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Structural change, catching up and falling behind in the BRICS: A comparative analysis based on trade patterns and Thirlwall's law

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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 (Wilson, Puroshothaman, 2003) that aimed to estimate long-term economic growth rates for those countries until 2050. The 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. This central conclusion was so appealing that the acronym BRICS became better known in global markets than the acronyms of several actual regional economic agreements such as ALADI (Latin American Integration Association), CARICOM (the Caribbean Community) and ASEAN (Association of South East Asian Nations).

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. One can say that the creation 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 100 billion US$ 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 BRICS has, in fact,

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become more than just an acronym. Therefore, notwithstanding their historical, economic and cultural differences, their increasing political and economic influence justifies a comparative study on their economic performance over 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 concordant 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.[3] Although both contemporary neoclassical and heterodox economists assert that technological progress is one of the main engines of long-term growth in capitalist economies, they have

[1] As O'Boyle, 2014, p. 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 Marx, 1887, institutions North, 1990, or even stable long-term expectations and investment to GDP ratios Keynes, 1936, especially chs. 11 and 12. However, technological progress is one of the most important factors to accelerate labour productivity, generate structural change and sustain economic development.

[3] 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). A theoretical treatment of normative implications is carefully analysed by Corden, 1974. The political economy of the role of state in accelerating technological progress and economic development is discussed by Dosi et al., 1990, especially ch. 8.

different ways of conceptualizing technology itself. For the former group of economists, technology is understood as a non-rival good and is taken as synonymous of stock of accumulated knowledge.[4] For heterodox economists, it is neither a free nor a universal good and has distinctive characteristics such as path-dependence and lock-in.[5] The main normative implication of this theoretical divergence is that, on the one hand, neoclassical economists emphasize deregulation and free trade policies in providing sine qua non conditions for accelerating technological progress and long-term economic growth. Heterodox economists, on the other hand, emphasize the role of the state in creating policy instruments to influence private markets' decisions and short- and long-term economic performance, and the role of institutions in promoting structural change and technological progress.[6]

Based on preliminary evidence dating back to 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 prioritized 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 distanced itself from laissez-faire or even from unconditional free trade policies. It is hard to regard the Chinese economy as a totally capitalist economy or a market economy, given the severe control over all markets (goods, money and exchange rate markets) by the government (Artus et al., 2012; Inter-American Development Bank, 2004). 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 that 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

[4] See for instance Romer, 1986, 1990.
[5] See Nelson, Winter, 1982; Arthur, 1989; and David, 1985.
[6] See Cimoli et al.. 2009, ch. 2, even though one of the authors (Joseph Stiglitz) of this essay cannot be classified as heterodox but rather as, in Lavoie's words, a "dissenter" within orthodox economics (Lavoie, 2011, pp. 9-10).

free operations by multinational firms. Note that protection here does not necessarily mean non-tariff and tariff barriers against imports, but other ways of protecting China's domestic markets. Non-tariff barriers were eliminated and tariff imports sharply reduced in the mid-1990s. Although since then Chinese governments have been relaxing the previous prohibition against multinational enterprises establishing plants to sell in the Chinese 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, or joint-ventures with state-owned enterprises (Artus et al., 2012; Inter-American Development Bank, 2004; Cesarin, 2005; Feenstra, 1998). 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, along with a 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.[7]

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.[8] 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 faced by Chinese governments in sustaining long-term growth and pursuing a catching up strategy are

[7] 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 (by 5% on average) from 1994 to 2008. However, from the 2008 global economic crisis to 2011, the renminbi has remained overvalued by 5% (on average) in real effective terms (Artus et al., 2012, p. 34), although Artus et al., 2012, 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% by February 2016 in relation to 2010 (monthly averages). See http://www.bis.org/statistics/eer.htm (last accessed on March 29, 2016).

[8] See List, 1841 and, for further discussion, Gomes, 1987.

not few: i) they need to overcome the excess of capacity in many manufacturing industries;[9] ii) since the relative share of gross investment and exports as main growth drivers is being reduced, they have to learn how to give household consumption a more pronounced role in economic dynamics without seriously jeopardizing Chinese long-term growth;[10] 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.[11]

India, on the other hand, introduced liberalizing reforms in the early 1990s. These reforms were adopted in a much more cautious way with respect to 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 for those directed to private and governmental bonds (Patnaik, Shah, 2012; Subbarao, 2014); moreover, industrial policy (characterized by horizontal and selective instruments involving import tariffs, subsidies, and public credit among other things) 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

[9] See Yongding, 2009.

[10] As to the debate on the outlook of China's long-term growth, Pettis, 2013, has been one of the authors to emphasize most that, in virtue of the fact that 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 decrease of China's real GDP growth to 3% (or less) per year in the next decades. Yet Yongding, 2009, and Lardy, 2015, 2012, despite recognizing these imbalances, assure that China, by still having a much smaller capital-output ratio than several developed countries, will be able to smoothly transition to a new economic model driven by household consumption and heavy investments in the infrastructure sector. For these authors, China's real GDP growth could be sustained at around 6% or 7% in the next decade.

[11] See, for instance, Yongding, 2009, who also stresses this specific challenge for Chinese policy-makers.

controls, the Reserve Bank of India has preserved the stability of the real exchange rate and avoided overvaluation in real terms of India's currency (Subbarao, 2014; Subramanian, 2010).

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. One can say that in these economies, quite differently from India, liberalizing reforms were introduced as a "shock therapy" (Lin, Chang, 2009). In addition, while India has never renounced the continuity of explicit industrial and technological policies ("the Five-Year 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 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 tended to be 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.[12]

These different national strategies suggest that the way each country engages in international trade and global capital flows affects, either positively or negatively, its promotion of structural change and its catch-up strategy.

[12] 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 provide a quick panoramic view in these paragraphs. For more details see, among others, Nassif, 2000, for a comparison between economic liberalizing reforms in Brazil and India; Nassif et al., 2011; 2015, for Brazil; Gaidar Report, 2014, for Russia; and Faulkner et al., 2013 for South Africa. For a wide comparative analysis, see also Amsden, 2001; Nadkarni, Noonan, 2013; Nassif et al., 2016; Popov, 2014.

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

It is commonplace to take the evolution of per capita income as the standard indicator of the pace of a country's catching-up process over time. The investigation is mainly concerned with identifying the economic forces that could explain the rapid and sustainable growth of per capita income necessary for the country to catch up. A relative consensus has emerged that, all else being equal, the creation and diffusion of innovation and technological progress is the main engine that promotes structural change and economic development. However, the forces responsible for facilitating the creation and diffusion of innovation and technological progress represent the main point of disagreement among economists.

The theoretical approaches to this issue can be divided broadly into two. The first one, which we call the 'liberal' approach,[13] follows the neoclassical paradigm and is based on the belief that market forces are, apart from a few exceptions, sufficient to provide the best allocation of resources in the economic system, and so to boost and diffuse technological progress as well as accelerate long-term growth. According to this approach, economic development results from the efficiency with which resources are combined in the economy as a whole. The second one, which we label the 'developmental' approach or 'national strategic' approach, follows an heterodox paradigm, and challenges the assumption that market forces are strong enough on their own to provide the best economic efficiency both in static and dynamic terms.

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

2.1 The liberal versus the developmental approach: the positive debate

The liberal approach has been elaborated, along 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 the necessary Ricardian conditions for countries to trade in the global economy unchanged (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 lower relative costs and prices (explained, in turn, by the intensive use of the factor considered abundant in each of them)[14], the adoption of free trade strategies allows 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 best strategy to provide both countries with static benefits, fits well in the Walrasian general equilibrium model and fulfils the conditions for reaching maximum social well-being in the Pareto sense. 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 that gave support to the idea of not considering the kind of product traded

[14] The Ricardian sources of comparative advantage (inter-sectoral differences in relative productivity and technologies) were confirmed by several empirical tests (see Balassa, 1963; MacDougall, 1951). 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, Soete, 1988, pp. 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.

in international markets relevant. In fact, if free trade promotes the equalization of all relative prices of goods and factors, it does not matter whether a country produces and exports 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 using the canonical H-O-S model as the basis for determining a country's net trade pattern (i.e. exports minus imports). Thus, 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 at decreasing prices.[15]

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. One strand, though, of the new trade theory has emphasized the dynamic impacts of trade flows on long-term growth (Grossman, Helpman, 1991). In general terms, a country can

[15] Graham, 1923, 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 et al., 2012, pp. 145-148, too 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" (*ibid*., p. 148).

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 is 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, Helpman, 1991, pp. 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 explore. Prebish, 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, which is higher for manufactured products, especially the more technologically sophisticated ones, than for traditional goods, especially the primary ones. Based on his centre-periphery model, Prebisch 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] 2011a. According to Prebisch's theory, since goods in which "peripheral" countries are specialized have lower income elasticity of demand than those in which "centre" 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, 2011b, recently recognized, Thirlwall's law (Thirlwall, [1979] 2011a) is strongly based on Prebish's, 1950, critique. Thirlwall's law is generally expressed as:

$$\frac{\dot{Y}}{\dot{Z}} = \frac{\varepsilon_X}{\pi_M} \quad (1)$$

where $\dot{Y}$ is the rate of economic growth in the domestic country; $\dot{Z}$ 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.[16] Thirlwall's law can be used as an indicator to evaluate whether a country has been catching up or falling behind over a long period of time (Nassif et al., 2015a). 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:

$$\frac{\dot{Y}}{\dot{Z}} = \frac{X}{\pi_M} \quad (2)$$

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.[17] As Thirlwall, 2011b, pp. 317-318, argues, in this case, "[actual] export growth (X) must also include the effect of relative price changes as well as the effect of world income growth which weakens somewhat the argument that the balance of payments is always brought into equilibrium by domestic income changes". He

[16] Thirlwall's law is derived from a current account equilibrium equation and conventional export and import demand functions. As this law is widely known in the structuralist literature on economic development, we did not replicate the demonstration of the result represented by equation (1), which can be found in Thirlwall, 2011b, pp. 316-317.

[17] Equation (2) is derived from the substitution of the variable x (the actual export growth) for the estimated ε_X in the numerator of equation (1). In this case, equation (2) considers that relative prices change over time.

adds "the model is best tested, therefore, using the 'strong' version if robust estimates can be made of ε_x" (*ibid.*).[18]

Prebisch was not the first author to challenge the theories of comparative advantage in the history of economic thought.[19] The developmental tradition started with Hamilton, 1791, and List, 1841, was further developed by Posner, 1961, and has later been modelled by post-Schumpeterian authors such as Dosi et al., 1990. In their book, Dosi et al., 1990, point out that the Ricardian and H-O-S 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 would not only represent a reallocation of resources towards sectors in which each of them has comparative advantage, but would also provide each country with greater aggregate consumption than would have been possible under autarkic conditions. In fewer words, gains from trade are static and definite.

Dosi et al., 1989, on the other hand, argue that since the opportunities for technological change are differentiated depending on the goods and sectors, an allocation of resources oriented to free markets and relative prices, though 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-

[18] 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.

[19] 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.

Rodan, 1943; Schumpeter, 1943; Hirschman, 1958; Posner, 1961; Kaldor, 1966; and Nelson, 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.[20]

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 pioneered in calling attention to the damage a developing country still suffers by embarking on a premature de-industrialization in the process of catching up.

In short, developmental strategies depart from both the theoretical and normative implications related to the liberal approach based on comparative advantage, as its proponents reject the general equilibrium paradigm and work on important effects that international and inter-sectoral adjustments have on macroeconomic activities. According to Dosi et al., 1990, pp. 26-27, the growth of each economy is often constrained by the balance of payment, and this constraint becomes tighter or looser according to the levels and forms of the participation of each country in world trade flows.

[20] 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 in 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 matters, in the sense that since innovative activities are non-ergodic and cumulative ("path dependence"), the more technologically advanced firms, industries and countries are, the greater is their potential to introduce successful innovation in new methods of production and new goods. Finally, the potential for spillovers 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.

2.2 The normative debate

A panoramic discussion of the 'normative' economics (i.e. the best short-term and long-term economic policies) related to the liberal versus the developmental approach debate seems necessary at this point. The proponents of the liberal approach, as we anticipated earlier, 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. However, they always stress the difficulty of correctly identifying market failures, so governmental intervention can aggravate the original flaw, creating a "government failure".[21] Thus, liberal economists reject government 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, or the subsidization of research and development (R&D).[22]

More recently, even some economists who favour a more pro-active industrial policy have analysed it within the market failure framework. Hausmann, Rodrik, 2003, 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 single countries 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

[21] For details, see Corden, 1974, p. 13.

[22] It is important to note that some governmental stimuli characterized as "horizontal" by liberal economists can benefit some sectors to the detriment of others. For instance, if a railroad is constructed for transporting iron ore from the state of Minas Gerais to the state of Espírito Santo, Brazil, they will primary benefit enterprises located close to the railroad rather than those located elsewhere.

services or in productive processes (or, in the authors' words, in discovering new processes, goods and activities). They 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." (*ibid*., p. 5, emphasis in the original).

In this context, the role of the government in developing countries is to help potential innovators discover new processes, goods and activities that have 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, Rodrik, 2003, recommend public credit (provided by development banks, for example) to potential innovators. The authors rightly come to the conclusion 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. 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 have 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 and, 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.[23] 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 (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. Since goods and sectors have different long-term income elasticity of demand, economic theory clearly supports a combination of selective ("vertical") and horizontal instruments of industrial and technological policy that aim to change the productive structure of a developing economy, 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.[24] As most dynamic industries

[23] 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).

[24] We are aware that some of these policy instruments are constrained by multilateral agreements under the World Trade Organisation WTO, 2002. This means that these instruments should be used without violating these multilateral agreements. For example Ocampo et al., 2009, ch. 9, advocate credit policies by developmental banks

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 in terms of avoiding 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).[25] They could be summarized as follows: *i*) the levels of protection must be moderate or low; high levels of protection such as in the case of Latin American countries in the import substitution period (especially during the 1970s and 1980s) should 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 should 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 policy; *iv*) public incentives (import tariffs, subsidies, public credit, and so on) must be temporary in order to avoid corruption and rent-seeking unproductive activities; *v*) governments must be "strict", in the sense that they must require a good economic performance from private entrepreneurs who benefit

as a powerful instrument that is still not constrained by multilateral trade agreements, to promote structural change and reduce the technological gap.

[25] See especially Alice Amsden's, 1989, masterful work. By comparing the Korean labour productivity growth with the Japanese and US labour productivity growth, Guarini et al., 2007, confirm that South Korea continued to sustain a sound process of catching up after the mid-1980s.

from public incentives over time (in terms of reducing the technological gap, increasing labour 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 *vii*) last but not least, there must be a fine coordination between long-term industrial and technological policies and short-term macroeconomic policies (especially monetary, fiscal and exchange rate policies).[26]

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.[27] The capacity of policy-makers to maintain the latter three macroeconomic variables around those levels is a *sine qua non* condition for reducing the opportunity cost of investment in both productive and innovation projects and, therefore, increasing 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 variables are not in the right place. Strictly speaking, of those three variables, the real exchange rate is the most important for a developing country to continue its catching-up trajectory, in virtue of its direct or indirect impact on several other

[26] All these lessons are confirmed by several empirical and case studies on these countries' experiences, such as Amsden, 1989, 2001; Rodrik, 1995, 2008; and Nayyar, 2011, among others.

[27] 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 Nassif et al., 2011; 2015a, a domestic currency that is 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, 2009; and Berg, Miao, 2010.

microeconomic and macroeconomic variables. As Bresser-Pereira et al., 2014, pointed out:

> "imports, exports, the investment rate, the saving rate, and inflation depend [… 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]" (*ibid*., pp. 10-11).

In developing countries, there have been two forces contributing to the cyclical tendency of domestic currencies to appreciate: the first, a structural force, is the "Dutch disease", which severely affects some of the BRICS's larger exporters of commodities, namely Brazil, Russia and South Africa. The Dutch disease in these countries is aggravated at times during which a boom in commodity prices (such as the one that occurred in the 2000s) gives rise to the proliferation of Ricardian rents, increases the relative prices of non-tradable goods and, therefore, fosters a tendency for the domestic currency to appreciate in real terms.[28] The second one is predominantly a financial force that acts in countries with a very open external capital account. In phases during which global financial markets are liquid, excessive net capital inflows can move towards countries whose policy-makers have chosen to sustain economic growth with foreign savings, thus contributing to the appreciation of the domestic currency in real

[28] Flood, Rose, 1995, show that, since nominal exchange rates are highly volatile over short periods of time and nominal prices are rigid, there is evidence that nominal and real exchange rates are correlated almost one to one in the short term.

terms.[29] Considering that the overvaluation trend jeopardizes long-term growth, a government has a set of useful policy instruments to prevent this from happening. While the effect of the Dutch disease on the cyclical trend of currency appreciation can be neutralized by an income tax on the Ricardian rents generated by commodity exports,[30] the impact of excessive net capital inflows on currency appreciation can be avoided with a mix of policy instruments, such as sterilized purchases of international reserves in the spot exchange market, other foreign exchange interventions and ad hoc capital controls.[31]

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 the 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.[32] 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

[29] In some sense, this second force can also be understood as structural because the strategy of growth with foreign savings, although not sustainable in the long term, is the government's choice of a particular country.

[30] This is Bresser-Pereira et al.'s, 2014, suggestion.

[31] Blanchard et al., 2015, p. 2, show that "foreign exchange intervention leads to less exchange rate appreciation in response to gross inflows". Ostry et al.'s, 2011, p. 15, suggest that capital controls can be "a legitimate part of the toolkit to manage capital inflows in certain circumstances".

[32] See, for instance, Cimoli et al., 2009, p. 6, table 1.1, who compare different strategies (and therefore different performances) in the East Asian and Latin American countries in the 1980s and 1990s.

rent-seeking) can be changed by policy over time.[33] 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 the 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 what are known as 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, 2012, p. 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, 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". Here Palma makes a shrewd reference to Keynes' position against Ricardo's claims in relation to Say's law.

Thus, we assume that differences in the way economic policies have been followed in the BRICS under the neoliberal agenda (especially those concerning how to engage in international trade and capital flows) greatly explain their different long-term economic

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

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.

The following section, subsequently, has two main goals: i) to evaluate the BRICS's long-term growth economic performance as well as their trade pattern, through a comparative perspective, and ii) to identify which of the BRICS countries have embarked on a catching-up trajectory and which have taken a path that is causing them to fall behind, based on an econometric estimation of the long-term elasticity of demand for exports and imports and Thirlwall's law.

3.1 BRICS's long-term growth performance indicators

As is well-known, 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% per year, which dropped to 2.8% in the 1980-2013 period. Among the BRICS, the Brazilian economy decelerated the most, its growth rate decreasing from 6.9% per year to 2.4%, followed by South Africa, which saw its growth rate reduced by half – from 4.5% to 2.3%. Both performed below the world average in the 1980-2013 period. The Russian economy, for which no data are available before 1980, exhibits the worst results, its growth rate 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% per year) to an average growth rate well above the world growth rate in the 1980-2013 period (6.2%).

Finally, the Chinese economy was the most successful, consistently growing at a rate above that of the world economy in all the periods.

One explanation for the differences in growth dynamics among the BRICS can be found in Kaldor's writings (Kaldor, 1970, 1966), in which he argues that the manufacturing sector, with a strong

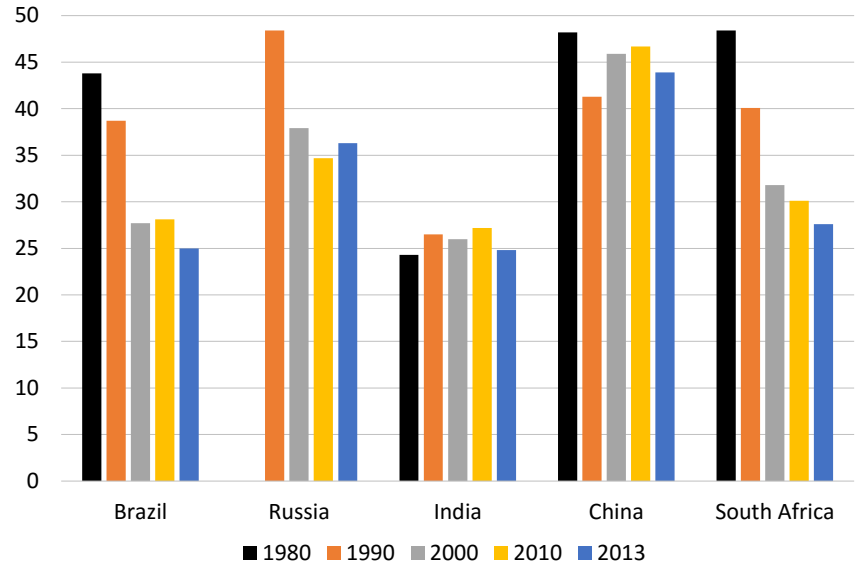
presence of static and dynamic economies of scale, is the "engine of growth". From this perspective, differences in growth performance are related to, among other things, the productive structure of the economies. Figure 1 shows how the share in aggregate value added in the economy from manufacturing has been changing among the BRICS between 1980 and 2013. Except for India, which kept 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 the total value added. Brazil, Russia (since 1990) and South Africa experienced 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 favourable terms of trade. In the cases of Brazil and South Africa, this latter factor, associated with sharp net capital inflows, contributed to a significant overvaluation of the domestic currency in real terms over the second half of the 2000s (Nassif et al., 2011, 2015, for the case of Brazil; and Arezki et al., 2012, for the case of South Africa).

Table 1 – *Average real GDP growth rate (%): the BRICS and the world economy, selected periods*

	World	Brazil	Russia	India	China	South Africa
1961-1979	4.8	6.9	n.a.	3.4	5.7	4.5
1980-1989	3	2.2	2.2	5.6	7.8	1.7
1990-1999	2.7	1.7	-5.2	5.8	6.8	1.3
2000-2009	3.1	3.2	5.4	7.2	11.4	3.6
2010-2013	1.7	3.1	3.4	6.2	8.7	3
1980-2013	*2.8*	*2.4*	*1*	*6.2*	*8.7*	*2.3*

n.a.: not available.
Source: The World Bank, *World Development Indicators*, for world estimates (GDP at 2005 US dollars), and database of University of Gronengen, *Groningen Growth and Development Centre (GGDC)* database for the BRICSs estimates (GDP at 1990 US dollars converted at Geary Khamis PPPs), available at https://www.conference-board.org/data/economydatabase/ (last accessed on 8 February 2015).

Figure 1 – *The BRICS: share of the manufacturing sector in total value added (%), selected years*



Note: manufacturing sector includes mineral extraction.
Source: the World Bank, *World Development Indicators,* available at http://data.worldbank.org/indicator.

The argument in favour of manufacturing as the engine of growth also calls attention to the evolution of the productive structure from an 'immature' to a 'mature' one.[34] 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, which enables domestic producers to compete in foreign markets. Therefore, in a Kaldorian analytical perspective, the growth trajectory of an

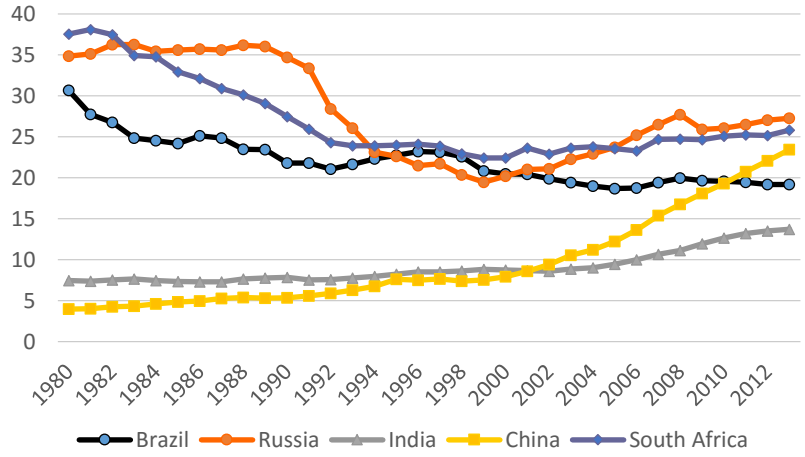
[34] An immature economy is characterized by a large supply of labour in low-productivity sectors, which can be absorbed by more productive sectors as the industrialization process expands. Countries would attain the maturity phase when productivity levels among all economic sectors become aligned.

immature economy greatly depends on the space dedicated to the implementation of long-term developmental policies. In the case of the BRICS, most of the observed divergence in growth patterns can be explained by the way each country has tackled the short-term liberal agenda of economic policy. In this sense, a rapid and sharp drop in the weight of manufacturing value added in the total economy might indicate a process of early de-industrialization, under the assumption that all the BRICS still present immature productive structures, in Kaldorian terms.

A method to evaluate the maturity (or immaturity) of the productive structures is to measure the productivity gap (figure 2). This is constructed as the distance, in terms of percentage, between the GDP per person employed in an economy relative to the economy at the technological frontier, here assumed to be the United States of America. 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 productivity gap in 1980. Through the 1980s, though, their gap relative to the US productivity level increased. India and China, on the other hand, followed the opposite trajectory, consistently shortening during the whole period the distance in terms of productivity from the US level. Since the 2000s, Brazil's productivity continued to fall with respect to the United States', in contrast to the other economies' productivity gap, which exhibited a decrease.

Therefore, although the BRICS are economies that 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 productivity and economic growth. A clear indicator of the

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



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

incomplete nature of the industrialization process is the fact that, except for China, the trade balance displays a structural deficit in the more technology-intensive goods. 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: a natural resource-based group, a labour-intensive group, a scale-intensive group, and an engineering-science and knowledge-based group. Appendix 1 lists the industries that comprise each group.[35]

Table 2 shows that the share of natural resource-based manufactured goods in total exports has increased for all countries,

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

Table 2 – *BRICS's exports of manufactured goods classified according to factor and technological intensity for 2000 and 2013 (%)*

	Brazil		Russia		India		China		South Africa	
	2000	2013	2000	2013	2000	2013	2000	2013	2000	2013
Natural resource-based	8.9	11.7	52.3	73.2	22.5	31.6	4.0	4.5	21.4	16.6
Labour 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*.

except South Africa, in the 2000-2013 period. In the cases 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. Among the BRICS, China exhibits the lowest concentration of natural resource-based goods in manufacturing exports. Exports of labour-intensive manufactured goods have decreased in importance in all countries in the period. The share of scale-intensive manufactured goods in total exports in India and South Africa increased, and so did the engineering-science and knowledge-based goods in India and China.

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

On the side of manufacturing imports (table 3), Brazil and South Africa sharply increased the share of natural resources-based goods, while China's share remained practically unchanged. As to imports of labour-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 weaker economic dynamics of these countries during the period, compared with the other BRICS countries.

Table 3 – *BRICS's imports of manufactured goods classified according to factor and technological intensity for 2000 and 2013 (%)*

	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
Labour-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*.

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] 2011a, seminal article was published, growth models with balance of payments constraints have been tested for several countries or groups of countries with econometric time series or panel data models. Thirlwall, 2011b, summarizes these empirical analyses. In order to proceed with the econometric estimation of the BRICS's long-term growth rates, which would be 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:[36]

$$X_t = A_t(REER_t)^{\varphi} Z_t^{\varepsilon_X} \quad (3)$$

$$M_t = A_t(REER_t)^{\psi} Y_t^{\pi_M} \quad (4)$$

Where X is the volume of exports; A is a constant term; $REER$ is the real effective exchange rate; φ is the price elasticity of demand for exports (> 0);[37] Z is the world income (as a proxy for world aggregate expenditure); ε_X is the income elasticity of demand for exports (> 0); M is the volume of imports; ψ is the price elasticity of demand for imports (< 0); Y is the domestic income (as a proxy for domestic

[36] This specification follows Pacheco-López, Thirlwall, 2006.

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

aggregate expenditure); 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), we produce the following equations to be estimated (where lower case letters mean logarithms, e is an error term, and countries are identified by subscript i):

$$x_{it} = a_X + \varphi \cdot reer_{it} + \varepsilon_X \cdot z_{it} + e_{it} \quad (5)$$

$$m_{it} = a_M + \psi \cdot reer_{it} + \pi_M \cdot y_{it} + e_{it} \quad (6)$$

Our aim is to empirically estimate these equations for the BRICS countries. Yearly data for all BRICS countries are only available for the period 1995-2013. Data on exports (x) and imports (m), measured in real terms, were taken from the *World Economic Outlook* database of the International Monetary Fund; GDPs (y), expressed in constant values, were obtained from the *World Development Indicators* database of the World Bank; the world GDP (z), available on the *World Economic Outlook* database, was obtained by subtracting the GDP of each BRICS country; and *reer* is the real effective exchange rate, obtained from the Bank for International Settlements database. Augmented Dickey-Fuller (ADF) unit root tests show that for all series we cannot reject the null hypothesis (H_0) that the series are not stationary at a 5% significance level. As shown in appendix 2, by performing ADF tests on the first differences of the series, the calculated t statistics allow rejection of the null hypothesis, indicating that the series are stationary in first difference and therefore are $I(1)$. Next, we proceed to check for a co-integration relationship, which implies the existence of a long-term 'balanced' relationship among these variables.[38] As it turns out, the variables are $I(1)$ and co-

[38] The Johansen test is used for this purpose and is based on a vector auto-regression model (VAR) in which all variables are endogenously determined. The co-integration vectors can be found from two likelihood ratio tests: trace and maximum value. Following Enders, 2009, if the results of these two tests are different, the best choice is the result of the maximum value test. Thus, we took the results of the maximum value test, whose basic idea is to check the significance of the largest eigenvalue, comparing the null hypothesis that r co-integration vectors are statistically significant,

integrated, so we can work with them in level and the ordinary least square (OLS) is consistent for all parameters (see Hamilton, 1994, p. 558).

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 the price elasticity of demand for exports were statistically significant only for China and India, while those for the price elasticity of demand for imports were significant 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 et al., 2012, p. 424, argue, 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 the income elasticity of demand for exports and imports were significant at a 1% significance level for all BRICS countries. China has the highest coefficient of income elasticity of demand for exports (5.81), which implies that a 1% increase in world income increases China's exports by 5.8%. 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% in world income implies a rise of only 0.64% 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 (1.5).

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% significance level, we can reject the null hypothesis of no co-integration and accept the alternative hypothesis that the demand functions for exports and imports include a co-integration vector (see appendix 2). Therefore, the Johansen test indicates a long-term stable relationship among these functions in the BRICS countries.

Finally, India exhibits the lowest income elasticity of demand for imports among the BRICS in the period 1995-2013.

Table 4 – *The BRICS: price and income elasticities 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***
South Africa	-6.39***	0.64***	-0.24

*** significant at 1%; ** significant at 5%; * significant at 10%.
Sources: International Monetary Fund, *World Economic Outlook* database, available at http://www.imf.org/external/pubs/ft/weo/2015/01/weodata/index.aspx; World Bank, *World Development Indicators* database, available at http://data.worldbank.org/indicator; Bank for International Settlements database, available at http://www.bis.org/statistics/eer/index.htm. All data accessed on 27 March 2015.

Table 5 – *The BRICS: price and income elasticities 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*

*** significant at 1%; ** significant at 5%; * significant at 10%.
Sources: see notes to table 4.

Table 6 presents the results for the strong (expressed by the ratio ε_X/π_M, as formulated in equation 1) and weak (expressed by the change in the X/π_M ratio, as shown by equation 2) versions of Thirlwall's law. At first sight (column 4), the strong version 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 GDP growth rate (by around 272% and 103%, respectively, on average). Brazil's, Russia's and South Africa's economies, according to this indicator, are falling behind, as their estimated long-term growth rate compatible with balance of payments equilibrium is below the average of the world growth rate. However, in order to ensure the robustness of the estimates Thirlwall, 2011b, suggests applying further statistical and parametric tests.

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

Country (1)	GDP growth, % (2)	Change in exports, % (3)	ε_X/π_M Thirlwall's law (4)	X/π_M Thirlwall's law (5)
Brazil	3.17	6.01	0.87	2.99
Russia	3.32	4.17	0.48	1.86
India	6.95	9.56	2.03	7.3
China	9.67	15.91	3.72	10.2
South Africa	3.13	4.23	0.43	2.82

The last column in table 6, labelled as the weak version of Thirlwall's law, 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 are very close for all BRICS

countries, except Russia. For India, China and South Africa the estimated weak version of Thirlwall's law is 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 in 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.[39]

Following Thirlwall, 2011b, 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 that is consistent with the 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 (reported in table 5). If not, the estimated balance of payments constrained growth rate will be a good predictor of the actual GDP growth rate.[40] The results are reported in table 7.

As can be seen in table 7, Brazil's, China's, India's and South Africa's predicted growth rates do not statistically differ from their actual growth rates. This means that, except for Russia, the estimated balance of payments constrained growth rates performed very well in 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

[39] In Thirlwall's, [1979] 2011b, seminal paper, 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 the two rates).

[40] An empirical application of this test can also be found in Hussain, 1999.

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	0.1	1.9	1.1★
China	1.56	0.11	1.65	0.82★
India	1.31	0.07	1.38	1★
Russia	2.23	0.17	1.26	5.71
South Afric	1.5	0.11	1.35	1.36★

Notes: The test is the absolute value of the *t*-statistics based on the null hypothesis that $\pi_M^* = \pi_M$.
★ Indicates that π_M^* is not statistically different from π_M.

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% in the case of Brazil) or far below (only 43% in the case of South Africa) the world growth rate between 1995 and 2013. This suggests that the two economies, albeit at different paces, have taken a path that is causing them to fall behind.

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, given their demographic and economic characteristics. Our study showed, however, that, considering the economic performance observed so far, not all BRICS economies have fulfilled that expectation.

In the theoretical discussion we reviewed the 'liberal' and the 'developmental' approaches. We concluded that the main challenge to developing countries is to find a balance between the static gains from the liberalization of their economies (especially trade) – as strongly emphasized by 'liberal' economists – and the risks of dynamic losses, in terms of low long-term economic growth rates, 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 – as emphasized by 'developmental' economists. 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. According to our basic assumption, the way in which each country engages in international trade and global capital flows affects, either positively or negatively, the promotion of structural change and their catching-up trajectory. In fact, taking the evolution of the productivity gap, for instance, 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.

Changes in the trade balance also show striking differences as to the way each BRICS country has engaged in international trade as well as their ability to promote structural transformation. Brazilian manufactured exports relative to total exports, for instance, decreased from 61.8% in 2000 to 44.6% in 2013, indicating a reprimarization of the exports basket. In the case of Russia, the reprimarization of industrial exports was much more remarkable: exports of natural

resources-based products increased from 52.3% in 2000 to 73.2% in 2013. India has shown a stable share of manufactured exports and imports in total trade between 2000 and 2013, and China's industrial exports as a share of total exports has decreased from 80.3% to 75.6% in the same period. However, the share of engineering-science and knowledge-based industrial exports increased in China from 41.5% to 56.8% and industrial imports relative to total imports decreased by 10 percentage points, from 81.9% in 2000 to 71.9% in 2013. Similarly to Brazil, South Africa has shown a loss in the share of industrial exports and an increase in the share of manufacturing imports, suggesting that the country has deepened an international specialization pattern in primary products.

To conclude our empirical discussion, we presented 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 course that has allowed them to rapidly catch up 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 course that is causing them to fall behind. 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 tendency to fall behind.

According to our theoretical discussion, the results for China and India can be seen as a consequence of their greater ability to apply industrial policy instruments that were consistently coordinated with short-term economic policy over the last three decades. This ability has increased their potential capacity to promote structural change and economic development. Brazil, Russia and South Africa, in turn, for different reasons and to different degrees, opened their economies at a faster pace, dismantling old institutions established to promote

industrialization and economic development. The reduction of protectionist measures was justified as a strategy to correct distortions and static economic inefficiencies that had resulted from several decades of semi-autarkic economies. Indeed, since the manufacturing labour productivity of these three economies has slowed down since the 1980s, greater integration into the world economy was also justified as a way to revert this negative trend. However, since Brazil, Russia and South Africa embraced both rapid trade liberalization and open capital movements, unlike China and India, not only did their external fragility increase, but their policy space to promote structural change and long-term growth shrank significantly.

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Appendix 1

Manufacturing sector classified according to factor and technological intensity

NATURAL RESOURCE-BASED

Mineral extraction
Oil and Alcohol
Food Products
Beverage
Wood Products
Pulp, paper and paper products
Non-metallic mineral products

LABOR INTENSIVE

Textile products
Manufacture of clothing items and accessories
Preparation of leather and its artefacts and footwear
Metal products
Furniture and other industries

SCALE INTENSIVE

Chemicals
Rubber and plastic
Metallurgy
Motor vehicle and parts

ENGINEERING-SCIENCE AND KNOWLEDGE-BASED

Machines and equipment
Machinery, equipment and electrical material
Computer equipment, electronic and optical products
Other transport equipment

Appendix 2 – Further empirical results

Table A1 – *Argumented Dickey-Fuller tests (ADF): variable in levels (logs)*

variable	term	*t* stat	Critic Value:		
			1%	5%	10%
GDP, Brazil	C,t	-2.56	-4.27	-3.55	-3.21
GDP, China	C,t	-1.85	-4.27	-3.55	-3.21
GDP, India	C,t	-1.12	-4.27	-3.55	-3.21
GDP, Russia	C,t	-2.49	-4.61	-3.71	-3.29
GDP, South Africa	C,t	-3.10	-4.27	-3.55	-3.21
Imports, Brazile	C,t	-2.57	-4.27	-3.55	-3.21
Imports, China	C,t	-2.66	-4.27	-3.55	-3.21
Import,s India	C,t	-2.41	-4.27	-3.55	-3.21
Imports, Russia	C,t	-1.60	-4.61	-3.71	-3.29
Imports, South Africa	C,t	-2.33	-4.27	-3.55	-3.21
Real exchange rate, Brazil	C,t	-3.12	-4.27	-3.55	-3.21
Real exchange rate, China	C,t	-1.39	-4.27	-3.55	-3.21
Real exchange rate, India	C,t	-0.40	-4.27	-3.55	-3.21
Real exchange rate, Russia	C,t	-3.05	-4.61	-3.71	-3.29
Real exchange rate, South Africa	C,t	-2.24	-4.27	-3.55	-3.21
GDP of the rest of the world, Brazil	C,t	-2.04	-4.27	-3.55	-3.21
GDP of the rest of the world, China	C,t	-1.79	-4.27	-3.55	-3.21
GDP of the rest of the world, India	C,t	-2.01	-4.27	-3.55	-3.21
GDP of the rest of the world, Russia	C,t	-1.68	-4.61	-3.71	-3.29
GDP of the rest of the world, South Africa	C,t	-2.03	-4.27	-3.55	-3.21
Exports, Brazil	C,t	-2.22	-4.27	-3.55	-3.21
Exports, China	C,t	-1.89	-4.27	-3.55	-3.21
Exports, India	C,t	-2.84	-4.27	-3.55	-3.21
Exports, Russia	C,t	-3.05	-4.61	-3.71	-3.29
Exports, South Africa	C,t	-2.24	-4.27	-3.55	-3.21

Note: Russia from 1992 to 2013, other countries from 1980 to 2013.

Table A2 – *Argumented Dickey-Fuller tests (ADF): variables in first difference (logs)*

variable	term	*t* stat	Critic Value:		
			1%	5%	10%
GDP, Brazil	C,t	-4.11	-4.27	-3.55	-3.21
GDP, China	C,t	-5.63	-4.27	-3.55	-3.21
GDP, India	C,t	-5.53	-4.27	-3.55	-3.21
GDP, Russia	C,t	-3.69	-4.61	-3.71	-3.29
GDP, South Africa	C,t	-4.10	-4.27	-3.55	-3.21
Imports, Brazile	C,t	-4.58	-4.27	-3.55	-3.21
Imports, China	C,t	-5.02	-4.27	-3.55	-3.21
Import,s India	C,t	-5.62	-4.27	-3.55	-3.21
Imports, Russia	C,t	-3.77	-4.61	-3.71	-3.29
Imports, South Africa	C,t	-6.50	-4.27	-3.55	-3.21
Real exchange rate, Brazil	C,t	-6.29	-4.27	-3.55	-3.21
Real exchange rate, China	C,t	-5.13	-4.27	-3.55	-3.21
Real exchange rate, India	C,t	-4.75	-4.27	-3.55	-3.21
Real exchange rate, Russia	C,t	-4.15	-4.61	-3.71	-3.29
Real exchange rate, South Africa	C,t	-7.15	-4.27	-3.55	-3.21
GDP of the rest of the world, Brazil	C,t	-3.97	-4.27	-3.55	-3.21
GDP of the rest of the world, China	C,t	-3.91	-4.27	-3.55	-3.21
GDP of the rest of the world, India	C,t	-3.95	-4.27	-3.55	-3.21
GDP of the rest of the world, Russia	C,t	-3.16	-4.61	-3.71	-3.29
GDP of the rest of the world, South Africa	C,t	-3.88	-4.27	-3.55	-3.21
Exports, Brazil	C,t	-5.13	-4.27	-3.55	-3.21
Exports, China	C,t	-5.43	-4.27	-3.55	-3.21
Exports, India	C,t	-5.51	-4.27	-3.55	-3.21
Exports, Russia	C,t	-4.15	-4.61	-3.71	-3.29
Exports, South Africa	C,t	-7.14	-4.27	-3.55	-3.21

Note: Russia from 1992 to 2013, other countries from 1980 to 2013.

Table A3 – *Demand function for imports*

Hypothesized n. of CEs	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.
Brazil – 3 lags				
None	0.570966	25.38660	24.25202	0.0353
At most 1	0.402428	15.44643	17.14769	0.0870
At most 2	0.183875	6.095621	3.841466	0.0135
China – 2 lags				
None	0.695745	36.88655	25.82321	0.0012
At most 1	0.446381	18.32965	19.38704	0.0707
At most 2	0.197419	6.817584	12.51798	0.3639
India - 2 lags				
None	0.665284	31.73972	24.25202	0.0043
At most 1	0.277113	9.410565	17.14769	0.4538
At most 2	0.024838	0.729400	3.841466	0.3931
Russia – 1 lag				
None	0.837114	32.66474	24.25202	0.0031
At most 1	0.647634	18.77551	17.14769	0.0288
At most 2	0.271028	5.690162	3.841466	0.0171
South Africa – 2 lags				
None	0.649061	32.46143	24.25202	0.0033
At most 1	0.246021	8.754099	17.14769	0.5213
At most 2	0.207631	7.214587	3.841466	0.0072

Table A4 – *Demand function for exports*

Hypothesized n. of CEs	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
Brazil – 2 lags				
None	0.778533	46.73191	21.13162	0.0000
At most 1	0.185409	6.357162	14.26460	0.5678
At most 2	0.006752	0.210029	3.841466	0.6467
China – 3 lags				
None	0.657834	32.17377	17.79730	0.0002
At most 1	0.281207	9.905460	11.22480	0.0845
At most 2	0.008064	0.242901	4.129906	0.6809
India – 1 lag				
None	0.653934	31.83376	25.82321	0.0071
At most 1	0.417129	16.19366	19.38704	0.1371
At most 2	0.175451	5.787562	12.51798	0.4877
Russia – 1 lag				
None	0.800997	29.05986	25.82321	0.0181
At most 1	0.504256	12.63052	19.38704	0.3587
At most 2	0.418353	9.754047	12.51798	0.1388
South Africa – 2 lags				
None	0.595839	27.17829	21.13162	0.0062
At most 1	0.332108	12.10885	14.26460	0.1066
At most 2	0.083381	2.611899	3.841466	0.1061