Export quality and economic growth in the 2000s[1]

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ABSTRACT

This paper examines the relationship between composition of exports and economic growth for a large set of countries, between 2000 and 2013, following the assumption that the technological structure of exports has important implications for economic development. The paper builds an index of exports quality, based on the classification by technological intensity proposed by Lall (2000): primary products, resource-based manufactures, low-tech, medium-tech and high-tech manufactures. Then, we estimate the relationship between quality of exports and economic growth by using panel data models. The results suggest that the export quality index is highly significant to explain economic growth. Between 2000 and 2008, booming demand for commodities benefited exporters of primary products and resource-based manufactures, and lower export quality is associated with higher rates of economic growth. For 2009-2013, in turn, results confirm what is expected by theory and suggest that export structures with higher technological content have brought about positive effects on economic performance.

Keywords: exports, technology, economic growth, panel data.

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1 – INTRODUCTION

The relationship between productive specialization, international trade and economic growth is a crucial issue for development, since the characteristics of the production and export structures of a given country conditions its economic performance over time.

Kaldor (1957, 1966) emphasized the role of exports and of the manufacturing industry for economic growth. In turn, Prebisch (1949) has stressed how the export profile of peripheral countries (exporting commodities and importing manufactures) would represent an important obstacle to development. In this case, the technological content of exports is an important issue, given that products with higher technological content are usually produced by more developed countries.

Thus, an understanding of the nature, determinants and implications of the export structure of developing countries is critical to understand their present and future development prospects, since the technological structure cannot be rapidly altered and it depends on its previous path.

The goal of this paper is to examine the relationship between composition of exports and economic growth, for a wide range of countries, based on the assumption that the technological structure of exports has crucial implications for economic development. First, we build an export quality index, following the 5-group classification by technological intensity proposed by Lall (2000). Then, the relation between export quality and economic growth is estimated by using panel data models. The period of analysis goes from 2000 to 2013, which allows investigating to what extent the strong expansion of commodities' demand and prices for most of the 2000s has benefited primary goods exporters.

The remainder of the paper is organized as follows. Next section presents the theoretical foundations of this work, associated with Kaldorian and Schumpeterian views on the relation between exports, productive specialization and economic growth, as well as some empirical results from the literature about the influence of the patterns of specialization on long-term growth rates. Section three briefly describes international trade over the past decade, with a special focus on the classification of exports by technological intensity. In section four, we present the export quality index, as well as the data and the methodology used for estimation. In section five, we assess the relation between the composition of exports and economic growth in the period 2000-2013, with the use of panel models. Section six presents some concluding remarks.

2 – TECHNOLOGY, INTERNATIONAL TRADE, AND GROWTH

The importance of the export performance for economic growth has long been highlighted by the economic literature. However, in traditional international trade theory, the technological structure of exports has never given enough attention as an explanation for the export performance of countries. Moreover, the theory is unable to explain why export capabilities are so unevenly distributed, both between rich and poor countries, and among developing countries in particular.

For the purposes of this paper, however, the starting point is the relation between patterns of specialization in the economy, in particular the role of the technological structure of exports, and economic growth in the long term. Schumpeterian and Kaldorian theoretical currents have addressed this theme and serve as a reference to this article.

In the first group, the focus is on the importance of the mechanisms of generation and dissemination of technological innovation for growth and economic development. In general, it is assumed that international differences in per capita income levels are explained by differences in technology and innovative capacities among countries. Furthermore, it is considered that such differences are not easily surmountable, since there are several factors that slow or hinder the dissemination of information between countries, such as the existence of patents, imperfect information, shortage of scientific and technological infrastructure, and the difficulty of adaptation and absorption of new products or processes by firms (Dosi, Pavitt and Soete, 1990; Fagerberg, 1994).

The second theoretical foundation of this article is based in the works of Kaldor (1966, 1970). In this case, the initial hypothesis is that the industrial sector is the "engine" of economic growth due to existence of significant economies of scale in this sector and its importance in the generation and propagation of technological progress. Furthermore, it is argued that the intrinsic characteristics of the industrial sector bring about gains in international competitiveness in the economies where this sector expands, which leads to an expansion of demand via exports and lower external constraints to growth.

The Kaldorian argument is based on the idea that economic growth is fundamentally limited by the growth of aggregate demand, and particularly by the growth of exports, which are considered the main truly autonomous component of demand. Thus, export growth fuels the demand required for the expansion of production, which, in turn, leads to productivity gains due to the occurrence of increasing returns to scale, particularly in the manufacturing sector. Under certain conditions, such productivity gains may lead to a decrease in wage costs and, given a constant profit margin, to a decrease in prices, raising the country’s international competitiveness, and allowing for further expansion of exports, which cumulatively feeds this virtuous cycle. In this way, once a country or region gets some growth advantage, it tends to keep it, due to the competitiveness gains induced by growth under conditions of increasing returns to scale.

In addition, resource allocation patterns determined by international trade have dynamic implications that may bring about positive or negative long-term effects, since different products and sectors imply different opportunities to innovate and different income-elasticities of demand. Under a Keynesian/Kaldorian perspective, exports therefore determine the pace of economic growth of a country, via multipliers that adjust the rate of growth of investment and consumption. Thus, countries with higher income-elasticities of demand for its exports tend to have a better economic performance.

On the other hand, from a Schumpeterian perspective, catch up processes are an important part of the dynamics of development of countries, and are possible due to mechanisms of imitation, learning by doing, reverse engineering, incorporating technologies via the import of capital goods, among others. In this case, it is argued that the process of imitation of existing technologies represents an alternative development pathway for technologically backward countries so that these countries do not depend exclusively on their innovative capacity – as is the case of leading countries – but also on their performance as imitators. As the relative cost of absorbing existing technologies would be lower than the generation of new technologies, latecomers would tend to present higher rates of productivity growth, which would guarantee the occurrence of catching up.

It should be noted that, in theory, the pace of technological progress and productivity gains will be faster the further away a country is from the technological frontier. This means that the growth potential of backward countries tends to reduce as countries advance in the incorporation of new technologies from leading countries, reducing the technological gap. However, efficiency in imitation and absorption of new technologies depends on structural and institutional features of the countries, which are not guaranteed exclusively by relative backwardness. That is, the mere occurrence of technological gaps does not guarantee the efficient incorporation of technologies and, therefore, it is necessary to establish appropriate conditions for that, associated mainly to the qualification of the workforce and the existence of research institutions. Thus, the effect of innovation and diffusion of technology on economic growth is uncertain, and may give rise to growth trajectories in which countries converge or follow completely divergent paths. (FAGERBERG, 1988, p. 439)

According to the Schumpeterian approach, therefore, the relation between economic growth and productive specialization depends on the ability to generate and absorb technologies. Thus, different production structures carry different implications for long-term growth, because they represent different possibilities for innovation, differentiation and learning. According to Lall (2000, p. 339-340):

> *Technology-intensive structures offer better prospects for future growth because their products tend to grow faster in trade: they tend to be highly income elastic, create new demand and substitute faster for older products. (...) They also have greater potential for further learning because they offer more scope for applying new scientific knowledge. They have larger spillover effects in terms of creating new skills and generic knowledge that can be used in other activities. Simple technologies, by contrast, tend to have slower growing markets, more limited learning potential, smaller scope for technological upgrading and less spillover to other activities.*

It is well-known, however, that export structures have strong inertia and are difficult to change, because they are the result of long and cumulative processes of learning, agglomeration and institutional building. Thus, changes in the production and export structures of an economy, toward activities with higher technological content, involve high degree of difficulty and therefore require an integrated and comprehensive set of policies (Lall, 2000). Therefore, it is crucial to examine the production and export structures of countries and regions, as well as their evolution over time.

Before closing this section, it is worth to briefly mention a growing empirical literature that examines the relationship between economic growth and productive specialization. We do not intended to do a comprehensive review on the topic, but just to recognize the existence of such literature, by mentioning some selected works.

Rodrik (2007) lists a series of stylized facts about the relationship between industrialization and economic growth, which confirm several arguments from the Kaldorian and Schumpeterian literature, and that can be summarized in the following propositions: (i) economic development requires diversification, not specialization; (ii) countries with high growth rates are those with a large industrial sector; (iii) processes of growth acceleration are associated with structural changes towards the manufacturing sector; (iv) patterns of specialization are not determined by factor endowments; (v) countries that promote exports of more sophisticated goods grow faster; (vi) there is “unconditional” convergence at the level of individual products; (vii) Some patterns of specialization are more effective than others in promoting industrial development.

Hausmann, Hwang and Rodrik (2007) argue that the mix of products that is produced and exported by a particular country has crucial implications for its development. In particular, they suggest that "countries become what they produce" (Hausmann, Hwang and Rodrik, 2007, p. 2), i.e. countries which specialize in goods that are typically produced by rich countries tend to grow faster than those which maintain a productive structure based on products traditionally exported by poor countries. Hausmann, Hwang and Rodrik (2007) build an index of exports quality and, using cross section and panel data, conclude that there is a positive relationship between that index and economic growth.

Finally, we mention the work of Lederman and Maloney (2009), which investigates the relation between productive structure and growth, with special attention to the so-called "natural resources curse". Its main conclusion is that there is a negative correlation between concentration of exports – measured by a Herfindahl index and by the share of natural resources in exports – and economic growth. In particular:

> *Arguably, it is concentration per se, and not natural resources in particular, that is negatively correlated with growth. If indeed, there is no “resource curse,” but there is a curse of export concentration, the implication is that policy makers should strive to provide a policy framework conducive to product and market diversification*. (Lederman and Maloney, 2009, p. 51).

3 – EXPORTS BY TECNOLOGICAL CONTENT (2000-2010)

The literature on exports and development presents various alternatives for classifying exports by technological intensity. This paper will follow the classification developed by Lall (2000), which is based on a combination of the schemes proposed by OECD (1994) and Pavitt (1984). So, exports are classified into five major groups, namely:

Primary products (PP): little or no processing. Examples include fresh fruit, rice, cocoa, coffee, soybeans, wood, coal, crude oil, gas.

Resource-based manufactures (RB): generally simple, labor-intensive products, but there are also segments that use capital-, scale-, and skill-intensive technologies, such as petroleum refining or processed foods. This group includes agricultural or mineral products, such as meats and fruits, beverages, wood products, vegetable oils, ore concentrates, petroleum, cement.

Low-technology manufactures (LT): products that use stable and well-diffused technology, usually embodied in capital equipment. The markets for such products tend to grow slowly, and there is little differentiation, including, in many cases, competition via prices. Examples include clothing, textiles, shoes, furniture, toys, and plastic products.

Medium-technology manufactures (MT): it represents a crucial segment of the industrial activity in developed economies, and comprises the majority of skill- and scale-intensive technologies in intermediate and capital goods. It tends to present high barriers to entry and to employ relatively complex technologies, with relatively high levels of P&D, requiring advanced qualifications and long learning periods. This segment includes automobiles and auto parts, fertilizers, chemicals and paints, steel, engines and industrial machinery, ships, among others.

High-technology manufactures (HT): advanced technology products in rapid evolution, characterized by high R&D investments and emphasis on product design. In this group, we include telecommunication and electronics, office equipment, precision instruments, pharmaceutical and aerospace industry.

In this paper, we present data on exports by technological intensity, considering the whole sample of countries, in order to capture the dynamics of the international markets during the 2000s. In general terms, world exports have grown rapidly throughout the decade. PP and RB exports have grown above average, and therefore these products increased their shares in international trade during the decade.

Developing countries surpassed developed countries in the growth rates of exports of manufactures of low, medium and high technology, as well as in exports of natural resources-based manufactures. Over the decade, developing countries were able to increase their participation in exports of all categories. Table 1 summarizes some of the main results.

Table 1. Growth rates and shares of exports by technological content (%)

	Total	PP	RB	LT	MT	HT
			Growth rates 2000-2010 (%)			
World	53.54	59.56	61.50	49.26	50.46	47.61
Developed	47.44	60.44	57.00	43.69	44.96	35.03
Developing	62.94	58.60	70.43	55.77	66.51	63.66
			Share of products in world exports, 2000 and 2010 (%)			
2000	100	14.23	15.24	15.24	31.86	23.43
2010	100	16.45	18.51	14.05	30.08	20.91
			Shares of developing countries in world exports, 2000 and 2010 (%)			
2000	29.64	48.79	25.74	40.18	17.28	30.48
2010	37.40	47.66	33.52	46.10	25.56	43.95

Source: Authors' calculation, based on data from UN-COMTRADE.

Among developing countries, East Asia was the region with higher export quality, in terms of technological intensity, and also the region with greater improvements over the decade, following the path also observed in the 1990s. Despite the increase in the share of resource-based manufactures, the main change in exports was a shift from simpler to more complex products.

Another important element was the consolidation of China as the main exporter among developing countries. By the end of the 2000s, China was the leader in exports of all categories of products, except primary products. Ten years before the country was only important in the exports of RB and LT. This means that China was able to increase substantially its total exports, and also to improve significantly the quality of its export profile, in terms of technological content, which is crucial for economic development.

An important event during the decade was the 2008-2009 international financial crisis, which brought about a sharp contraction on international trade. Such decrease was more pronounced for developed countries, whose trade dropped over 30% in 2009. For developing countries, in turn, the decline in international trade was less intense, but it was particularly important in the group of primary products.

In sum, the group of countries that dominate exports from the developing world has not changed significantly, especially if we consider the categories with higher technological content. Thus, it can be said that even with the high growth of the total exported, the ability to develop and improve the export performance remained restrict to a small group of countries.

4 – DATA, MODEL AND ESTIMATION METHODOLOGY

This paper aims to evaluate the importance of export specialization for economic growth. More specifically, it examines the hypothesis that higher technological content of exports is associated with a better economic performance. In order to test such hypothesis, our starting point is to build an index of export quality, as specified below.

Following the classification of exports by technological intensity (Lall, 2000), exports were divided into two large groups, X1 and X2. The first group comprises products classified as primary products, resource-based and low-technology manufactures (PP, RB and LT, respectively). This means that X1 represents exports with lower technological content. The second group, named X2, includes middle- and high-technology manufactures (MT and HT), which correspond to products with higher technological intensity. Then, export quality index EQI_{it} was defined as:

$$EQI_{it} = \frac{X2_{it} - X1_{it}}{Total\ exports_{it}} \tag{1}$$

This index ranges from -1 to +1. Lower values are associated with lower technological content of exports. The extreme cases are: (i) a country exports only PP, RB and LT (*EQI = -1*); (ii) a country exports only MT and HT (*EQI = +1*). Therefore, as EQI approaches +1, the better is the quality of exports of country *i* in period *t*.

Exports are measured in current US dollars, and the source of the data is UN COMTRADE (http://comtrade.un.org/db). The sample includes 195 countries for which exports data were consistently available from 2000 to 2013.

The classification adopted in this paper follows the three-digit SITC, revision 2. According to Lall (2000), this classification does not capture all aspects of technological modernization, because it does not fully distinguish between different levels of technologies used in exporting activities and their modernization over time. Still, the three-digit level SITC allows for a considerable disaggregation, despite grouping together products of different technological intensity under the same category. The classification also does not consider the process involved in the production of goods in different locations, and for this reason includes in the same category high-tech, complex developments, and simple assembly activities. Finally, it does not take into account technological improvements over time within each category. However, the ways of dealing with such problems, inherent to the data, would imply great loss of information or too much disaggregation, so that the costs would exceed the benefits.

The estimated model was a dynamic panel with fixed effects:

$$Y_{it} = \delta + \rho Y_{it-1} + \beta_1 EQI_{it} + \beta_2 TT_{it} + \beta_3 X\_GDP_{it} + \alpha_i + \varepsilon_{it} \qquad (2)$$

i = {1, . . . , 195} and t = {2000 to 2013}

Where Y_{it} is the GDP growth rate, Y_{it-1} is the lagged GDP growth rate which captures the effects of time-varying omitted variables, EQI_{it} is the Export Quality Index (EQI), TT_{it} is an index of variation of the terms of trade and X_GDP_{it} is the share of Exports in GDP. Due to the introduction of the lagged term in the regression, the coefficients β_1 to β_3 represent the short run effect of the remaining independent variables on the GDP growth rate.

The term ε_{it} is the vector of *i.i.d* errors and α_i are the unobserved heterogeneity or time invariant variables which are typical in panel data modeling. This heterogeneity may represent a country-effect that includes a wide range of factors from geographic to cultural features which are likely to be correlated with the explanatory variables in the model EQI_{it} , TT_{it} and X_GDP_{it} .

Were it not for the presence of the dynamic term, the correlation among the explanatory variables and α_i could be addressed with the usual methods of panel data estimation. However, in this case Y_{it} exhibits *state dependence*, and the usual methods for removing the individual effects as fixed effects (*within estimator*) or first difference estimators lead to inconsistent estimation of the parameters. The estimation here requires an initial transformation in first differences (or forward orthogonal deviations) to eliminate the individual effects α_i and a subsequent estimation by 2SLS (Two Stage Least Squares) or GMM (Generalized Method of Moments) with appropriate instruments to mitigate the correlation between ΔY_{it-1} and $\Delta \varepsilon_{it}$.

The use of GMM methods in analysis of dynamic panels was introduced by Holtz-Eakin, Newey and Robsen (1988) and later refined by Arellano and Bond (1991), Arellano and Bover (1995) and Blundel and Bond (1998). There are at least two major variants of these estimators for dynamic panels, the GMM in first differences (Arelano and Bond, 1991; Arelano & Bover, 1995) and the GMM-system estimation (Blundel and Bond, 1995). The first consists of an estimation in first differences, using as instruments the lags of the lagged term and the lags of the exogenous and pre-determined explanatory variables in level.

Blundell and Bond (1998) have shown that the estimator in first differences may perform poorly in finite sample when the panel series are close to a random walk. This has lead to the development of a GMM-system estimator which combines equations in difference with equations in level. The equations in differences are instrumented with the lags of the variables in level and those in level with the variables in first difference. In our case, although pre-estimation tests rejected the null hypothesis of a unit root, the short period of time does not favor a good performance of the unit root tests. Hence, we used the two estimators, the

GMM first-differences (FD-GMM) of Arellano & Bond, and Arellano & Bover (1991, 1995) and the GMM-system estimator of Blundel & Bond (1995).

In order to better assess our results, we performed initially OLS levels and Within Groups (Fixed Effects) estimations of the coefficients. As we know, both estimators for ρ are biased, the OLS upward and the Within Groups downward. Thus, the value for $\hat{\rho}$ obtained from the OLS estimation is usually seen as an approximate upper bound whereas the $\hat{\rho}$ obtained from the Within Group estimation is regarded as a lower bound (Hoeffler, 2002; Roodman, 2006).

Also, the estimation considered the variable terms of trade to be endogenous. This may be justified by either simultaneity or by the omitted variable bias. It should be noted that results change considerably when we consider terms of trade as exogenous, which by itself is a strong evidence of endogeneity of the variable.

Finally, we included a structural break in the estimation in order to capture the effects of the 2008-2009 international economic crisis, which caused a widespread slowdown in international trade and GDP growth rates. The procedure adopted in the estimation means that we consider two subperiods with distinct features: (i) 2000-2008, characterized by higher growth rates and booming commodity markets; and (ii) 2009-2013, characterized by lower growth rates and lower demand for commodities.

A NOTE ON SPATIAL HETEROGENEITY

Although panel modeling takes into account the unobserved heterogeneity among countries, represented by the term α_i, we have reasons to believe that there are regional similarities between countries in the same geographical region as well as regional differences between countries located on different sides of the globe. These effects are translated in spatial dependence (similarity between neighboring countries in the same region) and spatial heterogeneity (differences between countries located in different regions).

We should have been able to take into account the spatial autocorrelation in the analysis. Unfortunately, we only got complete data for 195 of the 252 countries. The presence of the missing data makes it difficult to perform spatial tests and estimations.

Nonetheless, for illustrative purposes, we performed a Moran's I test in some variables after artificially filling the missing observations using spatial smoothing methods. The tests rejected the null hypothesis of no spatial autocorrelation in most of the periods, i.e., the variables appear to be spatially autocorrelated (see Table A1, in appendix). However, besides the fact that spatial smoothing introduces spatial autocorrelation, the Moran's I test is not able to distinguish clearly between spatial heterogeneity and spatial autocorrelation (Anselin and Rey, 1991). This means that the results may be indicating both spatial autocorrelation and/or spatial heterogeneity.

Therefore, we decided to include some form of spatial heterogeneity in our model and analysis. The inclusion of spatial heterogeneity in model (2) takes the following form:

$$Y_{it} = \rho\, Y_{it-1} + \beta_1 EQI_{it} + \beta_2\, TT_{it} + \beta_3\, X\_GDP_{it} + \lambda\eta_R + \alpha_i + \varepsilon_{it} \qquad (3)$$

Where η_R is a group of regional dummy variables accounting for the "measured" spatial heterogeneity among regions. Since these regional effects may be correlated with the unobserved effects ($\alpha_i + \varepsilon_{it}$), in order to estimate them we adopt the two steps procedure suggested by Hoeffler (2002).

The first step consists of the estimation of equation (2) by GMM-system obtaining consistent estimators and residuals. In a second step, these residuals are regressed against regional dummies in a OLS or fixed effects estimation.

$$(Y_{it} - \hat{\delta} - \hat{\rho}\, Y_{it-1} - \hat{\beta}_1 EQI_{it} - \hat{\beta}_2 TT_{it} - \hat{\beta}_3 X\_GDP_{it}) = \lambda\eta_R + (\alpha_i + \varepsilon_{it}) \qquad (4)$$

Results for regional heterogeneity are presented in the appendix, table A2.

5 – RESULTS AND INTERPRETATION

Columns (1) and (2) in Table 2 contain the results of the OLS and Within Groups estimations which provides the upper and lower limits suggested for the coefficient of the lagged dependent variable. We see that the values of the lagged term of the coefficient obtained by the two GMM estimations are within the limits suggested in the literature. Columns (3) and (4) show the results of the GMM estimation in first differences (FD-GMM) and of the System-GMM estimation, respectively.

The Sargan test for the FD-GMM model only accepts the validity of the instruments at seven percent level. The instruments for the GMM-system estimation did not reject the null hypothesis of valid instruments, so, with these data it seems that the Blundel and Bond (1995) estimator performed better.

In both GMM specifications (columns 3 and 4), the export quality index is highly significant to explain economic growth. It should be noted that the sign of the estimated coefficient changes between the two periods of analysis. For 2000-2008, the negative sign suggests that lower export quality, with greater weight of primary products and resource-based manufactures, is associated with higher rates of economic growth. Although this result is not in line with the Kaldorian and Schumpeterian perspectives described before, it can be justified by the atypical behavior of commodity markets during the period, when growing demand (especially from China) caused an unprecedented increase in commodity demand and prices, which benefitted PP and RB exporters. Considering the system-GMM estimation, our results suggest that a 1 p.p. increase in the *EQI* causes on average a 2.16 p.p. decrease in yearly growth rates, during the period 2000-2008.

Table 2 – Exports Quality Index (EQI) and GDP Growth: 2000-2013

Dependent variable: GNP growth rate				
	(1)	(2)	(3)	(4)
	OLS	Within-Groups	FD-GMM	System-GMM
GDP growth rate$_{(t-1)}$	0.153	0.076	0.096	0.089
	(0.029)	(0.028)	(0.034)	(0.008)
Share exports in GNP	0.007	-0.192	-0.022	-0.027
	(0.011)	(0.031)	(0.048)	(0.019)
Terms of trade	0.07	0.1	0.242	0.15
	(0.011)	(0.016)	(0.033)	(0.007)
EQI: 2000-2008	-2.92	-3.822	**-8.42**	**-2.16**
	(0.618)	(1.380)	(3.372)	(0.090)
EQI: 2009-2013	8.331	9.825	**16.316**	**14.58**
	(0.948)	(1.267)	(1.914)	(0.050)
Const	-0.69	-2.821	-19.51	-6.02
	(1.014)	(1.644)	(4.382)	(0.080)
Instruments			160	184
Sargan test (prob)			0.07	0.31

Note: Robust Standard Errors in parentheses

For 2009-2013, in turn, the estimated coefficients are higher and the signs are positive. These results confirm what is expected by theory and suggest that export structures with higher technological content have brought about positive effects on economic performance during this period. The magnitude of the effects depends on the value of the estimated coefficients, which means that higher *EQI* values imply greater positive effects on growth rates. Thus, according to the model, a 1 p.p. increase in *EQI* is associated with a 12.42 p.p.[2] increase in yearly growth rates between 2009 and 2013.

6 – CONCLUDING REMARKS

This paper aimed to examine the evolution of exports by technological intensity for the period 2000-2013, based on the assumption that different export profiles present different implications for economic development. Our main hypothesis is that higher technological content of exports is associated with higher growth rates over time.

[2] This is calculated as the estimated coefficient for 2009-2013 minus the one for 2000-2008. Thus 14.58 – 2.16 = 12.42.

The booming commodity markets during most of the 2000s had visible impacts on the export profile of most developing countries, with significant growth of PP and RB exports. However, it should be noted that some developing countries, particularly in East Asia, were able to maintain an export profile with higher technological intensity, based on MT and HT manufactures, whereas most of the developing world increased the weight of PP and RB in their exports.

In this paper, exports were classified by technological content, following the 5-group classification proposed by Lall (2000). Then, we defined and export quality index (*EQI*), ranging from -1 to +1, in order to measure the technological intensity of exports. Finally, we estimated by different methods a model in which economic growth was explained by the *EQI*, among other variables. Our sample included 195 countries during the period 2000-2013.

The estimation results suggest that the export quality index is highly significant to explain economic growth. An interesting result is the change in the sign of the estimated coefficient between the two periods of analysis. For 2000-2008, the negative sign suggests that lower export quality, with greater weight of primary products and resource-based manufactures, is associated with higher rates of economic growth. This result can be justified by the atypical behavior of international trade markets during the period, when booming demand for commodities (especially due to the growth of China) benefitted PP and RB exporters.

For 2009-2013, in turn, the estimated coefficients are higher and the signs are positive. These results confirm what is expected by theory and suggest that export structures with higher technological content have brought about positive effects on economic performance during this period.

As mentioned before, the technological structure of exports cannot be rapidly altered and it depends on its previous path. Still, countries which have promoted efforts to export products with higher technological content are expected to present better growth prospects in the long run, given their potential to differentiate and innovate.

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APPENDIX

Table A1 presents the results of Moran's I statistic for some of the model variables. An interesting result is that all the variables are spatially correlated during the 2000s.

Table A1 – Moran's I Statistic

	GDP growth		EQI		Terms of trade	
Year	Moran's I	t	Moran's I	t	Moran's I	t
2000	0.06	1.98	0.24	6.71	0.10	5.02
2001	0.02	0.84	0.25	7.24	0.09	4.52
2002	0.21	7.04	0.23	6.59	0.09	4.44
2003	0.07	1.90	0.22	6.52	0.11	5.34
2004	0.12	3.63	0.24	6.98	0.13	6.36
2005	0.17	5.60	0.24	6.89	0.20	8.18
2006	0.12	4.32	0.23	6.72	0.22	8.82
2007	0.15	5.14	0.27	7.81	0.23	9.24
2008	0.14	4.86	0.24	6.97	0.28	10.20
2009	0.42	11.30	0.25	7.25	0.18	7.90
2010	0.17	5.16	0.25	7.14	0.23	9.30

Table A2 presents the results of the estimation for regional heterogeneity. It should be noted that most of the estimated coefficients are significant, except the ones for Europe and North America. Also, the coefficient for Asia 1 (which includes the most dynamic exporters from Asia, such as China, South Korea and Southeast Asia countries) is positive, whereas the ones for Africa and Latin America are negative.

Table A2 – Regional Heterogeneity

Dependent variable: residuals from System GMM	
	OLS
Africa	-5.484
	(1.533)
Central and South America	-3.299
	(1.571)
North America	-2.159
	(2.315)
Asia 1	6.586
	(1.839)
Asia 2	-4.285
	(1.616)
Europe	2.448
	(1.530)

Note: Robust Standard Errors in parentheses