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Trade patterns in a globalised world: Brazil as a case of regressive specialisation

André Nassif and Marta R. Castilho*

Globalisation is the extent and intensity with which a country's production, trade and capital flows are integrated into the world economy. Our focus is on globalisation through international trade. We analyse the main theoretical predictions about the effects of global trade integration on trade patterns between countries of different levels of income and technology and compare this analysis to our investigation of Brazil's trade integration between 1990 and 2016. Particularly, we investigate whether Brazil's recent trajectory has been directed to a pattern of regressive specialisation. By regressive specialisation, we refer to that in which both production and export structures are strongly oriented to goods of low technological sophistication and low income elasticity of demand. The recent theoretical literature on technological gaps suggests that when a country enters a rapid pattern of regressive specialisation, a falling-behind trajectory is observed. Our main findings are as follows (i) the technological gap significantly widened for all groups of manufactured goods classified by factor content and technological sophistication; (ii) the income elasticity of demand for Brazilian imports is greater than that for Brazilian exports, implying a falling-behind trajectory of the economy in the past few decades and that growth has been constrained by long-term balance-of-payments equilibrium (Thirlwall's law); and (iii) there has been a very marked trend of high concentration of Brazilian exports in primary goods, but imports composed of high technologically sophisticated manufactured goods, reinforcing the regressive specialisation of Brazil's trade pattern in the last decades.

Key words: Patterns of specialisation, Regressive specialisation, Diversification, Brazil

JEL classifications: F10, F11, F12, F14

Now I don't ask anymore where the road goes

Now I don't wait anymore for that early hour

It will be, it will be, it will have to be, it will be a sharpened knife

Blind glow of passion and faith, a sharpened knife

(“Blind faith, sharpened knife”, lyrics of a Brazilian song, by Milton Nascimento and Ronaldo Bastos, 1975)

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1. Introduction

Globalisation can be defined as the extent and intensity with which a country is integrated into the world economy. Although such integration can and does reach production, trade and capital flows, our focus is on the globalisation through international trade flows. Other earlier waves of economic internationalisation have occurred—from the Industrial Revolution till the beginning of World War I—but the speed and intensity with which the present wave of trade globalisation has spread over the entire world economy since the early 1980s have no precedent in the modern occidental economic history. In fact, from the 1980s onwards, the rise and diffusion of the microelectronic revolution as well as the significant reduction of trade barriers also put pressure on most developing countries to accelerate trade integration into the world economy.

In the case of Brazil, for instance, between 1990 and 1994, after several decades of protectionist policies adopted under the import substitution development strategy, the Brazilian government adopted a unilateral and ambitious trade liberalisation programme, which eliminated most non-trade barriers (NTBs) and reduced average nominal tariffs for all goods from 32.2% in 1990 to 11.2% in 1995.¹ Since several studies were released in the 1990s and 2000s with the goal of evaluating the impacts of the Brazilian trade liberalisation experience on productivity, trade pattern, employment, etc.,² this paper does not aim at replicating them. There is also extensive literature documenting two marked phenomena that have characterised the Brazilian economy in the last 25 years: the first one is the significant and continuous reduction of the share of value-added industrial activities in the Gross Domestic Product (GDP),³ and the second one is the recurrent long-term trend of overvaluation of the Brazilian currency in relation to the currencies of Brazil's main trading partners.⁴ Even though the second phenomenon may have contributed to deepening the first, both may have influenced the observed changes in the pattern of trade integration of the Brazilian economy in terms of sectoral specialisation, geographical composition of trade flows and the competitiveness of Brazilian goods.

In view of the above, this paper offers two main contributions: first, it reviews and analyses the main theoretical predictions about the effects of global trade integration on trade patterns between countries of different income and technological levels; second, it investigates the case of Brazilian trade integration over 26 years (1990–2016). Particularly, we are interested in investigating whether or not (and if so, to what extent) Brazil's recent trajectory has been directed to a pattern of regressive specialisation. By regressive specialisation, we refer to that in which both production and export structures are strongly oriented to activities or segments of low technological sophistication and, therefore, to low-income elasticity of demand.⁵

As will be further discussed, the recent theoretical literature on technological gaps and long-term growth suggests that when a country enters into a quick and sustained pattern of regressive specialisation, its capacity of showing growth rates aligned with its balance-of-payments equilibrium is reduced and, therefore, it enters a 'falling-behind' trajectory, the term coined by **Abramovitz (1986)** to contrast with a 'catching-up' path.

¹ See **Castilho and Miranda (2017, p. 25)**.

² See **Feijó and Carvalho (1994)**, **Moreira and Correa (1998)**, **Bonelli and Fonseca (1998)** and **Nassif (2005)**.

³ See **Nassif (2008)**, **Oreiro and Feijó (2010)** and **Nassif et al. (2015)**, among others.

⁴ See **Bresser-Pereira (2010)**, **Nassif et al. (2017, 2018)**.

⁵ **Coutinho (1997)** first coined the term regressive specialisation when analysing the Brazilian economy throughout the 1990s. In our paper, rather than production, we will emphasise the trade (export and import) structure.

Although we focus on the case of Brazil, the analysis and policy implications may be useful for policy-makers from other developing countries that have experienced such a regressive specialisation pattern.

The theoretical literature on international trade aims at responding to different questions such as the determination of trade patterns under different market structures and strategies of competition, the gains from trade, the decision of establishing production in other countries through foreign direct investment (FDI), the global fragmentation of production and many others. Our theoretical survey, however, will be restricted to only those models that focus not only on the *static effects* but also on the *dynamic effects* of free trade on a country's (especially a developing country's) long-term growth. This will contribute to a greater understanding of the changes observed in the Brazilian trade patterns in the last decades. By selecting and analysing indicators that capture the static and dynamic effects of Brazil's trade integration in the global economy, our study will link the theoretical discussion with the recent Brazilian empirical evidence, including the static trade pattern, the magnitude of intra-industrial trade, the technological gaps, the relationship between the income elasticity ratio of demand for exports to imports and Brazil's falling-behind trajectory, among others.

To analyse Brazil's recent change in trade patterns, we will estimate the following indicators: (i) income elasticity ratio of demand for exports to imports and its long-term dynamic implications; (ii) the composition and dynamics of both exports and imports classified by factor content and degree of technological sophistication; (iii) the degree of export diversification and the importance of the extensive and intensive margins (IMs) of trade for Brazilian exports, whose indicators permit us to measure the extent to which Brazil's export expansion resulted from the increase of goods traditionally exported (intensive margin [IM]) or 'old' goods or 'new' products highly demanded in the global markets (extensive margin [EM]); (iv) the degree of concentration versus diversification of the export basket; (v) the importance of intra-industrial trade; and (vi) the geographical distribution of exports and imports. Most indicators will be calculated through descriptive statistics, using a methodology that combines traditional with more recently formulated indicators, as compiled by [Reis and Farole \(2012\)](#).

The remainder of this paper is organised as follows. Section 2 reviews the theoretical literature on the determination of trade patterns in a globalised economy, including the new trade theories, and heterodox models that, by focussing on trade flows between countries with different per capita income and technological levels, emphasise the dynamic effects of global free trade. Section 3 presents a general view of the Brazilian economy during the period under study and shows empirical evidence of Brazil's recent experience, based on the above-mentioned indicators. Section 4 draws the main conclusions of the study as well as suggesting some policy implications.

2. Trade patterns in a globalised world: a survey of the theoretical literature

This section aims at presenting a brief survey of the theoretical literature on the determination of trade patterns in the global economy, including the dynamic impacts of free trade on the long-term growth of developing countries. We will restrict our discussion to the theoretical models directly associated with the empirical evidence on the static and dynamic effects of Brazil's engagement in global trade.

2.1 Trade patterns in traditional trade models of comparative advantage

The investigation of the determinants of trade patterns and the advantages of a country to engage in global trade has been a long tradition in economics. In the classical political economy, technological capacity was the main source for explaining different sectoral productivity levels between countries and, therefore, the benefits of global trade. Adam Smith (1776), however, was more concerned with the effects of global trade on a country's economic growth; more specifically, the effects of international trade on the allocative efficiency of productive resources and their capacity to increase social well-being by augmenting the trade volume between countries engaged in free trade. Ricardo (1817) and Mill (1848), in contrast, deviated completely from Smith's perspective: in Smith's theoretical analysis, trade was driven by differences in sectoral absolute costs between countries (which reflect, in turn, differences of absolute technology and productivity), whereas in Ricardo's and Mill's analysis, trade was driven by differences in sectoral relative costs (which reflect, in turn, differences of comparative productivity). Since Ricardo's and Mill's theoretical framework technology was exogenously determined and evaluated in comparative terms, they started a long-lasting tradition in which trade patterns were basically determined by supply-side forces.

In the modern neoclassical theoretical treatment of Ricardian analysis, the determination of trade pattern by comparative advantage depends on several unrealistic assumptions, such as perfect competition in goods and labour markets, total domestic labour mobility, technologies subject to constant returns to scale and full employment. By expanding the Ricardian model to many goods, Dornbusch *et al.*'s (1977) seminal paper showed that comparative advantage and trade pattern are jointly determined by different relative productivities at the sectoral level and different relative wages between countries. In fact, since differences in sectoral relative productivities are determined first and ranked for each country, and given a country's relative wage compared to another trading partner, it is possible to determine the range of goods for which each country has a comparative advantage.⁶ As the expenditure shares are the same in both trading partners (homothetic demand) in their model, the demand side has no role in determining trade patterns. Under such circumstances—like the original Ricardian model—international trade leads to complete inter-industrial specialisation, even considering that a sub-set of goods cannot eventually be traded, be it because relative unit labour costs (i.e., the ratio of wage rates to labour productivity) are the same in both countries, or because transport costs are high enough to work as a trade constraint.

Although the Ricardian hypothesis for determining a country's trade pattern (different sectoral relative productivities reflecting distinct relative technologies) has been supported by several empirical tests,⁷ it was the Heckscher–Ohlin (H–O) version of comparative advantage that became the standard neoclassical trade model for explaining trade pattern, gains from trade and advantages of free trade policies.

⁶ Formally, assuming that the world is formed by the Home and Foreign countries, their model shows that the z good will be produced by the country showing lower comparative costs than its trade partner. This can be written as: $a(z)w \leq a^*(z)w^*$, where a_n corresponds to the labour requirements for producing a unit of good n in the Home country, w represents the corresponding wage per hour worked and the symbol $*$ denotes the Foreign country. They show that the set of goods z produced and exported by the Home country corresponds to those within a rank of relative productivities $[(a_1^*/a_1) > (a_2^*/a_2) > \dots > \dots > (a_n^*/a_n)]$ above relative wages (w/w^*) . The remaining goods will be produced by the Foreign country. For more details, see Dornbusch *et al.* (1977).

⁷ See McDougall (1951) and Eaton and Kortum (2002).

The original model proposed by [Ohlin \(1924\)](#) is based on well-known restrictive assumptions, among which the most important for our analysis is that the technology of each industry, subject to constant returns to scale, is identical and available to all countries in the world. The main proposition of the H–O model is that each country exports goods that intensively use the abundant factor in their production, and imports those that intensively use the scarce factor ([Ohlin, 1933](#)).⁸

However, the normative implications of the H–O model and the factor price equalisation theorem were severely criticised by Latin American economists in the early 1950s.⁹ In an influential paper, [Prebisch \(1950\)](#) criticised the main hypothesis that supports the equalisation factor price theorem: while the theorem predicts that the engagement of primary products exporting countries in global free trade would favour relative prices and industrialisation by importing capital goods with falling relative prices, [Prebisch \(1950\)](#) argued that such a result depends on the income elasticity of demand of both goods being equal to one, a hypothesis not held in practice; as empirical evidence shows that manufactured goods (the main imported goods of Latin American countries) have much higher income elasticity of demand in the long run, periphery countries specialised in primary and commodity goods have their long-term economic growth recurrently constrained by balance-of-payments crises.¹⁰ As [Thirlwall \(2011, p. 13\)](#) recently recognised, [Prebisch's \(1950\)](#) equation expressing his core-periphery model was ‘the true forerunner of my [Thirlwall's] balance of payments constrained growth model developed much later’.

More importantly, since the famous empirical study by [Leontief \(1953\)](#) puts strong doubts on the H–O model's ability to explain the static trade pattern, several academic studies have been developed aiming at investigating new hypotheses for explaining trade patterns in the manufacturing sector as well as the dynamic effects of global free trade on long-term growth. This will be discussed in the following subsections.

2.2 From the heterodox models of the 1960s to the new trade theories of the late 1970s and onwards

The so-called new trade theory, a modern theoretical current of international trade captained by Paul Krugman, Elhanan Helpman, Anthony Venables, James Brander, Barbara Spencer and others, justifies the adjective ‘new’ because most models incorporate imperfect competition, increasing returns to scale and the dichotomy of homogeneous versus differentiated goods as basic assumptions. Heterodox authors, such as [Linder \(1961\)](#), [Posner \(1961\)](#) and [Vernon \(1966\)](#), had actually considered such assumptions in the 1960s. However, differently from the former group of authors, this latter group treated forces such as oligopolistic or monopolistic competition, product differentiation and economies of scale more as possibilities than precise hypotheses that could be demonstrated in formal models. Even so, the major innovation of some

⁸ It is worth noting that, in the H–O model, the unrealistic assumption of identical and unchanged sectoral technologies between countries is kept even when relative factor prices are changed by global free trade. In other words, trade is the main channel through which each country can surpass the scarcity of some factors of production.

⁹ See [Samuelson \(1948, 1949\)](#), who demonstrated the factor price equalisation theorem.

¹⁰ Needless to say, [Prebisch's \(1950\)](#) criticism was related to the long-term trend (or secular trend) of the income elasticity of demand for manufactured goods vis-à-vis primary and commodity goods. In other words, rather than static gains from trade, Prebisch was worried about the dynamic effects on economic development for countries unconditionally engaged in global free trade and specialised in primary goods.

of these heterodox models pioneered a demand basis trade theory for explaining a country's international competitiveness for exporting manufactured goods.¹¹

The set of neoclassical models labelled 'new trade theory', rather than having incorporated imperfect competition, brought other important contributions to trade theory, especially the consideration of several additional assumptions such as market size, number of competing firms, degree of barriers to entry and the possibility of either multiple equilibria or equilibria indeterminacy in oligopolistic markets. Following Vanek's (1968) suggestion of considering the net factor content in trade flows, the main contribution of Krugman (1981) was to show the possibility that trade patterns can be, simultaneously, driven by the interaction and coexistence of perfect competition, as predicted by the H–O model, with the presence of economies of scale, product differentiation and imperfect competition.

Krugman (1981), thus, integrated the traditional H–O trade model with the main features of the new trade theory, showing that both traditional and non-traditional determinants can be compatible. He proposed a model in which the global economy is composed of several countries defined by either their similarities or differences in their factor endowments.¹² In his model, the world is also divided into two groups of countries, but they differ from the Ricardian model in that the first group is all capital-abundant developed countries and the second is composed of all natural-resources-abundant developing countries. The global output is composed of two sectors: a capital-intensive sector, which produces scale-intensive and differentiated-and-knowledge-based manufactured goods subject to increasing returns to scale, product differentiation and monopolistic competition, and a natural resources-based sector, which produces primary and natural-resources-based manufactured goods subject to constant returns to scale and perfect competition.

Given the different factor endowments of the two groups of countries, a free integration of their markets implies that the resulting net trade pattern will be mainly driven by the traditional H–O model and predominantly of interindustry type. In other words, the developed countries will be net exporters of technologically sophisticated manufactured goods, which intensively use the services of the abundant factor (capital) available in this group. The developing countries, on the other hand, will be net exporters of primary goods and industrial commodities, which intensively use the abundant factor (natural resources) available in this group. However, there may be a range of intra-industrial trade in scale intensive and differentiated-and-knowledge-based manufactured goods between both groups. But the greater the difference in their respective factor endowments, the smaller the volume of such flows, which are, as already shown, driven by economies of scale and product differentiation. Summing up, Krugman's (1981) model demonstrates why most of the global flows of technologically sophisticated manufactured goods are concentrated in rich countries whose factor endowments are similar to each other.¹³

¹¹ Indeed, it is unacceptable that Linder's (1961) contribution, despite being recognised by Krugman's (1979) seminal paper, has been omitted from the bibliographic references in Krugman, Obstfeld and Melitz (2012), Helpman and Krugman (1985) and Feenstra (2004), the three leading textbooks in undergraduate and graduate courses.

¹² This is a free adaptation of Krugman's (1981) seminal model, which was summarised by Krugman (1990).

¹³ The new generation of neoclassical trade models (the so-called 'new new trade theory') has predicted intra-firm global trade, in which a significant share of manufactured goods is produced and traded by heterogeneous firms ranked among the highest level of productivity (Melitz, 2003; Helpman, 2011, ch. 5; Melitz and Trefler, 2012). These models predict the international integration of firms by means of both trade and foreign direct investment (FDI) flows and put in evidence the differences between the strategies of North and South firms, as well as the larger probability of the former to engage in FDI and act as multinational enterprises.

2.3 Structuralist–Neoschumpeterian technological gap model: trade patterns and growth dynamics

As all the conventional models previously analysed assume that either factor endowment or technology is exogenous, both trade patterns and the gains or losses from trade are evaluated in static terms. Few theoretical trade models are worried about the dynamic impacts of free trade on countries' long-term growth. In practical terms, the great challenge for developing countries characterised by large technological and productivity gaps in relation to developed countries is to evaluate the extent to which unconditional adoption of free trade policies could significantly reduce their long-term growth. This issue is clearly analysed by both Neoclassical ([Grossman and Helpman, 1991](#)) and Neoschumpeterian ([Dosi *et al.*, 1990](#)) approaches. Despite their quite different methodological frameworks, they reach similar conclusions.¹⁴ The most important cases are as follows. The first one is to consider the global economy composed of two countries that produce manufactured (the capital-intensive sector, subject to increasing returns to scale and product differentiation) and traditional goods (the labour-intensive sector that operates under conditions of constant returns to scale) and are completely similar in terms of endowments or technologies and accumulated knowledge. If these two countries decide to integrate their markets through free trade practices, both could sustain the same long-term growth rates if, and only if, the same rate of innovation is observed in both countries. Both countries thus benefit from free trade by enlarging the variety of traded goods, but the net dynamic effect of global trade to long-term growth would be zero.

The second case is to consider the global economy formed by two groups of countries that produce the above-mentioned kinds of goods: the first group is composed of developed innovator countries characterised by high per capita income, high levels of aggregated productivity and technological capabilities close or equal to the technological frontier; the second group includes all developing imitator countries characterised by per capita incomes close to the world economy's average as well as by significant technological and productivity gaps in relation to developed countries. Since these assumptions are closer to the reality of periphery countries like Brazil, we will briefly present a Structuralist–Neoschumpeterian model proposed by [Cimoli and Porcile \(2010\)](#),¹⁵ who replicate more realistically long-term growth dynamics and implications of these countries' engagement in free international trade.¹⁶

¹⁴ Among other aspects, while [Grossman and Helpman's \(1991\)](#) Neoclassical model assumes several unrealistic hypotheses such as free entry in the research and development (R&D) sector (notwithstanding that it is subject to large increasing returns to scale) as well as treating technology as a service easily adopted by firms through the knowledge transmission channels, [Dosi *et al.* \(1990\)](#)'s Neoschumpeterian model gives up on the method of general equilibrium, refuses the idea that technology can be freely traded in domestic and global markets and accepts the assumption that the pattern of specialisation can have long-term cumulative (positive or negative) effects.

¹⁵ The basic model was firstly presented by [Cimoli *et al.* \(1986\)](#), [Cimoli \(1988\)](#), [Cimoli and Soete \(1992\)](#), [Dosi and Soete \(1988\)](#) and [Dosi *et al.* \(1990\)](#). In this paper, we will strictly follow [Cimoli and Porcile's \(2010\)](#) model.

¹⁶ Even considering their quite different methodological approach, [Grossman and Helpman's \(1991, ch. 9, pp. 246–50\)](#) model has similar results to the Cimoli and Porcile's one presented afterwards. Yet, it is interesting that in his book entitled *Understanding Global Trade*, written without formalism with the goal of reaching a large audience, [Helpman \(2011\)](#) put aside the dynamic implications of an unconditional engagement in free trade for developing countries, especially lower long-term growth rates when their technological gap is large in relation to developed countries.

Cimoli and Porcile's (2010) model is a heterodox and dynamic modified version of Dornbusch *et al.*'s (1977) Ricardian static model, mentioned in Section 2.1. Now, however, the sets of countries are divided as follows: the North innovator countries (N), specialised in the production of manufactures and services of high technological sophistication, and the periphery-South imitator countries (S), specialised in the production of primary and low-tech goods. It is worth noting again that in Dornbusch *et al.*'s (1977) model the income elasticity of demand is equal for all goods (homothetic demand). Yet in Cimoli and Porcile's (2010) model, the goods produced by North innovator countries have higher income elasticity of demand than those produced by South imitator countries. In their model, as relative labour requirements are a function of the technological gap, inequality (1) ranks, in a decreasing order, the static pattern of comparative advantage of the South imitator countries (the symbol * refers to North innovator countries).

$$\frac{a_1^*}{a_1} > \frac{a_2^*}{a_2} > \dots > \dots > \frac{a_n^*}{a_n} \quad (1)$$

With the goal of jointly determining both trade pattern and the dynamic effects on long-term growth, they introduced the following assumptions in the model:

- (i) Based on Engels's microeconomic laws, the n goods can show a wide range of prices and income elasticities;
- (ii) Although there is only one factor of production (labour), the economic system is formed by workers and capitalists, who make the initial financial funds required for contracting workers;
- (iii) All goods are produced under conditions of imperfect competition, in such a way that the entrepreneurs fix prices according to a mark-up m on average labour costs, which correspond to w (wages) multiplied by a (the labour requirements). Thus, the set of goods z will be produced in South imitator countries if $mwa_z < m^*w^*a_z^*$;
- (iv) Since perfect competition is also removed from labour markets, the nominal wage is the result of bargaining between labour unions and entrepreneurs;
- (v) Rather than labour constrained, capitalist economies are balance-of-payments constrained in the long run;
- (vi) Given the state of technology, capitalist economies are generally below full employment; in the short run, economic activity depends on effective demand in the spirit of Keynes (1936);
- (vii) In the long run, changes in technology are endogenously determined and affected by expected demand.¹⁷

By modelling the technological gap dynamics of South and North countries, Cimoli and Porcile (2010) show that the relative growth rate of South countries depends on their ability to diversify their economies towards a significant set of z goods of higher income elasticity of demand. They also show that this ability must occur in such a way that the long-term growth rate of South countries compared with North countries

¹⁷ Dosi *et al.* (1990, p. 203), for instance, discard the possibility that technical progress can result from properties related to the steady-state equilibrium with 'representative agents' and expectations according to 'rational expectations'.

(\hat{Y}_s/Y_N) depends on the ratio of income elasticity of demand for South exports (ε_X) to income elasticity of demand for South imports (π_M), as expressed by the following equation:

$$\frac{\hat{Y}_s}{Y_N} = \frac{\varepsilon_X}{\pi_M} \quad (2)$$

The above equation shows the so-called balance-of-payments constrained growth rate condition required by Thirlwall's law: The capacity of South countries to show growth rates aligned with their balance-of-payments equilibrium over time depends on the elasticity of demand for their exports being greater than the elasticity of demand for their imports (Thirlwall, 1979). Additionally, as shown by Nassif *et al.* (2015), Thirlwall's law can also be used as an indicator to evaluate whether a country has been in a process of catching-up (if the elasticity ratio is above 1) or falling-behind (if the elasticity ratio is below 1) over a long period. Equation (2) is actually the 'strong' version of Thirlwall's law, for it assumes constant relative prices in international trade in the long run (and, therefore, constant real exchange rates over time).

A 'weak' version of Thirlwall's law (Thirlwall, 2011) can be expressed as:

$$\frac{\hat{Y}_s}{Y_N} = \frac{\dot{X}}{\pi_M} \quad (3)$$

The above equation can also be used as a measure of a developing country's convergence to developed economies over time when the parameter ε_X is not estimated and the observed annual export growth \dot{X} (calculated in real terms) is considered. As Thirlwall (2011, pp. 17–18) argued, in this case, '[actual] export growth (\dot{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 '. By comparing the right-hand side of equation (3) 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.¹⁸

Even taking into account that the strong version of Thirlwall's law assumes constant real exchange rate over time, Cimoli *et al.* (2010) remind us that 'the literature on growth and structural change suggests that the elasticity ratio [the right-hand side of equation (2)] is a function of the pattern of specialisation'. CEPAL (2007, p. 16) also stresses that the 'elasticity ratio depends on the productive structure of the economy, which, in turn, can suffer persistent changes over time as a result of the movements of the real exchange rate, notwithstanding that such effects, **by simplicity**, are not considered in the arguments of equation (2)' (adapted quotation; emphasis is ours). In fact, as the theoretical and empirical literature on the behaviour of the productivity and long-term growth shows, developing countries that keep their domestic currency a little undervalued in real terms can accelerate and sustain economic growth in the long run.¹⁹

¹⁸ In Section 3, we will estimate and analyse the empirical results of both versions of Thirlwall's law for Brazil in the period 1980–2010.

¹⁹ For a theoretical demonstration, see Ros (2013, ch.11); for empirical evidence, see Rodrik (2008) and Berg and Miao (2010).

3. Empirical evidence: the case of Brazil

In this section, we will analyse the evolution of the trade patterns of the Brazilian economy between 1990 and 2016. Throughout this period, Brazil experienced a process of trade liberalisation (1990–94); the stabilisation of high inflation rates (*Plano Real*, 1994); and other liberalising economic reforms, such as privatisation of state enterprises, the liberalisation of the domestic financial system and the opening of the capital account. For our analysis, we divided this section into two subsections: in the first, we will briefly analyse the main reforms introduced in Brazil in this period, with emphasis on trade liberalisation. We will also present some empirical indicators that suggest a trend of regressive specialisation and a falling-behind trajectory of the Brazilian economy; in the second, we will show empirical evidence of the regressive specialisation by analysing the changes in the Brazilian trade patterns.

3.1 *A brief analysis of Brazil's economic reforms and some previous empirical indicators (1990–2017)*

After a long period of industrialisation driven by import substitution (1930–89), Brazil adopted a unilateral trade liberalisation reform between March 1990 and December 1994 together with other liberalising reforms, such as financial deregulation and opening of the capital account.²⁰ Trade liberalisation was characterised by the elimination of most NTBs and a relatively rapid tariff reduction.²¹ Comparatively to other experiences of trade liberalisation in developing countries during the 1980s and the 1990s, the Brazilian trade reform represented a deep microeconomic shock for three reasons: first, it was concluded in a relatively short period of time (around four years), differently from South Korea and India, whose trade liberalisation reforms lasted around 5 (from 1983 to 1988) and more than 10 years (from 1991 on), respectively; second, contrary to the recommendations of the trade liberalisation literature, the elimination of NTBs and the reduction of import tariffs were jointly introduced and trade reform was adopted together with the liberalisation of the capital account, all within a context of a sharp overvaluation of the Brazilian currency²²; and third, industrial policy practically disappeared from the Brazilian government's policy focus between 1990 and the early 2000s, even after the conclusion of the trade reform. This, again, was done differently from South Korea and India, which preserved industrial policy together with their trade liberalisation programmes as a strategy for pursuing catching up.

Despite the negative microeconomic shocks, several studies show sound empirical evidence that between 1990 and 1998 labour productivity registered significant annual

²⁰ While the process of industrialisation based on import substitution (IS) in Brazil was spontaneously driven by the severe external crisis resulting from the Great Depression of the 1930s, from the early 1950s until the end of the 1980s, it was characterised by several protectionist measures. Despite all the imperfections of the protectionist policies of the IS period, there is no doubt that they created the conditions for developing a diversified manufacturing sector in Brazil over time. For details on the 1930–89 period, see [Furtado \(1959\)](#), [Tavares \(1963\)](#), [Nassif \(1995\)](#) and [Amsden \(2001\)](#).

²¹ According to [Castilho and Miranda \(2017\)](#), while the average nominal import tariff for all goods in Brazil was reduced from 32.2% to 11.2% between 1990 and 1995, its standard deviation and amplitude dropped significantly. See also [Kume et al. \(2000\)](#) for a detailed description of the trade liberalisation programme.

²² On the recommended sequence and speed for trade liberalisation, see [Bhagwati \(1978\)](#) and [Michaely et al. \(1991\)](#). For Brazil and South Korea, see [Moreira \(1995\)](#). For Brazil and India, see [Nassif \(2003, 2007\)](#).

average growth rates in Brazil, reversing the low and stagnant annual average growth rates shown in the previous decade.²³ Nassif (2005) and Kupfer (2005) showed, however, that such efficiency growth was mainly due to a labour shortage and the renewal of machine and equipment through the import of capital goods, rather than to technical change diffusion.

After the conclusion of the trade reform in 1994, Brazilian average import tariff remained practically unchanged while industrial policy, as stated, was almost completely absent. However, from 2004 on, during Lula da Silva's (2003–10) and Dilma Rousseff's governments (2011–14), industrial policy returned as one of the leading mechanisms for promoting strategic activities and for accelerating structural change towards scale-engineering-and-knowledge-based industries as well as diversifying productive and export structures.²⁴ The three industrial policy programmes adopted in this period aimed at boosting physical investment and innovation in the Brazilian economy.

Nevertheless, these plans repeated old mistakes and well-known misleading policies that had prevailed during the import substitution period: lack of selectivity and performance requirements from entrepreneurs who benefited from public incentives; an excessive use of public subsidies as the main instrument of governmental support, especially credit subsidies from the Brazilian Development Bank (BNDES); and, last but not least, lack of coordination between industrial, trade and macroeconomic policies. One example of coordination failure is related to the recurrent trend of overvaluation of the Brazilian real. Figure 1 plots the behaviour of the real effective exchange rate (REER) in Brazil since 1988.²⁵

Figure 1 shows that the overvaluation of the Brazilian real has been a recurrent trend since the early 1990s. The correction of such misalignments has only occurred after domestic or international shocks, such as the speculative attack against the semi-fixed exchange rate regime at the end of 1998, the crisis of the electrical energy sector ('*apagão*') in 2001, the electoral uncertainty during the transition from the presidency of Fernando Henrique Cardoso to Luiz Inacio Lula da Silva in 2002–2003, the aftermath of the 2008 global crisis and, finally, during the instability created by the impeachment of President Dilma Rousseff throughout 2015. Since all these episodes, the Brazilian *real* has entered a new appreciation trend in real terms. In an econometric model seeking to identify the main forces that pushed the Brazilian real towards that appreciation trend in the period 1999–2015, Nassif *et al.* (2017) showed that the favourable terms of trade and the sharp differential between Brazilian and international interest rates were the most significant explanatory variables.

Several studies have shown a strong correlation between the trend of overvaluation of the Brazilian *real* and the weak long-term economic performance of the Brazilian economy, expressed by a sharp premature deindustrialisation²⁶ as well as by low rates

²³ See Hay (1997), Bonelli and Fonseca (1998), Rossi and Ferreira (1999) and Bonelli (2002).

²⁴ For an analysis of the three programmes of industrial policy adopted between 2004 and 2011, see Coutinho *et al.* (2012) and Castilho and Miranda (2017).

²⁵ In Brazil, the exchange rate is defined as the domestic price of a foreign currency. So, while an increase in the exchange rate means a depreciation of the Brazilian *real*, a decrease means an appreciation of it. The real effective exchange rate was calculated by the Central Bank as a weighted average of the Brazilian *real* against a basket of currencies of Brazil's main trading partners, adjusted by the consumer inflation rate (IPCA).

²⁶ Several studies have attributed the real appreciation trend of the Brazilian currency as being one of the main causes of Brazil's premature deindustrialisation. See, for instance, Bacha (2013), Bresser-Pereira (2010), Nassif *et al.* (2015) and Nassif *et al.* (2018).

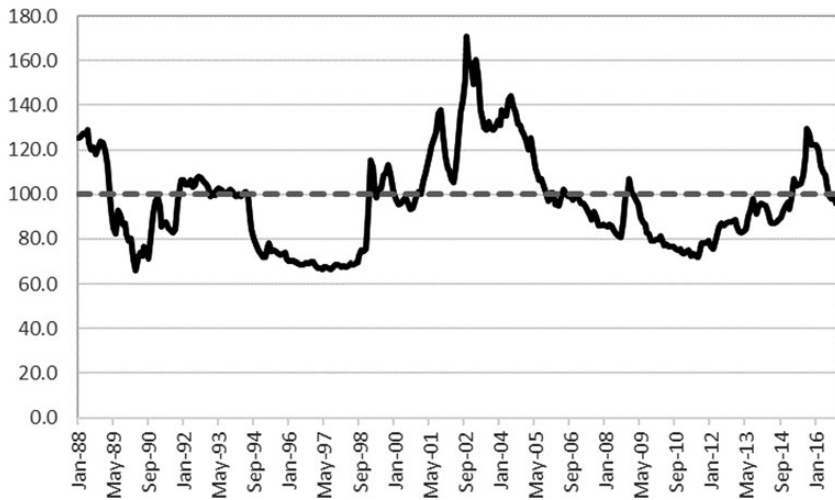


Fig. 1. Brazil: real effective exchange rate (REER) – 1988 to August 2017 (Index base: June 1994 = 100).

Source: Brazil's Central Bank.

of productivity and economic growth. After having been positively impacted by trade liberalisation in the 1990s, as previously discussed, the annual average growth rate of labour productivity in the Brazilian manufacturing sector has been stagnant and showed negative results between 1999 and 2015 (-0.2% p.y.).²⁷ With such a stagnant performance, it is not surprising to see in [Figure 2](#) that the technological gap of the manufacturing sector in Brazil (measured as the ratio of Brazil's labour productivity to the US labour productivity), after having shown a slow catching-up trajectory between 1970 and 1980, has tendentially widened since.²⁸ [Figure 2](#) also shows that the last period during which all segments of the Brazilian manufacturing sector significantly reduced the technological gap occurred in the aftermath of the trade liberalisation, especially between 1990 and 1998, as we discussed earlier. Particularly, the science-engineering-and-knowledge-based industries, after having reached almost half of the technological frontier in 1997, entered a falling-behind trajectory afterwards. Even though these indicators have not been updated by ECLAC-PADI, such trends can hardly have registered significant changes in the opposite direction in the face of the stagnant behaviour of the labour productivity growth in the manufacturing sector in the last decade, as commented on earlier.²⁹

²⁷ These results were calculated and kindly offered to the authors by Jorge N.P. Britto, from the Department of Economics at the Fluminense Federal University. The labour productivity was calculated as the ratio of the value of industrial output (a proxy for value added) to the number of employees directly occupied at production (these indicators are estimated, in turn, by the Annual Industrial Survey – PIA, from the Brazilian Institute of Geography and Statistics – IBGE). The numerator was deflated by sectoral Wholesale Price Indices (IPA) of *Fundação Getúlio Vargas*.

²⁸ These data are estimated by the Programme for the Analysis of Industrial Dynamics (PADI) of the United Nations Economic Commission for Latin America and the Caribbean (ECLAC). Originally, the taxonomy of ECLAC is composed of natural resource-based, labour-intensive and engineering-based manufacturing industries. As these latter industries also contain scale and science-based industries, we grouped all of them and renamed them as science-engineering-and-knowledge-based manufacturing industries.

²⁹ See also [Bonelli \(2015\)](#).

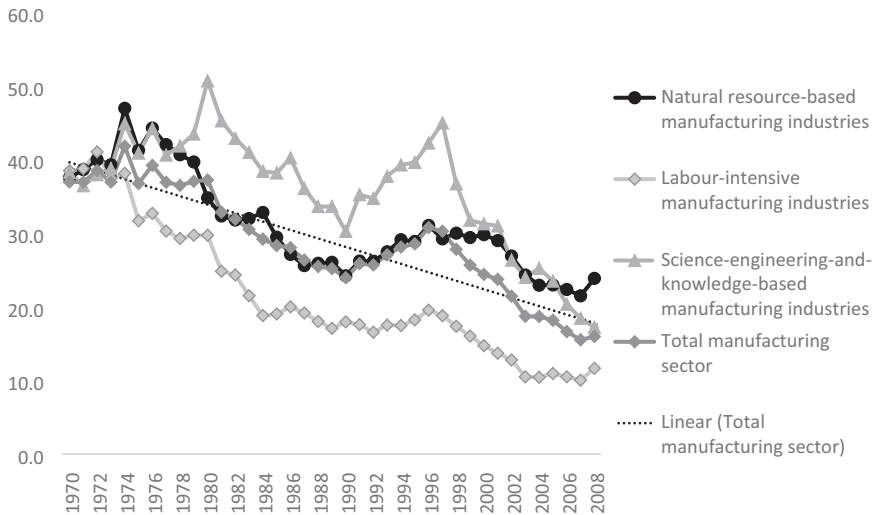


Fig. 2. Technological gap in the Brazilian industries of the manufacturing sector classified by factor content and technological sophistication.

Source: Calculated by the authors, based on ECLAC-PADI.

As discussed in Section 2, Thirlwall's law can be used not only for estimating a country's balance-of-payments constrained growth rate, but also as an indicator for checking if a country has pursued a catching-up or a falling-behind trajectory. Table 1 presents the results of both versions of Thirlwall's law for Brazil between 1980 and 2010—see equations (2) and (3).

The falling-behind trajectory of the Brazilian economy can be confirmed by the results of the strong version of Thirlwall's law for the Brazilian economy between 1980 and 2010. While in the period 1980–98, Brazil's estimated annual average growth rate compatible with its balance of payments equilibrium was 69% of the world GDP growth rate, between 1999 and 2010, however, this rate reduced significantly to only 40%, confirming the depth of the Brazilian economy's specialisation in goods of low-income elasticity of demand as well as Brazil's falling-behind trajectory in the decade.³⁰

As discussed in Section 2, the strong version of Thirlwall's law considers the real exchange rate to be constant over time. However, since the real exchange rate movements affect either positively or negatively the long-term growth, Table 1 also presents Brazil's actual real GDP and exports growth as well as the weak version of the Thirlwall's law, which takes into account changes in the real exchange rate. Similarly to most of the results for the several countries estimated by Thirlwall (1979), the last column of Table 1 shows that the estimated balance-of-payments constrained growth rates for Brazil were very close to the country's actual real GDP growth between 1980 and 2010, and moderately close in both subperiods 1980–98 and 1999–2010. These results seem to confirm the robustness of the estimation for both versions of Thirlwall's law.

³⁰ In another paper (Nassif *et al.*, 2016), we estimated Thirlwall's law for all the BRICS (Brazil, Russia, India, China and South Africa) in the period 1995–2013. The results did not alter for Brazil and revealed that only China and India showed a catching-up trajectory in the period.

Table 1. *Thirlwall's law and the falling-behind trajectory of the Brazilian economy (1980–2010)*

Period	Income elasticity of demand for Brazilian exports (ϵ_x) (1)	Income elasticity of demand for Brazilian imports (π_M) (2)	Average annual real GDP growth (in %) (3)	Average annual real export growth (in %) (4)	$(Y_{Brazil}/Y_{World}^*) = (\epsilon_x/\pi_M)$ Thirlwall's Law (strong version) (5)	Thirlwall's Law (weak version), Average annual real export growth/ π_M (6)=(4)/(2)
1980:3 to 2010:2	1.059	1.993	2.56	5.42	0.53	2.72
1980:3 to 1998:4	1.358	1.967	2.01	3.43	0.69	1.74
1999:1 to 2010:2	1.329	3.361	3.68	10.01	0.40	2.98

Notes: The numbers 1, 2, 3 and 4 indicated after the years refer to quarters. Real GDP and annual export growth correspond to the following periods: 1980–2010, 1980–1998 and 1999–2010 (quarterly data are not available for the entire period due to methodological changes in time series from IBGE). Real exports correspond to nominal exports deflated by the US PPI (Producer Price Index).

Sources: Nassif *et al.* (2015, p. 1326) for Thirlwall's law (strong version); Thirlwall's law (weak version) was calculated by the authors, based on database from Brazil's Foreign Trade Department (SECEX) and International Financial Statistics (IFS/IMF); Annual real GDP growth was drawn from the Brazilian Institute of Geography and Statistics (IBGE).

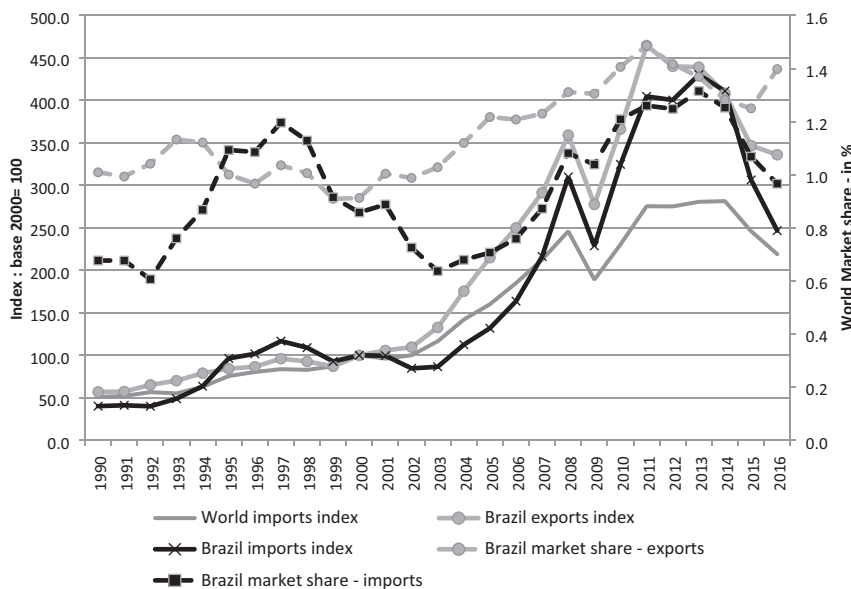


Fig. 3. Brazilian exports, imports and market share evolution (1990–2016).

Source: Elaborated by the authors based on COMTRADE database.

3.2 Brazil's trade patterns and the recent trajectory towards regressive specialisation

For Brazilian international trade, the period between 1990 and 2016 was characterised by a strong dynamism. During these 26 years, the total trade value was multiplied by six, whereas world trade was multiplied by four. Brazilian exports attained US\$336 billion and imports US\$246 billion.

Comparing the performance of Brazilian international trade in the 1990s with the 2000s, it is clear they were quite different. As shown in Figure 3, not only the growth in trade flows was stronger in the 2000s but also the dynamics of exports and imports were opposite in the two periods. During the 1990s, after the Brazilian trade liberalisation and during the period marked by the overvaluation of Brazil's currency, imports grew at a faster pace than exports. From the 2000s on, Brazilian exports grew faster than imports, even though imports also increased significantly.

The Brazilian market share (total trade) grew from 0.8% of world trade in 1990 to 1.4% in 2016.³¹ During the 1990s, the Brazilian market share increase was supported by the significant expansion of imports. The cumulated growth rate of Brazilian imports (148%) was twice that of the exports (75%) and well above the world trade growth rate (96%). From 2000 on, Brazilian exports have grown faster than imports (236% and 147%, respectively) but both have shown higher rates than global trade (119%). In this 26-year period, Brazil reached its highest share of exports in world

³¹ In a longer-term perspective, Brazilian exports attained their highest world market share during the 1980s (trade statistics are available from 1962 on). The average market share was 1.3% for the decade (lower than the period 2010–16) but it attained 1.7% in 1984. On the other hand, the lowest average was reached during the 1990s, when the Brazilian market share was 1.0%. From then on, the share has increased both in the 2000s and during the last period (2010–16).

trade in 2011 (1.5%) and for imports in 2013 (1.3%). The different pace of the recent decrease in world and Brazilian trade flows allowed the export market share recover to 1.4% (2016 data).

In [Table 2](#), trade flows were broken down into industries according to the relative use of productive resources (resource-based versus labour-intensive) as well as to the degree of technological sophistication, following [Pavitt's \(1984\)](#) classic taxonomy.³² The strong increase in Brazilian trade flows over this period was accompanied by important composition changes, mainly on the export side. On the import side, the sectoral composition kept relatively stable, with the manufactured goods representing a large majority of imports. The most important change during the whole period was the reduction in oil imports in the first half of the 1990s due to the increase in national oil production. After that, changes in import structure were minor, despite the increase in imports of labour- and scale-intensive sectors.³³

Regarding the important composition changes on the export side, the share of manufactured goods in exports remarkably decreased, going from 78% of total exports in 1990–95 to 53% in 2011–16, whereas the share of primary goods in total exports increased from 21% to 45% in the same period. In fact, between 1990 and 2016, the share of primary goods more than doubled and recovered the importance they used to have in exports at the beginning of the 1970s. This process has been named ‘export primarisation’ and, as mentioned in [Section 3.1](#), several factors explain it, such as the commodities price boom in the 2000s, due mainly to not only the so-called Chinese demand–pull effect but also to other problems associated with commodities in global markets (including speculative movements), the persistent overvaluation of the national currency and the dynamism of domestic demand for manufactured goods.³⁴ The primarisation process observed in exports was not, however, observed—at least not with the same intensity—in domestic production. [Torracca \(2017\)](#) shows this mismatch between the structure of exports and of domestic production. While primarisation is clear and strong in external trade flows, the domestic production structure is much more stable and less intensive in primary goods and resource-based sectors, even though their share in domestic production increased. These conclusions do not contradict the evidence of premature deindustrialisation in Brazil, especially from the mid-2000s. In fact, it is widely recognised that there has been a sharp reallocation of resources from the manufacturing sector to segments of low productivity in the tertiary sector in Brazil since the mid-2000s.³⁵

³² Detailed sectoral classification is available upon request.

³³ The increase in labour-intensive imports was strongly influenced by the rise in textiles, clothing, shoes and some chemical goods, while the transport equipment imports (cars, trucks and ships) were the main reason for the share of scale-intensive goods to increase.

³⁴ See [Bacha and Fishlow \(2011\)](#), [Bacha \(2013\)](#) and [Nassif et al. \(2017\)](#).

³⁵ In fact, according to the Brazilian Institute of Geography and Statistics (IBGE), the share of the agricultural sector in Brazil's GDP in real terms (1995 price) in 2016 was virtually the same as that of 1996 (6%). Yet, while the share of the manufacturing sector in total GDP was reduced from 13.8% to 9.8%, the share of the tertiary sector was increased from 57% to 60.7% during the same period. See <https://www.ibge.gov.br/estatisticas-novoportal/economicas/contas-nacionais/9300-contas-nacionais-trimestrais.html?&t=resultados> [date last accessed 25 October 2017]. See [Nassif \(2008\)](#) for the period 1947–2004 (in current prices).

Table 2. *Composition and evolution of Brazilian exports and imports by product groups (1990–2016)*

	Primary goods	Resource-based industry (1)	Labour intensive (2)	Scale intensive (3)	Specialised suppliers (4)	Science based (5)	n.c.	Manufactured goods (1–5)	Total
Exports									
Composition (% of total exports)									
1990–95	21.1	28.5	12.6	23.0	9.7	4.0	1.0	77.9	100.0
1996–2000	22.4	27.3	10.6	21.1	9.8	7.2	1.6	76.0	100.0
2001–05	26.4	24.2	9.2	20.4	9.1	8.8	1.8	71.8	100.0
2006–10	36.8	22.3	6.3	17.2	8.1	7.2	2.2	61.1	100.0
2011–16	45.1	21.2	4.9	14.5	7.2	5.2	1.9	53.0	100.0
Average annual growth (%)									
1990–95	5.4	9.7	7.7	8.2	10.7	5.6	10.3	8.2	8.2
1996–2000	5.0	(1.9)	2.3	2.3	1.5	29.2	11.4	3.5	3.5
2001–05	23.4	13.9	10.4	18.5	17.7	7.9	15.2	16.5	16.5
2006–10	21.6	11.3	1.6	1.9	4.7	3.5	11.6	11.2	11.2
2011–16	(2.3)	(1.3)	(0.7)	0.9	(0.1)	(1.7)	(8.4)	(1.4)	(1.4)
Imports									
Composition (% of total imports)									
1990–95	20.7	22.5	7.6	14.4	18.8	15.9	0.0	79.3	100.0
1996–2000	12.6	20.5	8.7	16.3	21.8	19.9	0.1	87.2	100.0
2001–05	15.5	18.5	7.8	14.2	21.3	22.6	0.0	84.5	100.0
2006–10	14.4	19.3	8.4	17.7	19.0	20.1	1.2	84.4	100.0
2011–16	11.2	21.0	9.7	19.2	18.7	20.2	0.0	88.7	100.0
Average annual growth (%)									
1990–95	(1.3)	25.3	33.2	38.2	19.7	19.1	39.0	19.1	19.1
1996–2000	(0.6)	(0.9)	(3.7)	(4.9)	2.5	9.0	(48.2)	0.7	0.7
2001–05	13.1	2.1	5.5	6.5	4.6	5.0	(48.2)	5.7	5.7
2006–10	10.7	22.3	22.9	27.7	19.6	16.2	105.5	19.7	19.7
2011–16	(7.9)	(4.2)	(2.6)	(6.8)	(4.7)	(1.6)	(2.8)	(4.5)	(4.5)

Notes: N.c.: not classified; Indicators between brackets are negative results.

Source: Elaborated by the authors based on COMTRADE database.

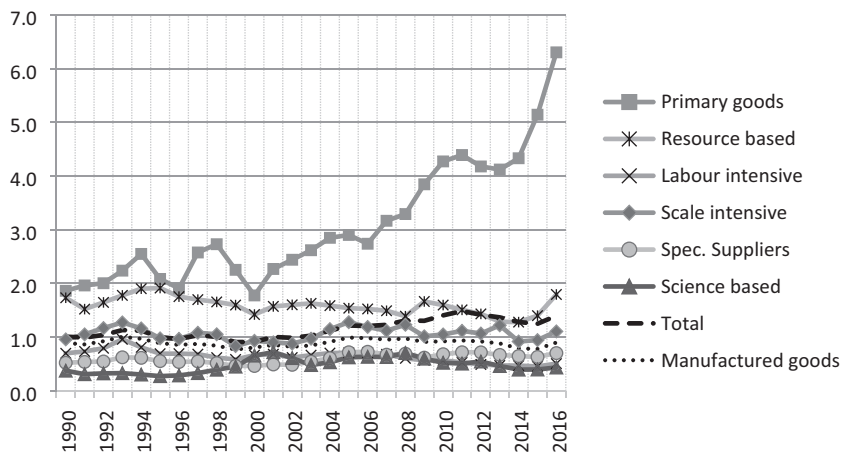


Fig. 4. Market share of Brazilian exports in world exports, by product group (1990–2016, % of world exports).

Source: Elaborated by the authors based on COMTRADE database.

All manufacturing sectors experienced a decrease in their share in total exports at the beginning of the 1990s, except the science-based group. The reduction in the share of manufactured goods in total Brazilian exports is, in part, explained by the exceptional increase in primary goods exports.³⁶

Among manufacturers, labour-intensive goods is the product group that lost the most share in exports since 1990s (from 13% to 5%), for the competitiveness of Brazilian goods in global markets significantly declined. Exports of scale-intensive goods also showed a remarkable decrease especially due to the reduction of steel products. The exports of science-based goods showed quite a dynamic trajectory till 2005 when their share in total exports began to retract. In 2016, their share (5.6%) was close to the average of the 1990s. Finally, despite the loss of around one-quarter of their share in total exports, resource-based and specialised suppliers were the only categories that augmented their share in manufacturing goods exports.

Figure 4 displays the market share of Brazilian exports in total world exports.

Despite the strong loss of importance of manufactured goods in Brazilian exports, their performance in world markets is less dramatic. This is because the primarisation process is partially explained by the commodities price boom which affected not only Brazil but also world exports. Figure 4 shows that, for manufactured goods, Brazil kept its (low) share of 1% in world exports until 2008. In terms of world market share, the product groups performed quite differently.

The labour-intensive goods is the only group presenting a net reduction from 1990 to 2016—a 25% loss of its world market share. Exports in science-based goods increased their share in world exports during the 2000s and decreased from 2009 on,

³⁶ The accumulated growth rate of Brazilian exports exceeded the rate of world exports for manufactured goods for the entire period 1990–2016 due to mainly the good performance between 2004 and 2013. Moreover, as shown by Castilho *et al.* (2019), the export primarisation in Brazil has a very strong geographical character since exports to China, which became the first trading partner after the financial crisis, are very concentrated in primary and resource-based goods.

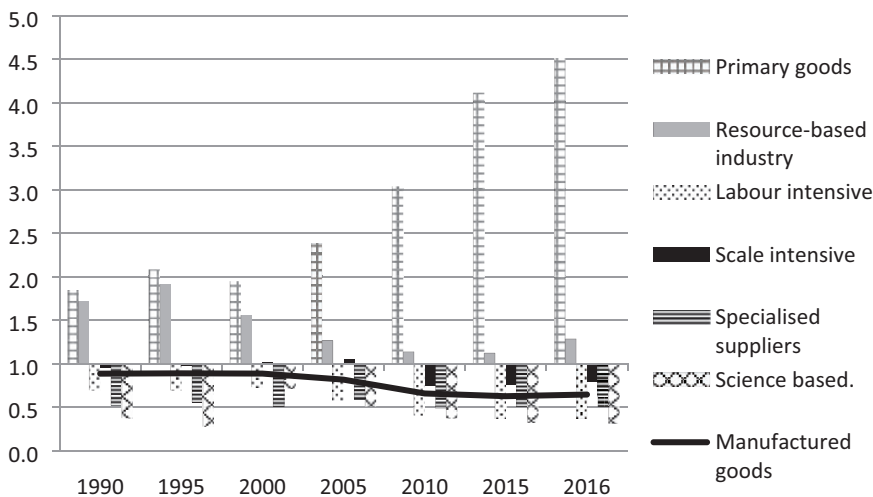


Fig. 5. *Brazilian revealed comparative advantage*

Source: Calculated by the authors based on COMTRADE database.

reaching 0.4% at the end of the period. Scale-intensive goods reached their highest share in world markets in 2005, when from this year on their share kept around 1%. Specialised suppliers' goods is the group with a more stable share during the period—around 0.6% over the 25-year period. Finally, resource-based goods, even showing a slightly decreasing tendency between 1995 and 2014, is the manufacturing sector with the highest share in the world market. Primary goods, on the other hand, presented a completely different performance: their market share, after a decade of relative stability of around 1.8% in the 1990s, was multiplied by 3.4 in 2016. Brazilian exports of primary goods represented in that year 6.3% of total world exports.

A traditional indicator of a country's pattern of specialisation is [Balassa's \(1965\)](#) Revealed Comparative Advantage (RCA) [see equation (A.1) in [Appendix 1](#)], whose results are shown in [Figure 5](#).³⁷ Indicators clearly register a deepening of Brazilian export specialisation based on primary goods. Since it was accompanied by a continuous drop in the RCA of several manufactured goods categories (notably, labour-intensive, science-based and specialised suppliers), these results characterise a regressive specialisation of Brazilian trade.³⁸

For analysing if, and if so to what the extent, Brazilian trade flows have been concentrated or diversified in the last decades, we used the Herfindahl–Hirschman index (HHI) as specified in equation (A.2) and shown in [Figure 6](#). As the HHI basically measures the degree of concentration (the larger the HH index, the more concentrated the exports or imports), [Figure 6](#) shows that Brazilian imports are currently more diversified than exports. The HHI also puts in evidence not only the difference in the degree of concentration of trade flows but also the divergent trends in the last 10 years of the period. Exports show a concentration trend after 2004, while imports present a

³⁷ If RCA is above 1, that means the country has a comparative advantage, whereas if RCA is below 1, that means the absence of comparative advantage—or comparative disadvantage.

³⁸ These trends are also confirmed by [Nassif et al.'s \(2015\)](#) empirical study.

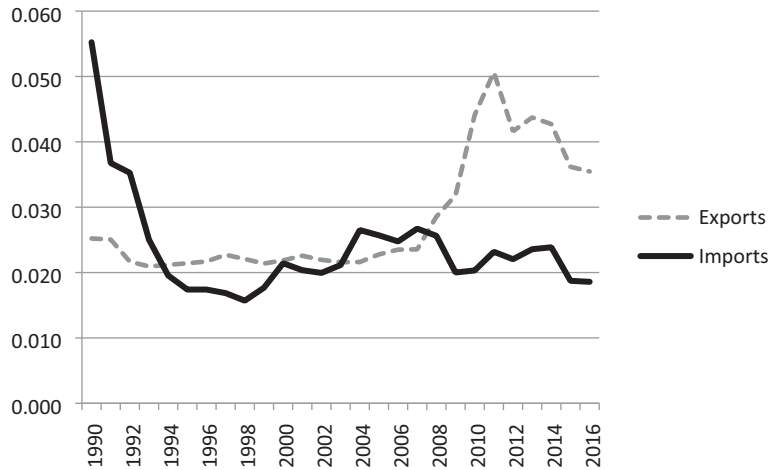


Fig. 6. Degree of concentration of Brazilian exports and imports (Herfindahl–Hirschman Index, 1990–2016).

Source: Calculated by the authors based on COMTRADE database.

stable evolution, after their diversification in the first half of the 1990s. The maximum level of export concentration measured by the HHI was reached in 2011. This latter result reflects the emergence of China as one of the most important Brazilian trading partners after the 2008 global crisis. In fact, a result of the so-called China effect on Brazil's trade flows is that Brazilian exports grew sharply and became extremely concentrated in mineral ores, soya beans and oil.³⁹

Table 3 shows the HHI for exports classified by factor content and technological sophistication. The major concentration changes occurred with the science-based goods, which showed the highest degree of export concentration by 2016. This was due to the high share of aircraft exports in this group.⁴⁰ The above-mentioned China effect has clearly influenced the high concentration of primary and resource-based goods. The group of scale-intensive goods is the one that exhibited the most stable degree of export concentration in the entire period.

Another way of evaluating the degree of diversification is to measure the extent to which Brazil has exported old and established goods in the world markets (intensive margin, IM) or new products and other goods with an increasing share in world exports (extensive margin, EM). The IM and EM were calculated according to the methodology proposed by Hummels and Klenow (2005) and are expressed by equations (A.3) and (A.4).⁴¹ The former corresponds to a country's market share of world exports in the products or categories in which it exports, indicating how consolidated the country is in exporting the same category of goods in the markets it traditionally acts in. The latter

³⁹ These three goods represent around 75% of Brazilian exports to China. As international prices of these commodities were very high until 2012, the share of these goods in total exports rose remarkably.

⁴⁰ Since 1990, aeroplanes have been the most important product in the science-based category. In the first half of the 1990s, they accounted for a quarter of this category's exports and reached 46% in 2016.

⁴¹ There are other different definitions such as the one used by Amurgo-Pacheco and Pierola (2008) which identifies 'old' and 'new' import and export products and markets of a country by comparing the existence of trade flows with a reference period.

Table 3. Concentration of Brazilian exports, by product group (HH Index, 1990–2016)

	1990	1995	2000	2005	2010	2016
Primary goods	0.186	0.181	0.156	0.149	0.181	0.149
Resource-based industry	0.094	0.077	0.068	0.072	0.122	0.117
Labour intensive	0.126	0.107	0.110	0.097	0.099	0.116
Scale intensive	0.093	0.086	0.089	0.086	0.086	0.084
Specialised suppliers	0.129	0.079	0.087	0.089	0.081	0.086
Science based	0.190	0.090	0.331	0.223	0.192	0.250
TOTAL	0.025	0.021	0.022	0.023	0.044	0.035

Source: Calculated by the authors, based on COMTRADE database.

corresponds to the share of a country's export basket in goods dynamically demanded by global markets. Thus, the EM shows how important the country's export basket (or its portfolio) is for the world market.⁴²

Table 4 shows the IM and EM for both total exports and categories of goods classified according to factor content and technological sophistication. Concerning total exports, despite the loss of market share in the categories of goods that Brazil exports (IM), the portfolio highly demanded by global markets (EM) has gained importance in world markets.⁴³ The evolution of the EM may, at first sight, seem to contradict the results shown by the HHI index, which revealed a concentration trend of exports from 2007 on. Indeed, the EM considers the range of the country's exported goods demanded by the world, and, therefore, it is a measure of dynamism or adherence of the country's export basket to the world trade. Brazil has notably expanded the number of exported goods but, in terms of value in US dollar, its exports have become increasingly concentrated in primary and other commodity goods.⁴⁴ This explains why the largest increases of the EM occurred for primary and resource-based goods, showing the dynamism of these groups in the global markets in the period, whereas the smaller changes took place in the more technologically sophisticated sectors exported by Brazil—science-based and specialised suppliers. These different sectoral changes suggest that primary goods

⁴² According to [Hummels and Klenow \(2005, p. 3\)](#), export growth can result from the expansion of exports of goods already exported or from a diversification process which corresponds to the 'enlargement of the variety of exported goods'. The second source of growth is usually associated with monopolistic competition models based on [Krugman \(1981\)](#), whose main prediction is that big countries will produce and export a larger variety of goods.

⁴³ The number of products is an alternative way of measuring EM. See [Carmo and Bittencourt \(2014\)](#), for example. For this period, the number of products, defined at the six-digit level of the 1992 HS classification, grew from 3,829 in 1990 to 4,263 in 2000 (out of a total of 5,036 products).

⁴⁴ To illustrate this point, we compared the EM, the number of exported goods and the share of the top 100 exported goods in Brazil, Argentina and the USA for 2016, using Comtrade exports data disaggregated at the six-digit level of 2012 HS classification. The EM is over 90% for all these countries (92% for Argentina, 98% for Brazil and 100% for the USA), suggesting, at first sight, that these countries have a diversified export basket. The number of exported goods, however, is quite different for each, corresponding to 69%, 84% and 99% for Argentina, Brazil and the USA, respectively, out of a set of around 5,200 goods. But the share of the top 100 exported goods in their total exports reveals a big difference in the degree of concentration in US dollar value terms: in Argentina and Brazil, the top exported goods represent, respectively, 85% and 78% out of the value of their total exports, while in the USA this share is much lower, at 47%. In other words, even considering that Brazil has many different goods in its export basket, in value terms its exports are quite concentrated.

Table 4. *The intensive (IM) and extensive margin (EM) of Brazilian exports by product groups (1990–2016)*

	EM				IM			
	1990	2000	2010	2016	1990	2000	2010	2016
Primary goods	50.1	94.4	97.3	93.7	11.1	2.0	4.5	6.4
Resource-based industries	77.9	89.9	87.6	96.8	5.2	1.6	1.8	1.7
Labour intensive	94.2	98.2	98.9	99.3	1.9	0.7	0.6	0.5
Scale intensive	94.4	98.1	98.8	98.9	1.9	1.0	1.1	1.1
Specialised suppliers	96.0	99.2	99.3	99.6	1.2	0.5	0.7	0.7
Science based	97.2	99.2	98.6	99.5	0.9	0.7	0.5	0.4
TOTAL	88.2	96.7	96.3	98.2	2.6	1.0	1.5	1.4

Source: Calculated by the authors, based on [Hummels and Klenow's \(2005\)](#) methodology and COMTRADE database.

revealed a more dynamic performance since it recovered its market share and showed a huge diversification in the global markets in the last decades.

As we analysed in Section 2.2 and as shown by Krugman's models (1979, 1980, 1981), the share of intra-industrial trade in total trade is usually larger among countries with similar development and income levels. And as this kind of trade is driven by scale-intensive and science-based industries, it is more dynamic and leads to gains for both partners due to the joint effect of higher competition and economies of scale. Depending on the level of statistical data disaggregation, intra-industrial trade sheds light on the degree of productive integration between countries as well as the extent to which trade partners engage in regional and global value chains.

We measured Brazil's intra-industrial trade through the Grubel–Lloyd Index (GLI), as expressed by equation (A.5) (see Grubel–Lloyd, 1971). As [Reis and Farole \(2012, p. 35\)](#) suggest, the GLI is important for not only indicating the amount of intra-industrial trade (GLI equal to 1 indicates maximum intra-industrial trade) but also capturing the degree of diversification within an industry (GLI equal to zero indicates absence of diversification within an industry).

[Table 5](#) shows GLI for Brazil between 1990 and 2016, which is estimated using data disaggregated at the 3-digit level of the STIC classification (240 products) and considers trade with all partners.⁴⁵

The index of intra-industrial trade in Brazilian trade pattern is quite reduced (around 0.36 in 2016).⁴⁶ After having grown between 1990 and 2005, the GLI showed a continuous reduction. Between groups, the level and evolution of intra-industrial trade differ significantly. As expected, the intra-industrial trade is more important for more elaborated goods or capital-intensive categories. As also expected, science-based, specialised suppliers and scale-intensive sectors are those with higher GLI due to their

⁴⁵ If higher levels of product aggregation overestimate intra-industrial trade and if one intends to analyse geographical dimensions of this kind of trade (for regional integration studies, for example), then it would be desirable to consider bilateral trade flows. For more details on these issues, see [Fontagné and Freudenberg \(1997\)](#).

⁴⁶ As several empirical studies show, the index of intra-industrial trade between some developed countries used to surpass 0.60. See, for instance, [Ito and Okubo \(2011\)](#) and The World Trade Organization (2013, Table B8:70).

Table 5. Brazilian intra-industry trade by product groups (Grubel–Lloyd Index, 1990–2016)

	1990	1995	2000	2005	2010	2016
Primary goods	0.168	0.184	0.167	0.094	0.080	0.098
Resource-based industries	0.136	0.217	0.256	0.257	0.199	0.212
Labour intensive	0.292	0.329	0.293	0.298	0.240	0.243
Scale intensive	0.231	0.328	0.302	0.268	0.319	0.324
Specialised suppliers	0.450	0.370	0.342	0.470	0.360	0.387
Science-based	0.457	0.534	0.305	0.271	0.397	0.372
TOTAL	0.300	0.383	0.412	0.433	0.401	0.356

Source: Calculated by the authors, based on COMTRADE database.

higher potential capacity to explore gains from economies of scale and product differentiation. The GL indices for science-based industries indicate that the intra-industrial trade grew rapidly in the mid-1990s, then strongly decreased from the end of this decade onwards and vigorously recovered after the 2008 global crisis. This recovery reflects larger trade flows within Mercosur, especially with automobiles.⁴⁷ Although scale-intensive industries increased their GLI between 1990 and 2016, specialised and labour-intensive suppliers showed reductions in the same period. As expected, the primary goods and the resource-based groups show the smallest values for the GLI in the period.

Table 6 shows the composition of exports and imports according to Brazil's trade partners (1990–2016). The data suggest that Brazil can be classified as a global trader because of its large variety of trading partners. Over the period 1990–2016, there were some important changes in the geographical composition of Brazilian trade. First, its most traditional partners [the USA and the European Union (EU)]⁴⁸ lost importance throughout this period. This reduction is stronger in relation to Brazilian exports, while on the import side, the EU kept its share in the Brazilian market. Brazil's export share in Latin American countries increased during the 1990s. Mercosur was the main market responsible for this change, which is also confirmed by the huge rise of the Argentinean share both in exports and in imports. After 2000, bilateral trade with Argentina declined, affecting Latin America's total trade. Even after this decline, Latin America remained one of Brazil's most important partners, especially on the export side. Another marked change was the increase of China's share in Brazilian trade after 2010. While in 2000, China's share for Brazilian exports and imports was around 2% of Brazil's total trade, this indicator jumped after the 2008 global crisis, reaching 19.2% and 17%, respectively, in 2016.

Although Brazil's trade with other countries (South Korea, Japan, Russia and India, as described in Table 6) is not as significant as that with China and the USA, the data suggest that there was a geographical deconcentration of Brazilian exports and, albeit

⁴⁷ Mercosur is the customs union that joins Brazil, Argentina, Uruguay, Paraguay and Venezuela. Intra-Mercosur trade grew rapidly until 1997, with a notable share of intra-industry trade in automobiles and capital goods sectors. The intra-regional trade was so negatively affected by the 1998–99 Brazilian crisis and the 1999–2001 Argentinean crisis that it did not return to the 1990s level.

⁴⁸ Here we kept the 12 countries belonging to the EU in 1990 and that remained the main partners (more than 90% of EU-27 trade).

Table 6. *Geographical distribution of Brazilian exports and imports (1990–2016; in %)*

	1990		2000		2010		2016	
	Export	Import	Export	Import	Export	Import	Export	Import
Latin America	11.0	12.5	24.8	21.7	21.6	15.3	19.5	12.1
Argentina	2.1	6.7	11.5	12.3	9.3	8.0	7.3	6.6
Mexico	1.6	0.9	3.2	1.4	1.9	2.1	2.1	2.6
USA	24.6	20.1	24.7	23.4	9.8	15.1	12.7	17.5
European Union (EU-12)	28.3	19.4	26.5	22.9	20.4	18.5	16.8	19.4
China	1.2	0.9	2.0	2.2	15.5	14.1	19.2	17.0
India	0.5	0.1	0.4	0.5	1.8	2.3	1.7	1.8
Japan	7.5	7.2	4.6	5.3	3.6	3.9	2.5	2.6
South Korea	1.7	0.4	1.1	2.6	1.9	4.7	1.6	4.0
Russia	n.a.	n.a.	0.8	1.0	2.1	1.1	1.3	1.5
World	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Note: n.a.: not available.

Source: Elaborated by the authors based on COMTRADE database.

to a lesser extent, of imports. In fact, during the 2000s, trade with Asia and Africa grew and diversified, even considering that trade with these two regions (except China) remained relatively weak.

The changes in geographical composition of Brazilian exports are reflected in the sectoral specialisation of the Brazilian export basket. This occurs as Brazil's trade structure differs according to the stage of development of its trading partners and their specialisation. Bilateral trade with some partners has a kind of North–South pattern of specialisation, as analysed in Section 2. That is, Brazil's trade pattern with the EU and China is considerably different from that with Mercosur or other neighbouring countries.

Such differences are illustrated by [Figure 7](#), which shows the change in Brazilian exports over time by partner. In this Figure, the left axis refers to the exported value in US dollars for all product groups (indicated by the bars), and the right axis refers to the share of manufactured goods in total exports to each region (represented by the black lines). We can clearly distinguish two groups of partners. The first group is formed by the very important markets for Brazilian manufactured goods exports—basically, Latin American countries and the USA. In 2016, manufactured goods exports to Argentina and to the USA were responsible for 94% and 84% of total bilateral exports, respectively. The second group of partners is composed of Asian countries and the EU-12, countries for which primary and resource-based manufactured goods represent the largest part of bilateral exports. For China and Japan, the share of manufactured goods in bilateral exports represented, respectively, 19% and 33% of the total in 2016. The case of the EU, which is one of Brazil's main trading partners and accounts for two-thirds of total Brazilian exports of primary and resource-based manufactured goods, is a little bit different from the Asian countries. Even if the share of manufactured goods in Brazil–EU trade in 2016 (63%) was lower than the USA, for example, EU-12 accounts for 18% of the total Brazilian manufactured goods exports—the same as the US market share.

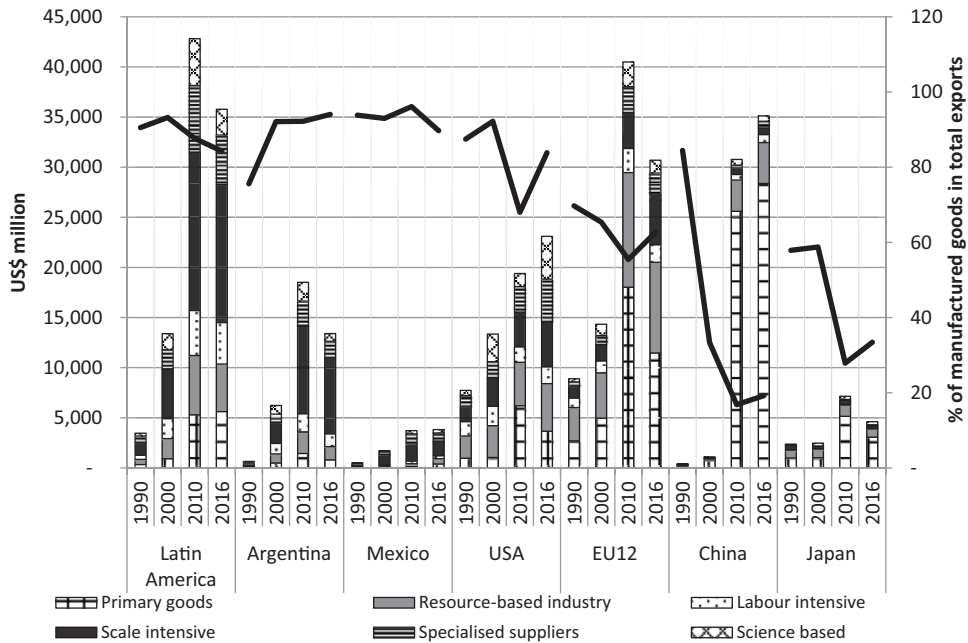


Fig. 7. Evolution of Brazilian exports by selected partners (1990–2016).
 Source: Elaborated by the authors, based on COMTRADE database.

Among manufactured goods exports, there are also differences in composition: the importance of more technologically sophisticated goods (science-based and specialised suppliers) differs significantly between these two groups of partners. For the Americas (Latin America and the USA), such categories varied from 18% (Argentina)⁴⁹ to 36% (the USA) in 2016. For the other group, the share is much smaller (3.5% for China, 8% for Japan and 11.4% for the EU).

Brazil's pattern of trade specialisation as described above is typical of middle-income-level countries. As theoretical models of intra-industrial trade and technological gaps predict, trade patterns depend on a country's relative level of development and are highly influenced by the technological gap itself. These models suggest that developing countries tend to have a kind of 'North–South' trade pattern with developed ones and an intra-industrial trade pattern of more technologically sophisticated goods with countries of similar per capita incomes. Brazil does not escape from this general rule. However, the Brazilian trade pattern with the USA is quite surprising, since it is not characterised by a typically North–South kind, seeing that trade in manufactured goods has been important in their bilateral trade in the last few decades.

⁴⁹ These shares differ especially from the earlier years. In the US case, we observed that the aeroplane exports inflated in the later years' statistics, and the share of these two categories became weaker in the earlier years. For LA, the share of these categories in the earlier years was higher, floating around 25%.

4. Concluding remarks

This paper analysed the performance and composition of Brazilian trade flows between 1990 and 2016. Since most conventional theoretical models reviewed in this study take either technology or factor endowments as exogenous, they emphasise the static effects of free trade (including the static gains from trade), rather than its dynamic effects (either positive or negative) on a country's long-term growth. In addition, as developing countries are characterised by large technological and productivity gaps compared with developed countries, descriptive statistics are insufficient to evaluate the extent to which unconditional engagement in free trade policies can positively or negatively affect their long-term growth. The main contribution of Structuralist–Neoschumpeterian models is to show that the extent of a country's technological gap affects its pattern of specialisation and growth dynamics. Specifically, they predict that a country characterised by a regressive specialisation trade pattern has low export diversification as well as income elasticity of demand for its exports lower than income elasticity of demand for its imports. This implies perverse long-term growth dynamics and compromises a virtuous catching-up trajectory.

Empirical evidence on Brazil has shown that since the early 2000s the technological gaps of the manufacturing sector (including natural resource-based segments) have significantly increased. Furthermore, as the income elasticity of demand for Brazilian exports has become significantly smaller than the income elasticity of demand for Brazilian imports after 1999—in comparison with the period 1980–98—Brazil's estimated long-term growth rate compatible with its balance-of-payments equilibrium has been much lower than the world growth rate. According to [Thirlwall's \(1979\)](#) law, such a performance marks a falling-behind path.

The analysis of Brazilian trade pattern evidenced its regressive trade specialisation. Despite the significant increase of Brazilian trade flows, the country's trade pattern did not show a virtuous trajectory between 1990 and 2016, especially with respect to the observed changes in the export structure. While the import structure remained relatively stable, with the more technologically sophisticated sectors accounting for around 40% of Brazilian imports since the mid-1990s, the export structure was marked by a severe primarisation process. The export of primary goods continued to increase its share in Brazil until 2014, even after the reversal of the commodity price boom from 2011 onwards. Among manufactured goods exports, labour-intensive and technologically sophisticated ones, such as scale and specialised suppliers, were replaced by primary and resource-based ones. The share of all resource-based segments (primary and resource-based manufactured goods) more than doubled over the last 26 years, reaching 60% of Brazilian total exports in 2016.

This primarisation phenomenon was reinforced by a concentration trend of Brazilian exports. Although Brazil's ability to export goods highly demanded by global markets (the EM) increased for all categories of goods between 1990 and 2016, these results did not imply a true diversification trend. Indeed, despite Brazil having notably expanded the number of exported goods, its exported value in US dollars became highly concentrated in commodity goods in the same period. As to the geographical composition of trade flows, its bilateral trade patterns differ considerably in terms of composition, diversification and degree of sophistication, depending on the trading partners. Brazil's bilateral trade with China, which became the most important Brazilian trade partner after the 2008 global crisis, is characterised by a typical North–South trade

pattern. In contrast, the Brazilian trade pattern with Latin American countries is radically different, being characterised by sectoral complementarities and intra-industrial trade. This suggests a major potential for generating dynamic gains from trade between Brazil and Latin America.

Brazil has noticeably had a sharp regressive trade specialisation in the last decades. Such a trend has normative implications, however, that go beyond the scope of this study. Notwithstanding, it is worth noting that appropriate industrial and trade policies finely coordinated with other economic policies (including the macroeconomic ones) are necessary for boosting productivity and for changing this current regressive specialisation pattern into another characterised by diversification of Brazilian exports towards technologically sophisticated manufactured goods. This strategy could help put Brazil in a successful catching-up trajectory.

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Appendix 1. Trade indicators

A.1

Revealed Comparative Advantage Index (Balassa, 1965)

$$RCA = \frac{X_i^{BR}/X^{BR}}{X_i^W/X^W} \quad (A.1)$$

where X_i^{BR} corresponds to Brazilian exports of product i and X^W corresponds to total world exports.

A.2

Herfindal–Hrismann Index

$$HHI = \sum_{i=1}^n (X_i/X)^2 \quad (\text{A.2})$$

where X_i corresponds to exports of product i and X corresponds to total exports.

A.3

Intensive and extensive margins of trade (Hummels and Klenow, 2005)

$$IM = \frac{\sum_{j \ni i} X_j^{BR}}{\sum_{j \ni i} X_j^W} \quad (\text{A.3})$$

$$EM = \frac{\sum_{j \ni i} X_j^W}{\sum_i X_i^W} \quad (\text{A.4})$$

where j is the sub-set of i goods exported by Brazil (that can be named as the *country's relevant export goods*); X_j^{BR} corresponds to Brazilian exports of the sub-set of products j ; and X^W corresponds to total world exports (X_j^W is the world exports of product j and X_i^W is the total world exports). The IM corresponds to the market share of Brazil for its 'relevant goods j '. The EM is the share of j products in total world exports.

A.4

Intra-industry Trade Index (Grubel-Lloyd, 1971)

$$GLI = 1 - \frac{\sum_i |X_i - M_i|}{\sum_i |X_i + M_i|} \quad (\text{A.5})$$

where X_i and M_i correspond to a country's exports and imports of product i , respectively.

For avoiding aggregation bias, we employed the six-digit Harmonised System disaggregation (around 5,000 product lines). Yet, trade flows are multilateral (not geographically disaggregated).