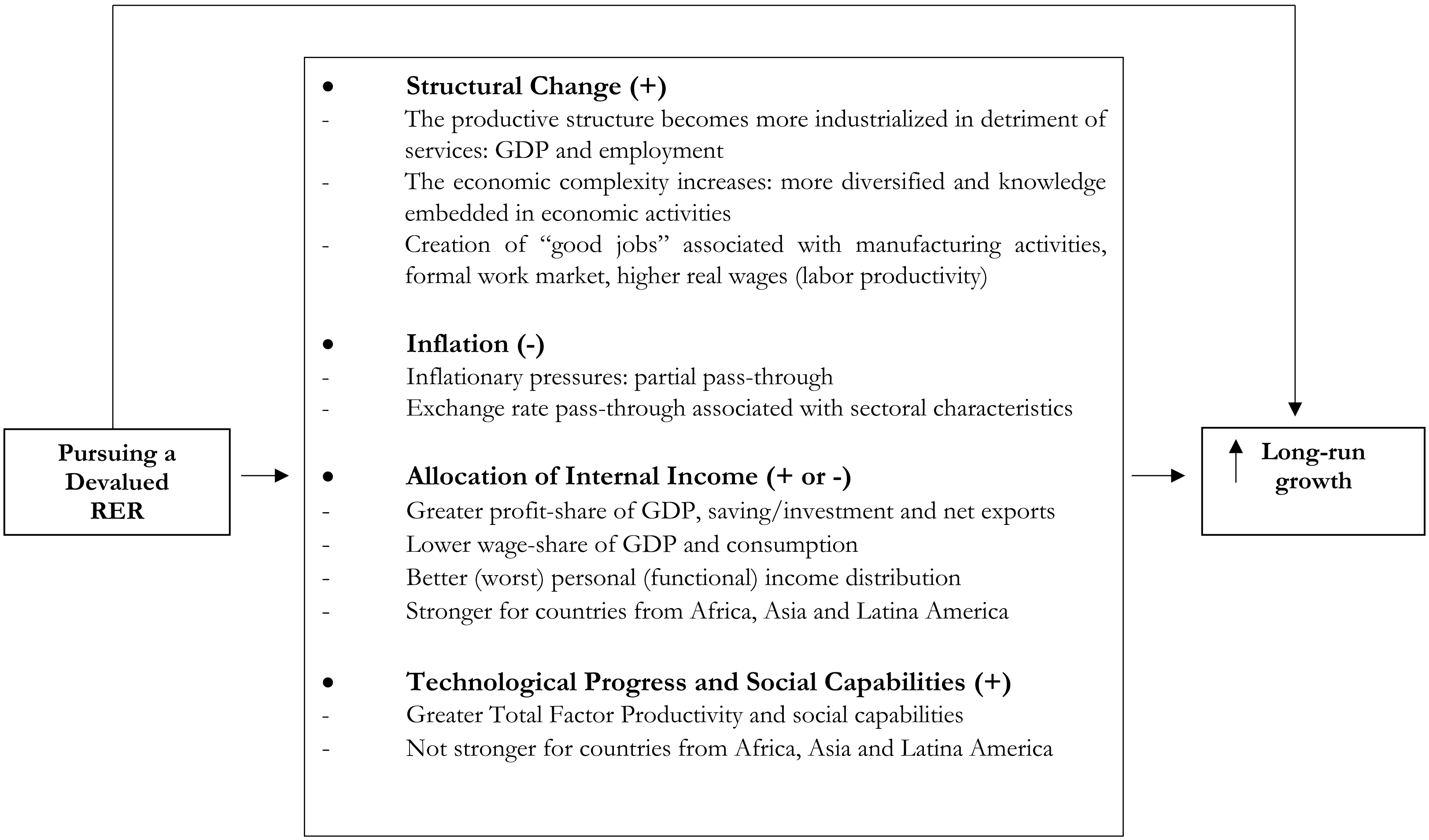
The results suggested that pursuing a competitive RER triggers important driver of long-run growth. Although such policy increases the income inequality in terms of profit-share in GDP, the saving/investment acts as the main role in promoting the economic growth, in detriment of consumption. Moreover, a more competitive RER increases directly and indirectly (via lower labor costs) the net exports' performance. By making the exports (imports) cheaper (more expensive), it boosts the net exports. In addition, by reducing the labor costs, it also boosts the net exports indirectly into the extent that this cheapens the national goods. Interestingly, the findings indicate that these effects were stronger for countries from Africa, Latina America, and Asia. A possible explanation for that might rely on the Dani Rodrik's argument. Pursuing a competitive RER offsets the damaging effects of bad institutions, in a broad sense, over the drivers of long-run growth.

In contrast with the previous results, the essay indicates that that pursuing a competitive RER improves the personal income distribution and boosts technological progress and social capabilities. These promising results need a careful investigation in a future research. However, it can be a suggestion that an exchange rate policy oriented for the economic development improves the personal income distribution, as well as the technological progress and social capabilities. The investigation about the channel through such possible influence occurs, as well as the robust validation of these results, is up for future studies.

In a nutshell, by taking the earlier findings, pursuing a competitive RER has proven a valid strategy to foster economic development or to boost the long-run growth – with positive and negative aspects. The theoretical study carried on this thesis developed a new Kaldorian approach to understanding the influence of RER on long-run growth, via the natural growth rate or, simply, via the interaction between the growth of demand and labor productivity (Kaldor-Verdoorn mechanism). In this theoretical framework, the influence of RER on long-run growth occurs via the changes in the labor productivity, induced by the influence of RER devaluations on capital accumulation/technological progress – as well as its influence on the intensity of the Kaldor-Verdoorn mechanism and its interaction with demand growth.

Moreover, the empirical studies indicate that pursuing a competitive RER produce a prosperous growth-path, in terms of long-run growth; a modern productive structure in terms of industrialization, economic complexity, and creation of "good jobs"; allocation of internal income to saving/investment to the detriment of consumption - even that this occurs at the expense of a lower wage-share in GDP; the promoting of net exports; greater Total Factor Productivity and social capabilities; better personal income distribution. However, it should be stressed the possible inflationary acceleration due to the devaluations of RER, and its consequences in terms of lower real wage (income distribution), and the importance of a well parametrized macroeconomic policy to avoid the deterioration of the macroeconomic environment. Figure 7.2 presents a summary of the thesis's empirical results.

Figure7. 2- A Summary of Empirical Results: the influence of RER on long-run growth



Finally, it should be regarded that pursuing a competitive RER is a necessary condition to reach a more developed economy (in qualitative terms) and a faster pace of GDP growth. There is a robust theoretical and empirical background that supports this argument. However, an exchange rate policy oriented for the economic development is not an enough condition for this purpose, and it does not replace the central role played by other elements (as educational, social, and industrial policies, inclusive institutions etc.). Managing the RER as a policy oriented for economic development does not provide a solution for all economic and social problems of poor and developing countries, but it has been proven a necessary condition to their catching-up. Pursuing a competitive RER should be seen as a complementary policy within a framework of economic policies for the economic development. It is up for future studies to measure such complementary association. In practical terms, the thesis' results highlight the importance of managing the RER as a policy for economic development and long-run performance, without ignoring the consciousness that this is a part of a broad strategy for economic development.