STRUCTURAL CHANGE, CATCHING UP AND FALLING BEHIND IN THE BRICS: A COMPARATIVE ANALYSIS BASED ON TRADE PATTERN AND THIRLWALL'S LAW

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RESUMO: Apesar da popularidade do acrônimo BRICS (Brasil, Rússia, Índia, China e África do Sul), esta sigla não seria realmente justificada se se considerassem as diferenças históricas, econômicas e culturais entre os países. No entanto, após a criação do acrônimo BRIC (a África do Sul foi incluída posteriormente), seus governos vêm se engajando em negociações políticas e econômicas como se fossem um bloco regional. Isso sugere que os BRICS tornaram-se uma força mais poderosa que um simples acrônimo. O objetivo do trabalho é comparar o desempenho econômico dos BRICS no período 1980-2013, utilizando dados de estatísticas descritivas e evidências econométricas, com base em estimativas da Lei de Thirlwall, para avaliar se (e, em caso afirmativo, em que intensidade) as economias estão em processo de catching up. Nosso pressuposto básico é que a forma pela qual cada economia se engaja no comércio internacional e nos fluxos globais de capital influencia decisivamente o seu desempenho econômico no longo prazo. Embora nossos resultados não permitam extrair uma conclusão de se a Rússia está ou não em processo de *catching up*, eles confirmam que a China e a Índia se encontram no processo de *catching up*, enquanto o Brasil e a África do Sul encontram-se em uma trajetória de *falling behind*.
Palavras-Chave: Mudança estrutural; desenvolvimento econômico; catching up; falling behind; BRICS

ABSTRACT: Despite its popularity, the acronym BRICS (Brazil, Russia, India, China and South Africa) would not be justified if one considers the historical, economic and cultural differences among the countries in the group. However, after the acronym was created in 2001 as BRIC (South Africa was included later) by the Goldman Sachs economist, Jim O' Neill, the governments of the BRICS have engaged in international and political negotiations in the recent years as if they were an economic regional group. This strongly suggests that actually the BRICS became more than a simple acronym. Thus, our aim in this paper is to compare the economic performance of the BRICS between 1980 and 2013, using descriptive statistical indicators and econometric evidence based on estimates of Thirlwall's Law. Thirlwall's equations, expressed by the "strong" and "weak" versions, have become classical and powerful indicators to evaluate if a country is in a catching up or a falling behind long-term path. Our basic assumption is that the way in which each country engages in international trade and global capital flows matters for influencing its long-term economic performance.. Though our results cannot confirm Russia's long-term growth trajectory, they do confirm that China and India have shown a rapid catching up path, while Brazil and South Africa have entered into a falling behind path over the period analyzed.
Keywords: structural change; economic development; catching up; falling behind; BRICS

JEL classification: 011; 014; 019; 047; P52

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1. Introduction

The acronym BRIC (Brazil, Russia, India and China), which later became BRICS with the inclusion of South Africa, was first coined by the Goldman Sachs economist Jim O'Neill. It appeared in a Goldman Sachs paper (see Wilson and Puroshothaman, 2003) that aimed to estimate long-term economic growth rates for those countries until 2050. This study concluded that the BRICS could be larger than the G6 in dollar terms by 2040 and a much larger force in the world economy by 2050.

The wide acceptance of this acronym, however, could not be justified by an in-depth comparative investigation into the economic development of the countries that constitute the group. But in this case, one can say that the creature went far beyond the creator. After the publication of the Goldman Sachs paper, the governments of the BRICS countries have not only created an international New Development Bank and a US$100 billion Contingent Reserve Arrangement, but have also engaged in international and political negotiations in recent years as if they were a regional economic group. This strongly suggests that, actually, BRICS became more than just an acronym. Therefore, notwithstanding their historical, economic and cultural differences, their increasing political and economic influences justify a comparative study on the economic performance of the BRICS countries in the last couple of decades.[1] In particular, we aim to investigate the long-term economic performance of the BRICS countries using descriptive statistical indicators and econometric evidence, in order to identify which of them have succeeded in accelerating the catching-up process and which of them are, in contrast to the Goldman Sachs projections, falling behind.

One of the few consensus views in economic theory is related to the main driving force for long-term economic growth. Both neoclassical and heterodox economists agree that, everything else being equal, technological progress is the main engine of long-term economic growth.[2] However, the main point of disagreement concerns **how** a country can generate and diffuse technological progress and, therefore, accelerate economic growth. Broadly speaking, while the neoclassical approach emphasizes the role of free markets in efficiently allocating resources to provide maximum social welfare in the economy, the heterodox approach questions the capacity of free markets to provide the best allocation of resources in both static and, more importantly, dynamic terms. The main normative implication of this theoretical divergence is that neoclassical economists emphasize deregulation and free trade policies in providing *sine qua non* conditions for accelerating technological progress and long-term economic growth, while heterodox economists emphasize the role of the state in creating policy instruments to influence private markets' decisions and short- and long-term economic performance.

Based on preliminary evidence dating from the early 1990s, it can be said that China leaned more toward state interventionist policies and India more toward moderate liberalizing ones, while the other BRICS have prioritized more the deepening of liberalizing economic strategies. In fact, if one compares the economic policy regimes that the BRICS have adopted in the past decades, it will be clear that China alone has gone far from laissez-faire or even unconditional free trade policies. (Inter-American Development Bank, 2004; Artus *et.al.,* 2011). Since the early 1980s the "great openness to the world" was limited to the Special Economic Zones (SEZs), enclaves within which multinational enterprises have been located and have had the freedom to import parts, components and other inputs with zero import tariffs and other tax exemptions for producing exclusively to export. China's domestic market has been highly protected from foreign competition and from free operations of multinational firms. Note that protection here does not necessarily mean non-tariff and tariff barriers against imports, but other ways of protecting domestic markets in

[1] As O'Boyle (2014:1) recognizes, the BRICS countries have taken on "a greater geopolitical role, which aims to enact institutional reforms that shift global power".

[2] In the history of economic thought, some forces are more emphasized than others as the main drivers of economic development, such as capital accumulation (see Marx, 1887), institutions (see North, 1990) or even stable long-term expectations and investment to GDP ratios (see Keynes, 1936 especially ch.11 and 12). However, technological progress is one of the most important factors to accelerate labor productivity, generate structural change and sustain economic development.

China. Non-tariff barriers were eliminated and tariff imports sharply reduced in the mid-1990s. However, since then, although Chinese governments have been relaxing the previous prohibition to multinational enterprises establishing plants to sell in their internal market, the authorization has been subject to several constraints and conditional requirements, such as the transfer of technology and know-how to local firms, joint-ventures with state-owned enterprises, among others (Feenstra, 1998; Interamerican Development Bank, 2004; Cesarin, 2005; Artus *et.al*., 2011). China's industrial and technological policies have also been closely coordinated with monetary, credit and exchange rate policies since the mid-1990s. The smart ability of China's governments to keep low real interest rates and real undervaluation of the Chinese renminbi since then has contributed to stimulating investment and innovation as well as promoting structural change and sustaining rapid and significant long-term growth at least until the 2008 global economic crisis.[3]

In some sense, Chinese development strategies seem to be following, in very radical terms, List's famous recommendation of protecting national infant industries during the time required for catching up and acquiring the capacity to compete in global markets. Whether or not China will be able to successfully catch up with per capita income and well-being levels of developed countries is an open question. Currently, the challenges of Chinese governments to sustaining long-term growth and pursuing the catching up strategy are not few: i) they need to overcome the excess of capacity in many manufacturing industries; ii) since the relative share of gross investment and exports as main growth drivers is being reduced, they have to learn how give household consumption a more pronounced role in economic dynamics without seriously jeopardizing Chinese long-term growth;[4] and iii) since they intend to transform the Chinese renminbi into an international currency, they will need to learn how to give up the successful strategy of an undervalued currency that had prevailed until 2008, without avoiding, at the same time, a sharp erosion of Chinese international competitiveness.

India, on the other hand, introduced liberalizing reforms in the early 1990s. These reforms were adopted in a much more cautious way than Brazil's, Russia's and South Africa's. For instance, Indian trade liberalization lasted more than 10 years (WTO, 2002); short-term foreign capital flows were relaxed for financial resources directed towards stock markets, but not to private and governmental securities (Patnaik and Shah, 2012; Subbarao, 2014); and industrial policy (characterized by horizontal and selective instruments involving import tariffs, subsidies, public credit and others) has been closely coordinated with short-term macroeconomic policies (particularly monetary and exchange rate policies) with the goal of creating dynamic comparative advantages and sustaining long-term economic growth (Government of India, 2014). With successful interventions in the foreign exchange markets and moderate capital controls, the Reserve Bank of India has preserved the stability of the real exchange rate and avoided India's currency overvaluation in real terms (Subramanian, 2010; Subbarao, 2014).

Meanwhile, Brazil's, Russia's and South Africa's liberalizing reforms, also introduced from the early 1990s on, were implemented quickly and without a fine coordination with short-term macroeconomic policies. Actually, we can say that in these economies, quite differently from India, liberalizing reforms were introduced as a "shock therapy" (Lin, 2009). In addition, while India has never renounced the continuity of explicit industrial and technological policies ("the Five-Year

[3] A comparison between the Chinese currency and a basket of foreign currencies, based on its real effective exchange rate, showed that the renminbi was undervalued (5 percent on average) from 1994 to 2008. However, from the 2008 global economic crisis to 2011, the renminbi has remained overvalued by 5 percent (on average) in real effective terms (Artus *et al*., 2011: 34), although Artus et al. (2011) provide real effective exchange rate data only until 2011. According to the Bank of International Settlements database, the renminbi had already accumulated an overvaluation level of 23.88 percent by February 2016 in relation to 2010 (monthly averages). See http://www.bis.org/statistics/eer.htm Accessed on March 29, 2016.

[4] As to this debate on the outlook of China's long-term growth, Pettis (2013) has been one of the authors to most emphasize that, in virtue of debt accumulation has grown faster than debt-servicing capacity in the last decades, the price to be paid for solving these deep internal imbalances will be a significant decreasing of China's real GDP to 3 percent (or less) per year in the next decades. Yet Yongding (2009) and Lardy (2011; 2015), despite recognizing these imbalances, assure that China, by still having a capital-output ratio much minor than several developed countries, will be able to softly transit to a new economic model driven by household consumption and heavy investments in the infrastructure sector. For these authors, China's real GDP could be sustained at around 6 or 7 percent in the next decade.

Plans") even when gradual and cautious liberalizing reforms were being introduced throughout the 1990s, Brazil, Russia and South Africa practically discarded ambitious long-term industrial policy in the same period, giving priority to wide liberalizing economic reforms. From the 2000s on, these economies have started to use active industrial policies again, but, for several different reasons, they have been facing coordination problems with short-term macroeconomic policy. Not by chance, since the 1990s, Brazil's, Russia's and South Africa's currencies have tendentially overvalued in real terms, be it because of sharp net capital inflows or because all these countries have suffered from either moderate (Brazil) or chronic (Russia and South Africa) Dutch disease.[5]

These different national strategies suggest that the way each country engages in international trade and global capital flows does affect, either positively or negatively, the promotion of structural change and the catching up strategy. With the main goal of presenting empirical evidence of the BRICS's structural change and catching up (or falling behind) paths on a comparative perspective, the remainder of this paper is divided into three sections. Section 2 presents a discussion on the theoretical arguments that support these different approaches to promote structural change, economic development and catching up. Through descriptive statistics for the period 1980-2013 and econometric evidence based on Thirlwall's law between 1995 and 2013, Section 3 shows some indicators on the BRICS's structural change as well as identifying which of them have been catching up and which are falling behind. Section 4 draws the main conclusions.

2. Static comparative advantage versus developmental strategies to promote economic development and catching up: a review of the theoretical and the normative debates

2.1 The liberal[6] versus the developmental approach: the positive debate

The liberal approach has been built together with international trade theories, especially under the umbrella of the theory of comparative advantage in its neoclassical version, the so-called Heckscher-Ohlin-Samuelson model (H-O-S). In its well-known textbook presentation, the H-O-S model not only kept unchanged the necessary Ricardian condition for countries to trade in the global economy (different inter-industrial relative costs and prices in each country in "autarky") but was also constructed through an integrated theoretical body to ideologically support the advantages of free international trade: since all countries in the world specialize in activities or industries with minor relative costs and prices (explained, in turn, by the intensive use of the factor considered abundant in each of them)[7], the adoption of free trade strategies could allow them to provide the best allocation of resources in order to maximize economic efficiency.

The H-0-S standard theoretical model, which supports the argument that free trade is the first-best strategy to provide both countries static benefits, fits well in the Walrasian general equilibrium model and fulfills the conditions for reaching the maximum social well-being in the Pareto sense. Any State intervention (through domestic or trade policies) would only be justified if markets failed to show the best economic result. Even so, policy intervention would be a "second best" compared with the "first best" provided by free market forces.

In particular, it is Samuelson's factor price equalization theorem (Samuelson, 1948; 1949; 1962) that gave support to the idea of not considering the kind of product traded in international

[5] See, among others, Nassif, 2007, for a comparison between economic liberalizing reforms in Brazil and India; Nassif, Feijó and Araújo, 2011 and 2015, for Brazil; Gaidar Report, 2014, for Russia; and Faulkner et al., 2013, for South Africa. As a more detailed analysis of the economic policies of the BRICS countries in the last decades would go beyond the scope of this paper, we limited to a quickly panoramic view in these four paragraphs. For more details, see the above mentioned references. And for a wide comparative analysis, see Amsden (2001), Nadkarni and Noonan (2013) and Popov (2014).

[6] The term liberal is used in the economic (and not political) sense, and it is different from the term neoliberal which is associated with the "Washington Consensus" "new" liberal agenda as codified by Williamson (1990).

[7] The Ricardian sources of comparative advantage (intersectoral differences in relative productivity and technologies) were confirmed by several empirical tests (see McDougall, 1951; and Balassa, 1963). However, it was the Heckscher-Ohlin (H-O) approach that turned out to be hegemonic in the static theory of international trade, even though the H-O version has not, paradoxically, been confirmed by Leontief's (1953) most famous statistical test. As Dosi and Soete (1988: 415-416) pointed out, given the political implications of the so-called Leontief "paradox", other empirical strategies were used to test the Heckscher-Ohlin model with the introduction of variables (e.g. labour skills) that do not derive rigorously from the original theory.

markets relevant. In fact, if free trade promotes the equalization of all relative prices of goods and factors, it does not matter if a country specializes and exports either coffee or airplanes. In the modern microeconomic theory of market failures, governments should only care about horizontal policies aiming to correct failures that prevent market forces from producing more technologically sophisticated goods.

Most of the literature that incorporates the role of static increasing returns to scale, product differentiation and oligopolistic competition in trade models have not given up the canonical H-O model as the base for determining the net trade pattern (i.e. exports minus imports). Krugman (1979, 1980, 1981) showed that relative factor endowment continued to be the main force to explain the net trade pattern in each country (expressed by inter-industrial trade among countries in the world economy). However, assuming that firms compete under conditions of monopolistic competition *à la* Chamberlin, the combination of increasing returns to scale and product differentiation is responsible for determining the intra-industrial international trade. Therefore, gains from trade are assured once consumers in each country can have access to a greater variety of differentiated products with decreasing prices.[8]

Even in "new trade theory" models, which incorporate assumptions such as imperfect competition, static economies of scale and product differentiation, the gains from trade are expressed in static terms.[1] One strand, though, of the "new trade theory" has emphasized the dynamic impacts of trade flows on long-term growth (Grossman and Helpman, 1991). In general terms, a country can accelerate its long-term growth if it is able to take advantage of the immense flow of knowledge derived from globalized trade, assuming that knowledge as a good that can be freely captured or traded in global markets. Indeed, technology is restrictively understood as a "blueprint" derived from activities of research and development in a specific sector characterized by the existence of a large number of firms under monopolistic competition. Even under these restrictive assumptions, Grossman and Helpman (1991, ch.9: 246-250) show that, if there is a significant technological gap between two countries, the one lagging the most in terms of technological and innovative capacities may not be able to capture the knowledge flow generated by free trade, and in this case it would grow slower than its trade partner.

The developmental approach, on the other hand, has many contributions and roads to be explored. Prebisch (1950) was one of the first economists to challenge the normative liberal implications of the H-O-S model, especially Samuelson's theorem of factor-price equalization. For him, this theorem does not hold in the real world because goods differ as to their respective income elasticity of demand — higher for manufactured products, especially those more technologically sophisticated, than for traditional goods, especially the primary ones. Based on his center-periphery model, Prebisch (*op. cit*.) identified the connections between international trade and balance of payments, anticipating important insights developed later on by Nicholas Kaldor (1966; 1970) and A. P. Thirlwall (1979) about balance of payment restrictions on growth. According to Prebisch's theory, since goods in which "peripheral" countries are specialized have lower income elasticity of demand than those in which "center" countries are specialized, reciprocal static gains from free trade are not assured, for relative prices in a long term perspective tend to benefit advanced countries. Because developing countries specialize in goods with low income elasticity of demand, their long-term economic growth is constrained by balance of payments, according to Thirlwall's law.

As Thirlwall (2011) recently recognized, Thirlwall's law (Thirlwall, 1979) is strongly based on Prebisch's (1950) critique. Thirlwall's law is generally expressed as:

$$\frac{\dot{Y}}{\dot{Y}*} = \frac{\varepsilon_X}{\pi_M} \qquad (1)$$

[8] We should recall Graham (1923), who was the first author to challenge the general conclusion that free trade was beneficial to all countries following such strategies. According to him, even static gains from trade could be severely impaired in a country pursuing free trade strategies if a sharp reallocation of resources should occur from industries with increasing returns to scale (especially in the manufacturing sector) to industries with non-increasing returns to scale. Krugman, Obstfeld and Melitz (2012:145-148) also recognize that countries can lose from trade, although they stress that "the difficulty of identifying external economies in practice is one of the main arguments against activist government policies towards trade" (op. cit: 148).

where $\dot{Y}$ is the rate of economic growth in the domestic country; $\dot{Y}^*$ is the rate of world economic growth; ε_X is the income elasticity of demand for exports; and π_M is the income elasticity of demand for imports. Thirlwall's law can be used as an indicator to evaluate whether a country has been in a catching-up or falling-behind process over a long period (Nassif, Feijó and Araújo, 2015). In fact, equation (1) shows that the convergence of the rate of economic growth of a developing country to world economic growth depends on the ratio of income elasticity of demand for exports to that for imports.

Equation (1) is the "strong" version of Thirlwall's law, which assumes constant relative prices in international trade in the long term (and, therefore, constant real exchange rates). A "weak" version of Thirlwall's law can be expressed as:

$$\frac{\dot{Y}}{\dot{Y}^*} = \frac{X}{\pi_M} \qquad (2)$$

Equation (2) can also be used as a measure of a country's convergence to the world economy over time when the parameter ε_X is not estimated. As Thirlwall (2011:17-18) argued, in this case, "[actual] export growth (X) must also include the effect of relative price changes as well as the effect of the world on [the country's] income growth, which weakens somewhat the argument that the balance of payments is always brought into equilibrium by domestic income changes". He added: "The model is best tested, therefore, using the "strong" version if robust estimates can be made of ε_X".[9]

Prebisch was not the first author to challenge the theories of comparative advantage in the history of economic thought.[10] The developmental tradition started with Hamilton (1791) and List (1841), continued to be developed by Posner (1961) and has been modelled by post-Schumpeterian authors such as Giovanni Dosi, Luc Soete and Keith Pavitt (1990). In their book, Dosi, Pavitt and Soete (1990) point out that Ricardian and H-O models assume that, once a country abandons autarkic strategies by engaging in free trade, aggregate national income does not change. Trade, then, does not have any effect on growth, but only on the improvement of relative efficiency in alternative uses of productive resources, given the same national aggregate level of income that prevailed in autarky. Therefore, even if both countries might gain from free trade strategies, these benefits would be static in the sense that they not only would represent a reallocation of resources towards sectors in which each of them has comparative advantage, but also would provide each country with greater aggregate consumption than would have been possible under autarkic conditions. In a few words, gains from trade are static and definite.

Dosi, Tyson and Zysman (1989), on the other hand, argue that, since the opportunities for technological change are quite differentiated by goods and sectors, an allocation of resources oriented to free markets and relative prices, despite improving the efficiency of the economy in static terms ("Ricardian efficiency"), could jeopardize technological development and long-term growth ("Schumpeterian efficiency"). This trade-off can be explained by the peculiarities involving innovative activities. "Heretic" authors such as Rosenstein-Rodan (1943), Schumpeter (1943), Hirschman (1958), Posner (1961), Kaldor (1966) and Nelson and Winter (1982) emphasize that most innovative activities come from the manufacturing sector and are subject to static and dynamic economies of scale that operate through several dimensions.[11]

[9] By comparing the right side of equation (2) with the actual growth rate of a country, one can evaluate how much the growth rate predicted from the balance-of-payments-constrained model fits the country's actual growth rate.

[10] The authors and roads to be explored on this topic are numerous. We focus on authors who have discussed the catching-up process in the context of an open economy. For this reason, we discard important development models such as Rosenstein-Rodan's (1943) big push theory and Lewis's (1954) model of economic development with unlimited supply of labour.

[11] First, innovative activities, which involve high entry costs and large financial resources subject to sunk costs, lead to significant static economies of scale once they are introduced into the productive process. Second, considering that innovative activities are highly dependent on learning, accumulation of knowledge and job training, the more firms and industries innovate, the higher will be their dynamic economies of scale. Third, the technological gap does matter, in the sense that since innovative activities are non-ergodic and cumulative ("path dependence"), the more technologically advanced firms, industries and countries are, the more their potential to introduce successful innovation in new methods of production and new goods. Finally,

Kaldor (1966) was the first to highlight the static and dynamic economies of scale as a "macro-phenomenon", emphasizing the importance of a large and diversified manufacturing sector for developing countries. Indeed, he was one of the pioneers to call attention to the damage a developing country still in a catching-up process suffers by embarking on a premature de-industrialization.

In short, the developmental strategies depart from both the theoretical and normative implications related to the liberal approach based on comparative advantage as authors reject the general equilibrium paradigm and work on important effects that international and intersectoral adjustments have on macroeconomic activities. According to Dosi, Pavitt and Soete (1990: 26-27), the growth of each economy is often balance of payment constrained, and this constraint becomes tighter or looser according to the levels and composition of the participation of each country in world trade flows.

2.2 The normative debate

So far, we have been discussing issues related to the "positive" economics (i.e. the theoretical part) of the liberal versus developmental approach debate. A panoramic discussion of the "normative" economics (i.e. the best short-term and long-term economic policies) related to this controversy is now needed. As to the liberal approach, as we have anticipated earlier in this paper, they are generally contrary to industrial policy and other governmental interventions in the free functioning of markets. This does not mean that liberal economists never admit government interventions. In the liberal literature on the role of the state in accelerating economic development, economists only accept the use of stimuli such as subsidies and protection if there is clear evidence of market failures.[12] However, they always stress the difficulty of correctly identifying market failures, so governmental intervention can aggravate the original flaw, creating a "government failure".[13] In other words, liberal economists reject governmental intervention in the process of economic development, and prefer the use of governmental policy mechanisms that benefit the economy as a whole (through the so-called horizontal instruments of industrial policy), such as investment in infrastructure and education and subsidies in research and development (R&D).

More recently, even some economists who favor a more pro-active industrial policy have analyzed it within the market failure framework. Hausmann and Rodrik (2002), for instance, define the process of economic development as a "self-discovery" of new processes, goods and activities. Since there are plenty of imitators, both in a specific country and in the global economy, entrepreneurs are continuously facing a lack of information about the real possibility of capturing all return gains from the introduction of innovations either in goods and services or in productive processes (or, in the authors' words, in discovering new processes, goods and activities). As Hausmann and Rodrik (2002:5, emphasis from the original) point out,

> *Typically, the intellectual property regime protects discoverers of **new** goods through the issuance of temporary monopolies, i.e., patents. But the investor in the developing country who figures out that an **existing** good can be produced profitably at home does not normally get such protection, no matter how high the social return. Indeed, ease of entry by competitors (i.e., imitators or copycats) is normally judged to be an important indicator of how well markets function—the lower the barriers to entry, the better. Free entry makes the nonappropriability problem worse, and undercuts the incentive to invest in discovering what a country is good at producing. Laissez-faire cannot be the optimal solution under these circumstances, just as it is not in the case of R&D in new products.*

In this context, the role of government in developing countries is to help potential innovations discover new processes, goods and activities with a high possibility of being demanded by markets. The challenge is to choose the most appropriate instrument to boost successful innovations in the market. Instead of import protection, which would not be able to discriminate between actual innovators and copycats, Hausmann and Rodrik (2002) recommend public credit (provided by development banks, for example) to potential innovators. The authors

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the potential for spillover of external economies (Marshallian economies) into the rest of the economy is greater for industries with more technological content, which are part of the manufacturing sector.

[12] The theory of market failures was pioneered by Samuelson (1954), Meade (1955) and Baton (1958).

[13] For details, see Corden (1974: 13).

rightly conclude that while consumers demand "new discoveries", trade protection tends to prevent actual innovators from recovering the sunk costs of R&D by promoting premature entry of imitators into the market and creating excessive entry of enterprises, undermining the gains from economies of scale in activities subject to increasing returns to scale. The issue is that a free trade tariff, by stimulating major import penetration of close substitute goods, would drive away potential local innovators before they had time to learn and spread out their products in the market. The major challenge for policy-makers is to find a balance through which adequate trade protection can stimulate innovation, but, at the same time, innovative producers can have access to intermediate and capital goods with low or zero import tariffs.

On the other hand, the developmental approach supports active industrial and technological policies in developing countries in order to accelerate their catching-up process.[14] The main argument is that firms, sectors and countries differ as to their technological capabilities and innovative potential in the global economy. In addition, considering that technologies have specific peculiarities such as path dependence and lock-in (see Arthur, 1989, 1990), a country (say, a developed one) that is specialized in producing engineering-science and knowledge-based goods tends to reinforce this pattern of specialization, while another (say, a developing country) whose activities are concentrated on the production of natural resource-based goods tends to perpetuate its productive structure and pattern of specialization in these activities, in the absence of appropriate industrial and technological policies. Therefore, since goods and sectors have different long-term income elasticities of demand, economic theory clearly supports a combination of selective ("vertical") and horizontal instruments of industrial and technological policies that aim to change the productive structure of a developing economy and, therefore, the pattern of trade specialization (i.e. promote "dynamic comparative advantages") and to accelerate economic development.

In other words, the role of governmental intervention is to combine a set of policy instruments such as moderate trade protection, production subsidies, R&D subsidies, public credit, local content requirements and governmental purchases in order to promote technological transformation, structural change and, consequently, economic development.[15] As most dynamic industries are part of the manufacturing sector, selective instruments should preferentially target those with more capacity to generate innovations and spillover effects of technological progress throughout the economic system.

However, it is important to stress that the major challenge faced by governments is **how** to combine selective mechanisms with horizontal instruments. With regard to selective instruments, some questions are hard to answer. For instance, which industries should be primarily targeted? What should be the best policy instrument — an import tariff, an R&D subsidy or a combination of both? This policy should not only be effective in terms of structural change and economic development but also avoid the predominance of corruption and rent-seeking unproductive activities.

Although there is no magic rule to answer these questions, we could draw some important lessons from the experience of the highly successful countries of East Asia (especially South Korea).[16] These could be summarized as follows: i) the levels of protection must be moderate or low, and high levels of protection as in the case of Latin American countries in the import substitution period (especially during the 1970s and 1980s) must be avoided; ii) the degree of dispersion must be relatively low, and a situation in which some industries have high and others have low levels of effective import tariff must be avoided; iii) the protection level for intermediate and capital goods not targeted by industrial policy must be close to what is provided in a free trade

[14] Dissatisfied with the lack of attention to the effectiveness of Brazil's industrial and technological policies in promoting a change to a more sophisticated industrial structure since trade liberalization was implemented in 1990, Nassif (2000) showed that, from the theoretical point of view, there is no incompatibility between both policy strategies (that is to say, between trade liberalization and industrial and technological policies).

[15] As a matter of fact, we are aware that some of these policy instruments are constrained by multilateral agreements under the World Trade Organisation (WTO).This means that these instruments should be used without violating these multilateral agreements. Ocampo et al. (2009, ch. 9) advocate credit policies by developmental banks, as a powerful instrument still not constrained by multilateral trade agreements, to promote structural change and reduce the technological gap.

[16] See especially Alice Amsden's masterful work (1989).

policy; iv) public incentives (import tariff, subsidies, public credit, and so on) must be temporary in order to avoid corruption and rent-seeking unproductive activities; v) governments must be "hard" in the sense that they must require economic performance from private entrepreneurs who benefit from public incentives over time (in terms of reducing the technological gap, increasing labor productivity and reducing average costs, among other results); vi) investment and qualitative improvement in education and job training are essential to realize the expected results from industrial and technological policies; and last but not least, vii) there must be a fine coordination between the long-term industrial and technological policies and the short-term macroeconomic policies (especially monetary, fiscal and exchange rate policies).

Although a detailed analysis of the last point (item vii) is beyond the scope of this paper, it is necessary to observe that for a macroeconomic policy regime to promote catching up, it must be able to maintain a countercyclical fiscal policy, a low and stable long-term inflation rate, low real interest rates and a competitive real exchange rate (that is to say, a marginal undervaluation of the domestic currency in real terms) over time.[17] The capacity of policy-makers to maintain the latter three macroeconomic prices around those levels is a *sine qua non* condition for reducing the opportunity cost of investment in both productive and innovation projects and, therefore, augmenting the possibility that the expected results of the industrial and technological policies are realized.

Most governmental interventions through industrial, technological and trade policies will not work towards actually accelerating structural change and sustainable long-term growth if those key macroeconomic prices are not in the right place. Strictly speaking, of those three macroeconomic prices, one of the most important for a developing country to continue its catching up trajectory is the real exchange rate, in virtue of its direct or indirect impact on several other microeconomic and macroeconomic variables. As Bresser-Pereira, Oreiro and Marconi (2014:10-11) pointed out:

> *Imports, exports, the investment rate, the saving rate, and inflation depend on it [on the real exchange rate]. Investments depend on it because we may think the exchange rate as the light switch that connects or disconnects the efficient business enterprises existing in a country from foreign markets and their own domestic markets. (…). The main problem that developing countries face is the tendency to the cyclical and chronic overvaluation of the exchange rate. If this tendency is not duly neutralized, the macroeconomic prices will be wrong (…): the exchange rate will be overvalued, the wage rate and all other revenues will be artificially high, the expected profit rate will be depressed, the interest rate will tend to be high, and, if the depreciation of the national currency is still taking place (it didn't level out), the inflation rate will fall. Thus, while the rentier capitalist will be happy with a high real interest rate, the business entrepreneurs — the men and women that really accumulate capital and innovate — will only invest to keep their plants technologically competitive [if they even do that].*

Most Latin American economies (including Brazil), during the relevant period of rapid industrialization under the import substitution strategy (especially in the 1970s), followed none of those seven lessons listed above and drew instead from the experience of East Asia during its catching-up process under the so-called export-led growth strategy. In the case of Brazil, as we have already discussed earlier, liberalizing reforms were adopted between 1990 and 2002 in such a way that developmental strategies were neglected. Moreover, most of those lessons were not followed in Brazil even from 2003 on, when active industrial and technological policies were restored.[18] One could ask why Latin American countries have so much difficulty in learning apparently simple lessons from the East Asian countries. This question does not have a simple answer. Even if one suspects that the differences are related to the cultural peculiarities of those continents, we prefer to believe that most cultural problems (e.g. corruption and rent-seeking) can

[17] Extensive empirical literature shows that an overvalued currency in real terms for a long period of time tends to reduce economic growth. As we stressed elsewhere (see Nassif, Feijo and Araujo, 2011; 2015a), a domestic currency marginally undervalued in real terms is essential for a developing country to pursue its catching up process and long-term growth. This conclusion was empirically supported by Rodrik (2008), Williamson (2008) and Berg and Miao (2010).

[18] See, for instance, Cimoli, Dosi and Stiglitz (2009: 6, table 1.1), which compares different strategies (and therefore different performances) in the East Asian and Latin American countries in the 1980s and 1990s.

be changed by policy over time.[19] In other words, we believe in learning-by-doing in order to improve both the design and the adoption of efficient industrial and technological policies as well as a close coordination of these latter with short-term macroeconomic policies.

3. Structural change, catching up and falling behind in the BRICS: empirical evidence

Since the early 1990s, most developing countries have been following the so-called neoliberal policies, which basically involve trade liberalization, privatization of state-owned enterprises, liberalization of financial markets and full capital account convertibility. Indeed, macroeconomic policies supported by the "new macroeconomic consensus" that prevailed until the 2008 global crisis became the main prescription for economic policy aimed at promoting sustained long-term growth.

However, as well remarked by Palma (2013: 2), there is an important difference in the way Asian and Latin American economies embraced neoliberal economic reforms. Emerging Asian economies followed the neoliberal agenda with a more pragmatic approach, as Palma observes, never giving up pro-growth macroeconomic policies, although a neoliberal discourse "to appease the gods of the market was adopted. Latin American economies, on the other hand, and Brazil in particular, have been taken by the neoliberal ideology … as completely (and fiercely) as the Inquisition conquered Spain", in Palma's shrewd reference to Keynes' position against Ricardo's in relation to Say's law.

Thus, we assume that differences in the way economic policies (especially those concerning with how to engage in international trade and capital flows) have been followed in the BRICS under the neoliberal agenda greatly explain their different long-term economic performances. We also consider that short-term macroeconomic policy (especially monetary and exchange rate policy) can have a permanent effect on the economy, which can be captured by changes in the productive structure and pattern of international trade.

3.1 BRICS's long-term growth performance indicators

It is a well-known fact that the growth rate of the world economy has decreased since the implementation of liberal institutional reforms in developed countries in the 1980s. As shown in Table 1, from 1961 to 1979, the world average growth rate was 4.8 percent per year, and it dropped to 2.8 percent per year in the 1980-2013 period. Among the BRICS, the Brazilian economy decelerated the most, its growth rate decreasing from 6.9 percent per year to 2.4 percent per year, followed by South Africa, which saw its growth rate reduced by half—from 4.5 percent per year to 2.3 percent per year. Both performed below the world average in the 1980-2013 period. The Russian economy, for which no data are available before 1980, showed the worst results, growing well below the world average in the 1980-2013 period.

The Indian economy showed a different pattern, moving from a growth rate below that of the world economy in the 1961-79 period (3.4 percent per year) to an average growth rate well above the world growth rate in the 1980-2013 period (6.2 percent per year). The Chinese economy was the most successful, consistently growing above the world economy in all the periods.

Table 1: Average real GDP growth rate (in percentage): the BRICS and the world economy, selected periods

	World	Brazil	Russia	India	China	South Africa
1961-79	4.8	6.9	n.a.	3.4	5.7	4.5
1980-89	3.0	2.2	2.2	5.6	7.8	1.7
1990-99	2.7	1.7	-5.2	5.8	6.8	1.3
2000-09	3.1	3.2	5.4	7.2	11.4	3.6
2010-13	1.7	3.1	3.4	6.2	8.7	3.0
1980-13	**2.8**	**2.4**	**1.0**	**6.2**	**8.7**	**2.3**

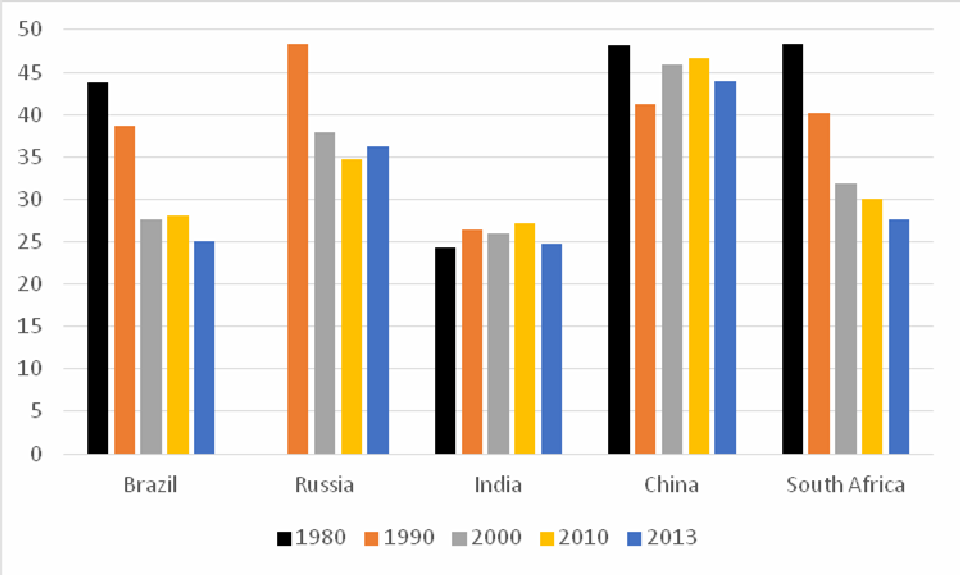
Note: n.a.: not available.

[19] This point was supported by the Brazilian singer and songwriter Caetano Veloso in a discussion with one of the authors of this paper.

Source: World Development Indicators/The World Bank for World estimates (GDP at 2005 US dollar), and database of Groningen Growth and Development Centre (GGDC)/University of Gronengen for the BRICSs estimates (GDP at 1990 US dollars converted at Geary Khamis PPPs). https://www.conference-board.org/data/economydatabase/. Accessed on 8 February 2015.

One explanation for the differences in growth dynamics among the BRICS can be found in Kaldor's writings (Kaldor, 1966, 1970), in which the author argues that the manufacturing sector, with a strong presence of static and dynamic economies of scale, is the "engine of growth". From this perspective, differences in growth performance are related to, among other things, the productive structure of the economies. Figure 1 shows how the share of manufacturing in aggregate value added in the economy has been changing among the BRICS between 1980 and 2013. Except for India, which could keep the share of its manufacturing sector in total GDP relatively unchanged, all the other countries registered a decrease in the weight of the manufacturing sector in total value added. Brazil, Russia (since 1990) and South Africa were the ones with the greatest losses. It is worth observing that the greatest losses for these economies have occurred in the 2000s, when Brazil, Russia and South Africa benefited from high commodity prices in international markets and favorable terms of trade. In the case of Brazil and South Africa, this latter factor, associated with sharp net capital inflows, contributed to a significant overvaluation of their domestic currency in real terms over the second half of the 2000s (Nassif, Feijó and Araújo, 2011; 2015, for the case of Brazil; and Arezki et al., 2012, for the case of South Africa).

Figure 1: The BRICS: Share of the manufacturing sector in total value added (in percentage) Selected years



Note: Manufacturing sector includes mineral extraction
Source: World Development Indicators/The World Bank

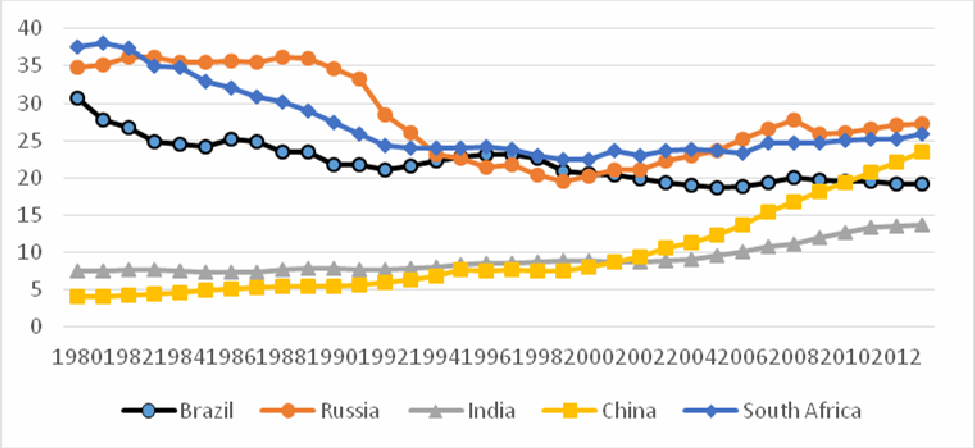
The arguments in favor of manufacturing as the engine of growth also call attention to the evolution of the productive structure from an "immature" structure to a mature one.[20] From this standpoint, the capital accumulation generated by the industrialization process is the key variable of economic development, since it speeds up technological change, benefiting the economy as a whole — as reflected in lower unit costs and higher-quality export products, enabling domestic producers to compete in foreign markets. Therefore, in the Kaldorian analytical perspective, the growth trajectory of an immature economy greatly depends on the space for long-term developmental policies to be implemented. In the case of the BRICS, most of the observed divergence in growth patterns can be explained by the way the short-term liberal agenda of economic policy has been tackled by each country. In this sense, a rapid and sharp drop in the

[20]An immature economy is characterized by a large supply of labor in low-productivity sectors, which can be absorbed by more productive sectors as the industrialization process spreads towards them. Countries would attain the maturity phase when productiviy levels among all economic sectors become more aligned.

weight of manufacturing value added in the total economy might indicate a process of early de-industrialization if we assume that all the BRICS still present immature productive structures, in Kaldorian terms.

A further investigation in order to evaluate how immature the productive structures are is to measure the productivity gap (Figure 2). The productivity gap is constructed as the distance, in percentage terms, of the GDP per person employed in an economy relative to the economy at the technological frontier, here assumed to be the United States. The evolution of the productivity gap of the BRICS is quite revealing of the impact of changes in productive structures for each economy. The three economies with the lowest growth rates and relatively greater loss in manufacturing weight — Brazil, Russia and South Africa — were the ones with the lowest distance in terms of productivity gap in 1980. Through the 1980s, though, their distance increased relative to the US productivity level. India and China, on the other hand, followed the opposite trajectory, consistently shortening the distance in terms of the US productivity level during the whole period. Since the 2000s, Brazil's productivity continued to fall relative to the United States', in contrast to the other economies' productivity gap, which showed a decreasing movement.

Figure 2: The BRICS: the productivity gap (1980-2012)
GDP (US dollar converted at Geary Khamis PPP) per person employed as percentage of the United States'



Source: The Conference Board Total Economy Database
GGDC/University of Gronengen (https://www.conference-board.org/data/economydatabase/)
Accessed on 10 February 2015.

Therefore, the evidence presented so far has shown that, although the BRICS are economies which have already developed, to some degree, semi-complex industrial structures, according to Kaldor's theory, none of them have yet completed the industrialization process in such a way that they are able to fully exploit static and dynamic economies of scale and sustain high gains from the overall productivity and economic growth.

A clear indicator of the incomplete nature of the industrialization process is the fact that, except for China, the trade balance displays a structural deficit in more technological-intensive goods. So, the dynamism of the manufacturing sector that largely explains the growth rate of an economy can be evaluated through the trade pattern based on a taxonomy which captures not only the intensity of using each factor of production but also the main determinant of competition in international markets. Tables 2 and 3 break down the structure of the BRICS's exports and imports of manufactured goods for 2000 and 2013 into four groups: the natural resource-based group, the labor-intensive group, the scale-intensive group, and the engineering-science and knowledge-based group. Appendix 1 lists the industries that comprise each group.[21]

Table 2: BRICS's exports of manufactured goods classified according to factor and technological intensity for 2000 and 2013 (in percentage)

	Brazil	Russia	India	China	South

[21] This classification is a modified version of the taxonomy proposed by Pavitt (1984) in his seminal paper.

										Africa
	2000	2013	2000	2013	2000	2013	2000	2013	2000	2013
Natural resources-based	8.9	11.7	52.3	73.2	22.5	31.6	4.0	4.5	21.4	16.6
Labor intensive	8.7	3.5	2.5	0.7	33.3	14.0	26.8	9.3	6.0	3.6
Scale intensive	25.4	16.8	20.8	12.7	17.2	22.8	8.0	5.0	30.5	34.3
Engineering-science and knowledge-based	18.8	12.6	5.6	3.3	4.9	9.6	41.5	56.8	9.7	9.7
Total	61.8	44.6	81.2	89.9	77.9	78.0	80.3	75.6	67.6	64.2

Source: Authors' elaboration based on the United Nations/Comtrade

Table 2 shows that the share of natural resources-based manufactured goods in total exports has increased for all countries, except South Africa, in the 2000-2013 period. In the case of Brazil and Russia, this group of manufactured goods is the only one that increased its share in total manufacturing exports in the period, an indication of the evolution of the Dutch disease in these countries in the period. Among the BRICS, China showed the lowest concentration of natural resources-based goods in manufacturing exports.

Exports of labor-intensive manufactured goods have decreased in importance in all countries in the period. However, the share of scale-intensive manufactured goods increased in total exports in India and South Africa, and so did the engineering-science and knowledge-based goods in India and China.

Concerning the changes in the countries' pattern of international specialization, the Brazilian and Russian economies have displayed an increasing specialization trend in industrial commodities. India has shown a tendency towards a more diversified basket of manufactured goods exported, increasing the share of natural resources-based, scale-intensive, and engineering-science and knowledge-based goods. China is clearly becoming more specialized in exports of engineering-science and knowledge-based manufactured goods, while South Africa has shown a quite stable composition of industrial exports in the period.

Table 3: BRICS's imports of manufactured goods classified according to factor and technological intensity for 2000 and 2013 (in percentage)

	Brazil		**Russia**		**India**		**China**		**South Africa**	
	2000	**2013**	**2000**	**2013**	**2000**	**2013**	**2000**	**2013**	**2000**	**2013**
Natural resources-based	17.7	21.5	12.4	6.8	50.6	48.0	7.6	7.8	20.3	26.3
Labor-intensive	4.3	5.9	5.5	10.7	2.3	2.2	21.0	7.3	6.2	6.8
Scale-intensive	28.6	32.9	20.7	29.3	13.3	14.7	10.8	5.7	20.1	23.2
Engineering-science and knowledge-based	32.1	26.3	21.2	29.2	12.3	13.7	42.5	51.1	28.5	24.3
Total	82.7	86.6	59.8	76.0	78.5	78.6	81.9	71.9	75.1	80.6

Source: Authors' elaboration based on the United Nations-Comtrade.

On the side of manufacturing imports (Table 3), Brazil and South Africa sharply increased the share of natural resources-based goods, while the share of China remained practically unchanged. As to imports of labor-intensive manufactured goods, Brazil and Russia, which had

reduced the export share of this group, augmented their import share. Except for China, the other BRICS economies have increased the share of scale-intensive industrial goods in total manufacturing imports. Finally, only Brazil and South Africa registered a significant decline in the share of engineering-science and knowledge-based goods in total manufacturing imports. Considering that these latter imports used to be highly correlated with investment expenditure (see Appendix 1), this result reflects the lower economic dynamics of these countries during the period, compared with the other BRICS countries.

3.2 Econometric estimates of Thirlwall's law for the BRICS: which countries are catching up and which are falling behind?

As discussed in Section 2, according to Thirlwall's law (equation 1), the larger the ratio between a country's estimated income elasticity of demand for exports and its estimated elasticity of demand for imports, the faster will be its economic growth consistent with its balance of payments equilibrium. This result can be a powerful indicator of the capacity of a country to converge with (catch up with) or diverge from (fall behind) the per capita income levels of advanced economies. Since Thirlwall's (1979) seminal article was published, growth models with balance of payments constraints have been tested for several countries or group of countries with econometric time series or panel data models. Thirlwall (2011) summarizes these empirical analyses.

To proceed with the econometric estimation of the BRICS's long-term growth rates compatible with their balance of payments equilibrium, we start with the estimation of demand functions for exports and imports from a conventional multiplicative specification as follows[22]:

$$X_t = A_t\,(REER_t)^{\varphi}\,Y^*_t{}^{\varepsilon X} \qquad (3)$$

$$M_t = A_t\,(REER_t)^{\psi}\,Y_t^{\pi M} \qquad (4)$$

where A is the constant term; X is the volume of exports; *RRER* is the real effective exchange rate; Y^* is the world income; ε_X is the income elasticity of demand for exports (> 0); M is the volume of imports; Y is the domestic income (as a proxy for aggregate expenditure); φ is the price elasticity of demand for exports (> 0) [23]; ψ is the price elasticity of demand for imports (< 0); π_M is the income elasticity of demand for imports (>0); and t is a time subscript.

Taking the logarithm of the components of equations (3) and (4) and adding the constant term, we produce the following equations to be estimated (small letters mean logarithms, and countries are identified by subscript i):

$$x_{it} = a_X + \varphi\,(reer_i) + \varepsilon_X\,(y^*_i) + e_t \qquad (5)$$

$$m_{it} = a_M + \psi\,(reer_i) + \pi_M\,(y_i) + e_t \qquad (6)$$

Our aim in this section is to empirically estimate these equations for the BRICS countries. Data for all BRICS countries are only available for the period 1995-2013. Data on exports (x) and imports (m), measured in quantum, were taken from the World Economic Outlook/International Monetary Fund database; GDPs (y), expressed in constant values, were obtained from the World Development Indicators/World Bank database; the world GDP (y*), available on the World Economic Outlook/International Monetary Fund database, was obtained by subtracting the GDP of each country; and *reer* is the real effective exchange rate, obtained from the Bank for International Settlements database.[24]

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[22] This specification follows Pacheco-López and Thirlwall (2006).

[23] Since the real exchange rate (RER) is defined as the domestic currency price of a foreign currency, an increase in the real exchange rate means a depreciation in the domestic currency in real terms as well as an expectation of an augment in exports (provided that the Marshall-Lerner condition is satisfied). In contrast, a decrease in the RER means an appreciation of the domestic currency in real terms as well as an expectation of a reduction in imports.

[24] World Economic Outlook/International Monetary Fund database: http://www.imf.org/external/pubs/ft/weo/2015/01/weodata/index.aspx ; World Development Indicators/World

The Dickey-Fuller (ADF) unit root tests, as proposed by Said and Dickey (1984), showed that for all series in level we cannot reject the null hypothesis (H_0) that the series are not stationary at a 5 percent significance level (results given by the authors upon request). In addition, by performing the ADF test for the first difference of the series, the *t* statistics calculated allow rejection of the null hypothesis, indicating that the series are stationary in first difference and therefore are *I (1)* [results given by the authors upon request].

As the demand functions for exports and imports for the BRICS are non-stationary, we proceed to check for a cointegration relationship, which implies the existence of a long-term "balanced" relationship among these variables. The Johansen test (1988) is used for this purpose and is based on an autoregression vector (VAR) in which all variables are endogenously determined. The cointegration vectors can be found from two likelihood ratio tests: trace and maximum value. We take the results of the maximum value test[25], whose basic idea is to check the significance of the largest eigenvalue, comparing the null hypothesis that *r* cointegration vectors are significant, against the alternative that the number of vectors *r +1* is significant, e.g. r = 0 against *r = 1*, *r = 1* against *r = 2*, and so on. Considering the 5 percent significance level, we can reject the null hypothesis of no cointegration and accept the alternative hypothesis that the demand functions for exports and imports include a cointegration vector (results given by the authors upon request). Therefore, the Johansen test indicates a long-term stable relationship among these functions in the BRICS countries. As the variables are *I (1)* and cointegrated, we can work with them in level. Following Hamilton (1994:558), in time series with such characteristics the ordinary least square (OLS) estimator is consistent for all parameters.

The estimated price and income elasticities of demand for exports and imports for the BRICS are presented in Tables 4 and 5. Estimated coefficients for price elasticity of demand for exports were significant only for China and India, while those for price elasticity of demand for imports were significant only for Brazil, India and South Africa. In all cases, the sign of the estimated price coefficients for exports and imports were as expected, except for the price elasticity of demand for imports in South Africa. This result suggests that a depreciation of the rand tends to increase South Africa's imports, instead of decreasing them. However, as Krugman, Obstfeld and Melitz argue (2012:424), differently from exports, "imports can rise or fall when the real exchange rate rises [when the domestic currency is depreciated in real terms], so the effect of a real exchange change [on imports] is ambiguous".

The constant term and the estimated coefficients for income elasticity of demand for exports and imports were significant at 1 percent level for all BRICS countries. China has the highest coefficient for income elasticity of demand for exports (5.81), which implies that a 1 percent increase in world income increases China's exports by almost 5.8 percent. India shows the second largest coefficient (2.66), followed by Brazil (1.74) and Russia (1.08). South Africa shows an inelastic income elasticity, which means that an increase of 1 percent in world income implies a rise of only 0.64 percent in South African exports.

As for the income elasticities of demand for imports, Russia shows the largest coefficient (2.23), followed by Brazil (2.01), China (1.56) and South Africa (1.50). India showed the lowest income elasticity of demand for imports among the BRICS in the period 1995-2013.

Table 4: The BRICS: price and income elasticity of demand for exports (1995-2013)

Country	Constant (a_X)	Income elasticity of demand for exports (ε_X)	Price elasticity of demand for exports (φ)
Brazil	-2.26***	1.74***	0.30
Russia	-1.24***	1.08***	-0.06
India	-3.51***	2.66***	0.31**
China	-7.99***	5.81***	1.10***

Bank database: http://data.worldbank.org/indicator; Bank for International Settlements database: http://www.bis.org/statistics/eer/index.htm. All data accessed on March 27, 2015.

[25] Following Enders (2009), if the results of the two tests are different, the best choice is the result of the maximum value test.

South Africa	-6.39***	0.64***	-0.24

Note: *** significant at 1 percent; ** significant at 5 percent; * significant at 10 percent.
Source: Authors' elaboration based on econometric estimates.

Table 5: The BRICS: price and income elasticity of demand for imports (1995-2013)

Country	Constant (a_M)	Income elasticity of demand for imports (π_M)	Price elasticity of demand for imports (ψ)
Brazil	-2.18***	2.01***	-0.35***
Russia	-2.58***	2.23***	0.34
India	-1.50***	1.31***	-0.57*
China	-1.84***	1.56***	0.39
South Africa	-1.61***	1.50***	0.42*

Notes: *** significant at 1 percent; ** significant at 5 percent; * significant at 10 percent.
Source: Authors' elaboration based on econometric estimates.

Table 6 presents the results for the "strong" (expressed by the ratio $\frac{\varepsilon_X}{\pi_M}$, as formulated in equation 1) and "weak" (expressed by the change in exports to the π_M ratio, as shown by equation 2) versions of Thirlwall's law. The "strong" version, at first sight (column 4), clearly indicates that among the BRICS only China and India are in a catching up trajectory. Their estimated growth rates compatible with their balance of payments equilibrium are high above the world economic growth rate (around 272 percent and 103 percent, respectively, on average). Brazil, Russia and South Africa, according to this indicator, are economies falling behind, as their estimated long-term growth rate is below the average of the world growth rate. However, in order to ensure the robustness of the estimates, Thirlwall (2011) suggested following some statistical and parametric tests.

The last column in Table 6, labeled as the "weak" version of Thirlwall's law (Thirwall, 2011), gives a hint about the consistency of the estimated balance-of-payments-constrained growth rates when compared with the actual real GDP growth rates (column 2).Comparing both rates, we note that the actual and the estimated growth rates consistent with the long-term balance of payments equilibrium ("weak" version) are very close for all BRICS countries, except Russia. For India, China and South Africa the estimated "weak" version of Thirlwall's law was very close to their observed growth rate during the 1995-2013 period, and for Brazil, it was quite the same. The rank correlation between the actual and predicted growth rates of our sample is 0.989 and the difference in percentage points between the mean deviation of the actual from the predicted growth rates is 0.52, when considering all the countries, and 0.34, when excluding Russia.[26]

Table 6: BRICS's actual GDP growth, change in exports and Thirlwall's law (1995-2013)

Country (1)	Actual GDP growth (in percentage) (2)	Change in exports (X) (in percentage) (3)	ε_X / π_M Thirlwall's law ("strong" version) (4)	X / π_M Thirlwall's law ("weak" version) (5)
Brazil	3.17	6.01	0.87	2.99
Russia	3.32	4.17	0.48	1.86

[26] In Thirlwall's seminal paper (1979), the rank correlation between the actual and predicted growth rates of the countries for the 1951-1973 period was 0.891, and the mean deviation of the actual from predicted rates over a sample of 11 countries was 0.56 (Japan was excluded because, like Russia in our exercise, it showed a significant difference between both rates).

India	6.95	9.56	2.03	7.30
China	9.67	15.91	3.72	10.20
South Africa	3.13	4.23	0.43	2.82

Source: Authors' elaboration based on econometric estimates.

Following Thirlwall (2011), we run a parametric test proposed by McCombie (1989), in order to evaluate how well Thirlwall's law fits our data. To proceed with McCombie's test, we calculate the income elasticity of demand for imports (π_M*) that would make the actual GDP growth rate equal to the estimated GDP growth rate which is consistent with balance of payments equilibrium. The following step is to verify if there is a statistically significant difference between π_M* and the estimated π_M (Table 5). If not, the estimated balance of payments constrained growth rate will be a good predictor of the actual GDP growth rate.[27] The results are listed in Table 7.

Table 7: McCombie's test of Thirlwall's law

Country	Estimated income elasticity of demand for imports π_M	Standard error	Implied income elasticity of demand for imports π_M*	Test result
Brazil	2.01	0.10	1.90	1.10**
China	1.56	0.11	1.65	0.82**
India	1.31	0.07	1.38	1.00**
Russia	2.23	0.17	1.26	5.71
South Africa	1.50	0.11	1.35	1.36**

Notes: The test is the absolute value of the *t*-statistics based on the null hypothesis that π_M is equal to π_M*.
* * Indicates that π_M* is not statistically different from π_M.
Source: Authors' estimations.

As we can see in Table 7, Brazil's, China's, India's and South Africa's predicted growth rates did not statistically differ from their actual growth rates. This means that, except for Russia, our estimated balance of payments constrained growth rates performed very well for explaining the BRICS's long-term economic growth. Therefore, as Table 6 illustrates, among the BRICS, China and India are the only countries that show an estimated growth rate compatible with its long-term balance of payments equilibrium much above the world economic growth rate in the 1995-2013 period. Since our estimated growth rate for Russia was not a good predictor of its actual growth rate, we cannot confirm whether Russia is falling behind. However, Brazil and South Africa show semi-stagnant and stagnant long-term economic performances, respectively, with an estimated balance-of-payments-constrained growth rate below (87 percent in the case of Brazil) or far below (only 43 percent in the case of South Africa) the world growth rate between 1995 and 2013, suggesting that these economies, albeit at different paces, have entered into a falling-behind pat

4. Concluding remarks

The acronym BRICS was created in the early 2000s to identify those economies with potential capacity to show accelerated growth in the next 40 years relative to the advanced economies. Our study showed, however, that, not all BRICS economies have fulfilled that expectation. In the theoretical discussion, we concluded that the main challenge to developing countries is to find a balance between the static gains from the trade liberalization of their economies and the risks of dynamic losses, in terms of low long-term economic growth rates,

[27] An empirical application of this test can also be found in Hussain (1999).

associated with the fact that free markets are not able to provide the best "Schumpeterian" (or, in some sense, "Kaldorian") allocation of resources towards the most dynamic industries in international markets. In other words, whatever each country produces, exports and imports matter in explaining its structural change and long-term economic growth rate.

The analysis of the evolution of the BRICS economies between 1980 and 2013 has revealed sharp differences in their long-term structural change and economic growth performance. In fact, we observed that Brazil, Russia and South Africa, which have all adopted quick liberalizing reforms from the 1990s on, have shown the lowest annual average growth rates, the greatest losses in the share of manufacturing in total output and have not been able to narrow the productivity gap during the period. Conversely, China, which has adopted a strong state interventionist strategy since the 1990s, and India, which has implemented moderate and cautious liberalizing reforms over the 1990s and 2000s, have been able to consistently reduce their productivity gap throughout the period.

To conclude our empirical discussion, we presented the econometric estimates of the BRICS's long-term growth rates corresponding to their balance of payments equilibrium, according to Thirlwall's law. Our results show that, among the BRICS, only China and India have shown balance-of-payments-constrained long-term growth rates above world economic growth. Our estimates confirm that these Asian countries have been two of the most dynamic economies in the global economy and have maintained a rapid catching up path in the last few decades. In contrast, Brazil and South Africa, by having shown estimated balance-of-payments-constrained long-term growth rates below the world economic growth rate, have entered into a falling behind path. Since our estimated growth rate for Russia was not a good predictor of its actual growth rate, we cannot confirm that this country has, in fact, shown a falling behind trajectory.

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Appendix 1: Manufacturing sector classified according to factor and technological intensity

NATURAL RESOURCES-BASED	LABOR INTENSIVE	SCALE INTENSIVE	ENGINEERING-SCIENCE AND KNOWLEDGE-BASED
Mineral extraction	Textile products	Chemicals	Machines and equipment
Oil and Alcohol	Manufacture of clothing items and accessories	Rubber and plastic	Machinery, equipment and electrical material
Food Products	Preparation of leather and its artifacts and footwear	Metallurgy	Computer equipment, electronic and optical products
Beverage	Metal products	Motor vehicle and parts	Other transport equipment
Wood Products	Furniture and other industries		
Pulp, paper and paper products			
Non-metallic mineral products			