Non-tradables in Brazilian economic history

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Abstract

Purpose – The purpose is to market a reinterpretation of Brazilian economic history highlighting the importance of non-tradable goods to understand major historical developments such as the lack of industrialization in the mining boom; the rise and contribution of industries to development in the early 20th century; indexation as hyperinflation in the late 20th century; growth and cycles in the early 21st century.

Design/methodology/approach – Section 2 introduces analytical perspectives on the relationship between non-tradables, transport costs and external shocks. Section 3 presents a historical overview of the gold and coffee cycles in the Brazilian economy, which highlights the crucial role played by transport costs in the genesis of industrialization. Thus, in a more precise way, industrialization was not an import substitution process but the substitution of non-tradables by the domestic tradable manufactures.

Findings – Section 4 shows that Brazilian statistical records and historiography disregard this characterization and, to that extent, underestimate economic growth in the primary export phase (1872–1920) and overestimate growth rates in the industrialization period (1920–1940). Section 5 shifts to the end of the 20th century to analyze the relationship between non-tradables, indexation and hyperinflation. Section 6 concludes with a brief discussion of the role played by the terms of trade and non-tradables in the unfolding of the 2014 economic crisis.

Originality/value – Distance from international markets and a continental geographic size made transport costs in Brazil historically prohibitive: the relevance of non-tradables in the Brazilian economic history. While the theme is not new, it seldom received proper attention in the historiography.

Keywords Brazil, History, Crisis, Industrialization, Hyperinflation, Non-tradables

Paper type Research paper

1. Introduction

The concept of non-tradables has a long tradition in economics. Ricardo (1821) and Mill (1968) already acknowledged it, but Cairnes (1873) was perhaps the first to explore its implications for Australia, later followed by Meade (1956), Salter (1959), Swan (1960) and Corden (1960). Thus, like parakeets, it looks like an Australian concept. Recent contributions came from Dornbusch, Fischer and Samuelson (1977), Dornbusch (1991), Eaton and Kortum (2002), Atkin and Donaldson (2015) and Donaldson (2015).

Distant from international markets and with a continental geographic size, Brazil is, in some way, a down-under country where transport costs were historically prohibitive, hence the relevance of non-tradables in the Brazilian economic history. While the theme is not new, it seldom received proper attention from the historiography [1].

The key contribution of the paper is to propose a reinterpretation of the Brazilian economic history that highlights the importance of transport costs and hence of non-tradable

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activities, paying special attention to their interplay with the export and tradable manufacturing activities.

In the basic model, reductions in transport cost increase the size of markets for tradable goods which, benefiting from economies of scale, outcompete non-tradable activities. This is the essence of the industrialization process. An export boom causes an exchange rate appreciation and – via income effects – an increased price of non-tradables. As a consequence, profits in tradable industries are doubly squeezed and, therefore, deindustrialization can take place. The combination of an export boom and a reduction of transport costs has ambiguous effects. Depending on the spatial patterns and the temporal sequences of events, manufacturing activities are promoted or repressed. Brazilian history illustrates these diverse possibilities.

Historically, the paper goes back to the 18th century when the mining boom and high transport cost precluded the rise of manufacturing despite the significant size of urban agglomerations. In the 19th century, railways reduced transport costs and led, at first, to the coffee boom inducing complementary non-tradable activities, and later on, in the 20th century, gave rise to enlarged market size, economies of scale, and the rise of manufacturing industries which substituted non-tradable activities. In this way, industrialization was partly a mere substitution of non-tradable goods and services, and not a net growth enhancing process as believed by the Brazilian economic history. Empirical evidence to this argument is an important empirical contribution of the paper. Thus, to circumvent the lack of Brazilian statistical records on non-tradable output, it uses the income approach instead of the output approach to estimate GDP in benchmark census years of 1872 and 1920. The new estimates show that the Brazilian economic growth is underestimated in the primary export phase (1872–1920) and overestimated in the industrialization period (1920–1940).

In the second half of the 20th century, manufacturing sectors were insulated from international competition by protectionist policies, thus allowing price indexation that fueled the hyperinflationary process. Finally, in the 21st century, transport cost reductions in frontier areas supported the commodity boom which led to exchange rate appreciation, increased relative price of non-tradables and deindustrialization.

The organization of the paper is as follows. Section 2 sketches analytical perspectives on the relationships between non-tradables, transport costs and external shocks. Section 3 presents overviews of the gold and coffee cycles in the Brazilian economy, highlighting the crucial role played by transport costs in the genesis of industrialization. Thus, industrialization was not solely an import substitution process but also the substitution of non-tradables by the domestic tradable manufactures. Section 4 shows that this characterization is disregarded by Brazilian statistical records and historiography, and, to that extent, economic growth tends to be underestimated in the primary export phase (1872–1920) and overestimated in the industrialization period (1920–1940). Section 5 shifts to the end of the 20th century to analyze the relationship between non-tradables, indexation and hyperinflation. Section 6 presents a brief discussion of the role played by the terms of trade and non-tradables in the unfolding of the 2014 economic crisis. Section 7 concludes wrapping up the main arguments.

2. Analytical perspectives

The rationales of non-tradables are transport costs or any kind of trade barrier that makes the export and import of certain goods unprofitable. The foundations are in distance, geographic obstacles, cultural differences and especially government taxation of trade (Anderson and Van Wincoop, 2004). Prices of non-tradables are, therefore, determined by domestic, when not local, conditions of supply and demand, while prices of tradable goods are determined in international markets.

To begin with, it is good to distinguish between tradables and non-tradables in the international and domestic sense. In internationally tradable sectors, the prices are set by international markets. The empirical characterization is the high share of imports and/or exports in the value of sectoral output. By this criterion, mining, agriculture, livestock, industry and wholesale trade are generally classified as tradable activities, while construction, public services and other services, including retail trade, as non-tradable activities (the Internet, however, makes retail increasingly tradable).

Domestic non-tradables are goods locally produced and consumed, and the prices are set by local conditions of supply and demand. By force, they are internationally non-tradable goods as well. Empirically, they are identified by the low levels of geographic concentration of production or employment (Jensen & Kletzer, 2006), aspects that have been historically associated with artisanal as opposed to manufacturing activities. Thus, it is reasonable to assume that, differently from manufacturing, the technologies of production of non-tradables were not subject to increasing return to scale.

Despite the isolation of non-tradable markets, external shocks, such as an export boom, increase – via income effects – the demand and the real exchange rate of the economy defined by the relative prices of non-tradable goods. This real exchange appreciation compresses the competitiveness and profitability of other tradable goods, thus leading to a reduction in their production, usually referred as the "deindustrialization" effect [2]. This deindustrialization is the early symptom of the "Dutch disease" which, in the long run, can result in the "plague of natural resources" that incapacitates sustained growth of the economy (Corden, 1984; Kouri, 1978; Aragón, Chuhan-Pole, & Land, 2015).

The causes of the export boom could be increase in international prices, discovery of natural resources (gold, "terras-roxas," Carajás iron, pre-salt oil, etc.) or technological innovations (railways, Embrapa's new cultivars and soil correction, etc.). Those factors are sometimes combined with the reduction of transport costs, which increasing the profitability of tradable goods, makes analytical results more complex and ambiguous.

Whatever the causes of the export boom, the rise of productivity and real wages in the export sector attracts workers from non-tradable sectors. The consequences are further appreciation of the real exchange rate and deindustrialization. The production of non-tradables, however, can decrease or increase (except when the export sector is an enclave and, therefore, the only impact on other sectors is through the income effect) [3].

Other consequences of the export boom are interregional or international immigration flows induced by the higher real wages (the "gold rush" effect via the labor market). Another possible outcome is social spending financed by the increased taxation of the export sector (the "Bolsa Família" effect via fiscal policies). At first, immigration increases the demand for non-tradables, but later on it can also increase the supply, and therefore can lead to both appreciation or depreciation of the real exchange rate. The production of tradables also increases, but it is possible to show that, with the increase in the expenditure on non-tradables, some de-industrialization will necessarily occur. That is, immigration is unable to reverse the negative effects of the export boom on the production of other tradables.

In the long run, the crucial issues are the effects of the export boom on capital accumulation and per capita income growth. Under simplified assumptions, it is possible to show that appreciation of the real exchange rate reduces the return on capital and, therefore, long-term investment and growth rates (Kouri, 1978). In more complex models, the results depend not only on the cause of the export boom but also on the conditions of supply and demand and, above all, on the substitutability between goods, as well as between factors of production (Eaton, 1987; Buffie, 1992).

Roughly summarizing, if the boom is caused by the discovery of natural resources and exports are relatively capital-intensive, per capita income will certainly increase in the long run (even though the capital stock may not). If the cause of the boom is export price, the

growth of per capita income in the long run depends not only on the greater capital intensity of exports, but also on the domestic demand conditions being such that exports are not a strong complement to non-tradables.

3. Historical overview

Transport costs, slavery and land abundance are the original sins of the Brazilian economic history, still in need of a proper consideration from the historiography [4]. Indeed, high transport costs constituted, since the beginnings of Portuguese colonization, one of the main obstacles to the economic development of the country. The geographic causes are to be found in the adverse combination of relief, climate, vegetation and hydrography, which made investment and operational costs in transportation infrastructure extremely expensive and historically prevented the economic integration of the country.

During the first two centuries, economic settlement was mainly restricted to the coastal strip making use of cabotage navigation with a few inroads by rivers or by oxcarts in plane areas. In the words of Friar Vicente Salvador, "like crabs, the Portuguese scratched the coast," and Friar Gaspar da Madre de Deus astutely observed that all goods produced in coastal areas could be profitably transported to Europe, while "transport costs for the goods produced in the backlands were so expensive that they would hardly reach the ports, and if they did, the farmers would not even consider to ship them at the prices they were paid at the ports" (Puntoni, 2004, p. 23, note 1).

Simple evidence of high transport cost is given by the fact that wheels were practically absent from long haul transportation in Brazil until the introduction of railroads in the mid-19th century. Wagons and oxcarts were viable only in local routes or in flatter areas of the South and Northeast regions. Furthermore, even horses were inadequate for the steep and rudimentary paths that traversed the Serra do Mar.

As a consequence, the transport of goods between the coastal areas and the central highlands was carried on the back of indigenous or African slaves. From São Paulo to Santos (approximately 70 km), a slave, with a 30 kg load, took four or five days for the round trip (Souza, 1958; Goulart, 1959; Monteiro, 1994; Dean, 1995; Austregésilo, 1950).

3.1 Gold

The introduction of mule troops from 1730 onward can be considered the first major technological innovation of land transportation in Brazil [5]. The historical coincidence of the discovery of gold in Minas Gerais with the decline of silver in Potosi reoriented the supply of mules of the Tucuman region to the central highlands of Brazil. For the next 150 years, mule troops dominated long-haul transport in Brazil, with important implications for the economic integration of the country.

Portuguese colonial policies reinforced the option for mules as mode of transportation. To reduce gold smuggling and tax evasion, fluvial routes along the São Francisco River were forbidden, making it practically compulsory to use the land routes where fiscal units were located. Long run consequences were the privileges given to the port of Rio de Janeiro in detriment of Recife and Salvador and the reduced feasibility of the economic settlement in the São Francisco Valley [6].

The economic rationale for the settlement of the highlands in the 18th century was the high profitability and specific values (value/weight) of precious minerals which implied negligible transport costs for the outlet of production but not for the provision of the necessities of the local population. The discovery of gold created unprecedented opportunities for income and wealth and a gigantic gold rush that attracted massive inflows of voluntary and enslaved immigrants from other areas of the country and across the

sea. The evidence available is that during the gold boom (1700–1750), around 600,000 enslaved Africans entered Brazil through the ports of Bahia and Rio de Janeiro, a considerable portion of them destined to the mining areas of the states of Minas Gerais, Goiás e Mato Grosso (Eltis, 2007). Thus, between free and enslaved, annual inflows were in the order of 15,000 immigrants.

The Dutch disease was immediately felt in a dramatic way. Due to the high price of minerals and prohibitive costs of transportation, increases in spending on non-tradables resulted in speculative price rises and chronic crises in the supply of foodstuffs. In 1703, prices in Ouro Preto were 10 to 30 times higher than in São Paulo. In this context, mule troops (and cattle herds by themselves) transported the tradable goods that alleviated supply crises and integrated the various regions of the country (Zemella and Ellis Junior, 1951; Ellis, 1958; Almeida, 1945).

In the long run, the profitability of mining relocated and reoriented the production of other tradables to the domestic market, sugar and related products in particular. For capital accumulation, however, the effect of the mining boom was restricted because of the predominance of labor-intensive technologies. Indeed, the essence and attractiveness of alluvial mining was to allow significant income gains with very little capital investment.

Throughout the 18th century, gold became increasingly scarce, demanding greater capital intensity in the extraction which induced the concentration of production and profits in a very small number of individuals and companies. For the economy at large, consequences were a drastic reduction in per capita income and the secular diaspora of the population and economic activities to the frontier regions. Naturally, these processes took place with varying intensity in time and space (Martins, 2018; Bergad, 2006).

With the depletion of precious minerals, the problem of high transport costs (aggravated by the heavy taxation of interprovincial exports) came to the forefront, imposing severe restrictions on trade between different localities. As a consequence, the region became an archipelago of self-sufficient and diversified economies, specialized in the production of non-tradable goods and services. The rise and fall of tradability in mining regions is shown in Figure 1 which compares the rise and fall of gold production with an index of tradability of the economy measured by quotient of the values of entry fees, charged on imports and tithes, charged on local activities (Maxwell, 2004; Noya Pinto, 1979; Martins, 2018).

Protected from imports by the high transport costs but unable to export, local economies had limited potential markets and possibilities for production specialization. Therefore, notwithstanding the preexistence of urban markets of significant size, they were unable to overcome the fixed cost barriers that allowed the exploitation of economies of scale and industrialization. As a consequence, production was restricted to artisanal production of non-tradables which, to minimize transport costs, tend to concentrate close to local urban
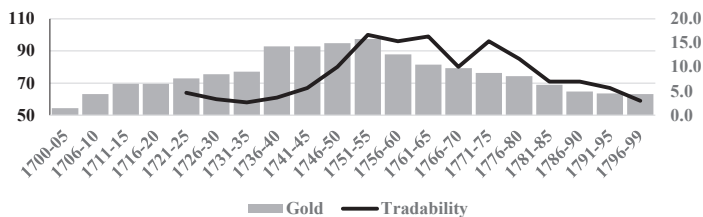
Source(s): Noya Pinto (1979), Maxwell (1973), Martins (2018)

Figure 1.
Gold extraction (ton/
year, right) and
tradability index
(export taxes/local
taxes, left) in Minas
Gerais, 1700–1799

markets or to disperse in the distant self-sufficient agricultural establishments (Krugman, 1991a, 1991b; Lee, 1994, 2000) [7].

In the long run, the economy of the central highlands grew extensively, without significant increases in the scales of production, productivity levels and per capita income. The accumulation and transmission of wealth basically took place through the appropriation of land in the agricultural frontier and the acquisition of slaves (Martins, 2018).

3.2 Coffee

In the mid-19th century, the coffee boom broke with the extensive pattern of growth. The origin of the boom was the expansion of international demand which, after 1860, raised the international price of coffee (Absell, 2020). The export boom was reinforced by the reduction in transport costs provided by the railroads, which opened for cultivation the vast areas of *terra roxa* in the western areas of São Paulo (Matos, 1974). Finally, increases in productivity and income attracted massive domestic inflows of enslaved and free immigrants which, from 1885 onward, were intensified by the international inflows (Milliet, 1982).

Different from the gold cycle, the domestic supply and demand conditions for coffee were conducive to capital accumulation and per capita income growth. On the supply side, coffee production was capital-intensive, requiring huge investments in the long maturity coffee plantations and in railroads with significant spillovers to other activities. On the demand side, coffee accounted for only a small portion of the family budget and was a very weak complement to the consumption of non-tradables. Increases in the price of coffee, therefore, had no substantial impacts on the consumption levels of the population [8].
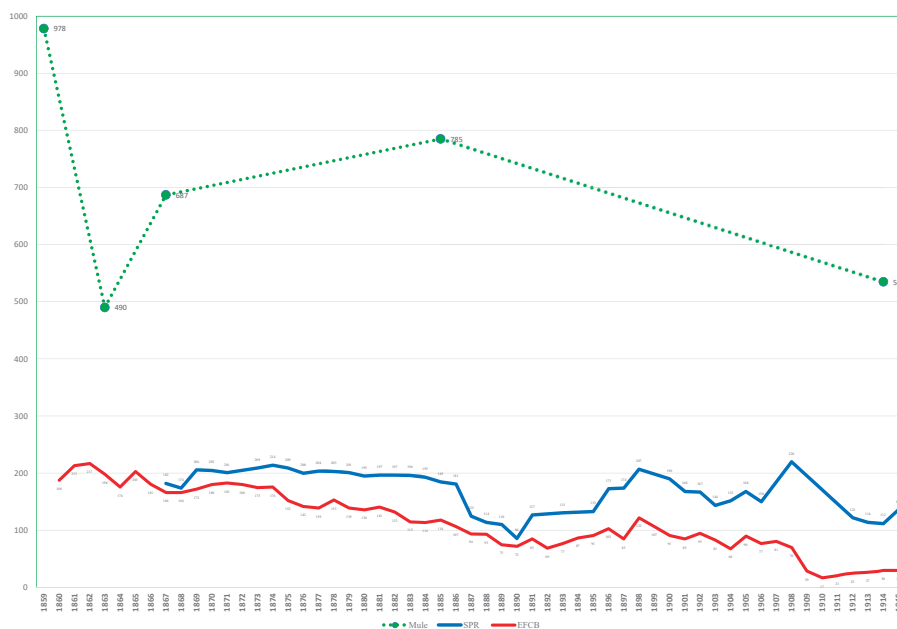
Due to high transport costs, the multiplier effects of income generated by exports, as well as of investments in transport infrastructure and expenditures with immigrants, were to a large extent directed toward the acquisition of non-tradables that were consumed in the form of food, furniture, clothing, textiles and, in the sphere of production, as craft products and services in the sectors of transport, construction, tools and machinery.

Spatial consequences were a significant growth of urban agglomerations dedicated to diversified non-tradable artisanal activities oriented toward local markets. In order to minimize transport costs, these activities tended to be located in the proximity of urban markets. Thus, differently from the classic pattern of development, the urbanization process in Brazil was premature in relation to industrialization. And industrialization, when it occurred, replaced, in addition to rural artisanal activities, those non-tradable urban activities that supplied the local markets (Venables, 2017; Gollin, Jedwab, & Vollrath, 2016; Haggblade, Hammer, & Hazell, 1991, Deutsch, 1994).

Since non-tradables did not cross tax barriers, activities related to their production and commercialization did not generate statistical records. For this reason, despite their economic importance, the growth of non-tradable activities is practically ignored in the product and income estimates for the primary export period which, to that extent, are significantly underestimated, as we try to show in the next section.

The reduction of transport costs brought by the railroads was a fundamental determinant of the economic growth in the coffee cycle. Compared to mule troops in the same routes, the value of unit freight (réis/ton.km) in railroads was, approximately, 80% smaller (Ottoni, 1938; Summerhill, 2003). Evidence is provided in Figure 2 which compares unit freight rates (réis/ton.km) for mule troops and for the two main railroads in selected years of the period 1859–1928. Mule freight rates observations are sparse and fluctuated depending on the product, the route, the price of corn and also on the competition of rail freights which declined steadily during the period in case.

The reduction in transport costs enabled the expansion of the agricultural frontier and thus sustained the boom in coffee exports and the appreciation of the real exchange rate.

Source(s): Reis (2019)

Outside the coffee sector, the real exchange rate appreciation caused the stagnation of exports of cotton and sugar in the Northeast, and of jerked beef in the South (Leff, 1984, 1991; Pereira, 2016, 2018). Furthermore, the reduction of transport costs contributed to the integration of domestic markets, increasing the competitiveness of tradables and leading to the geographic specialization of some regions in those activities to the detriment of non-tradables. In Minas Gerais, for example, statistics on interprovincial exports show growing specialization in coffee and cattle (Restitutti, 2006; Martins, 2018). In contrast, in the Northeast, the effects of railroads were less significant and more delayed, which may be explained, in part, by the availability of alternative modes of transportation such as oxcarts and rivers and also by the agronomic inability to reorient production and export patterns (Milet, 1881; Eisenberg, 1974; Denslow, 1975; Leff, 1991).

3.3 Industrialization

The most important consequence of the reduction in transport costs was the emergence of potential markets with sufficient size to reap the benefits of economies of scale that gave rise to a domestic manufacturing industry (Krugman, 1991a, b; Krugman & Venables, 1995). Due to their strategic positions in the railway system, the cities of Rio de Janeiro and, above all, São Paulo were the main beneficiaries of the integration of domestic markets, and as a consequence assumed the leadership of the industrialization process. But other locations where railway stations were installed also benefited by attracting manufacturing industries that, in the long run, ensured higher growth of population, productivity and income per capita (Prado, 1963; Cano, 1977; Summerhill, 2003, Monastério & Reis, 2008; Reis, 2014).

The fuel engine vehicles and the road system introduced in the first decades of the 20th century were other remarkable transport innovations with significant impacts on both the

reduction of transport and distribution costs as well as on the expansion and variegation of the transportation network in Brazil (Brasil, 1929).

Railroads were originally built to transport coffee, and as such they long preceded the rise of manufacturing activities. Thus, it is reasonable to assume that the reduction of transport costs they brought was exogenous to and therefore caused industrialization. It is also reasonable to assume that later on, the fuel vehicle roads made gradual improvements in the old mule troop road system by reducing logistic and distribution costs to the various local markets. As a consequence, they increased the profitability and competitiveness of manufacturing activities, with no significant impact on their original location (Monasterio & Reis, 2008).

The early industrialization process in Brazil is traditionally viewed as the substitution of imported manufactures by the domestic production of the same goods. The stimulus to the process is usually attributed to the commercial protection provided by tariffs and exchange rates, which allowed higher price and profitability to the domestic production of manufactured goods (Fishlow, 1972; Luz & Costa, 1975; Carone, 1977; Tavares, 2000).

The emphasis on the import substitution process is mainly due to the statistical records on foreign trade and manufactured output that did not exist for non-tradable output (Tavares, 2000). It should be noted, however, that the imitation of imported manufactures and their production processes constituted the basic mechanism of the technological innovation process (Gries & Heinrich, 2004). Thus, it was as a *blue print* for product and process innovations that import substitution played a crucial role in industrialization – not as a source of demand that came largely from preexisting demand for artisanal non-tradables and not from imported manufactures [9].

In this way, the hypothesis proposed here is that imported manufactured goods were close substitutes for non-tradable industrial products which, "naturally" protected by transport costs, were produced in an artisanal way without significant economies of scale in dispersed locations in the country. The stimulus for the domestic production of manufactured goods came from two sources: first, the imposition of tariffs which reduced competition from imported products, and second, the reduction of transport costs which reduced the "natural" competitiveness of locally produced non-tradables.

Industrialization replaced non-tradable goods produced in a traditional and artisanal way for local markets, with tradable manufactures produced with economies of scale in a few locations to supply substantial parts of the regional or national markets. Therefore, *à la Krugman*, it is mainly a process of spatial concentration of production giving rise to patterns of center and periphery among localities or regions of the country (Krugman, 1991a, 1991b; Krugman & Venables, 1995). At the root of the process was the reduction of transport costs which allowed the exploitation of economies of scale in the production of domestic tradables which, in turn, allowed them to outcompete and replace the production of non-tradables.

Thus, at least until the mid-20th century, industrialization in Brazil reproduced the classic pattern of industrialization in which manufacturing activities replaced preexisting artisanal activities. A classic example of this is the substitution of products from the artisanal activities of spinners and weavers for textile manufactures. Or else, in civil construction, replacing locally produced adobe and wood parts with products from manufactured products of cement, clay and metallurgical industry. Other examples occur in several other sectors and perhaps even more markedly and intensely in artisanal production of intermediate products (nails, tools, etc.) and capital goods that are substituted by manufactured products in the machinery and equipment sectors.

More than the substitution of imports, industrialization implied the substitution of non-tradables and, consequently, reduced the growth rates (if not the production levels) of those activities and sectors. Ignoring the effects of this process of substitution of non-tradables that occurred *in tandem* with industrialization obviously implies

overestimating the growth rates of the product of the industrial sectors in the period in question, since non-tradables represented a significant portion of production and expenditure, and, most likely, they had lower (if not negative) growth rates [10].

In addition to the revised estimation of growth, the new approach throws new light on the distribution of benefits of the industrialization process. In this way, it shows that industrialization had both winners and losers among productive sectors, social segments, regions and locations of the country. In contrast, in the import substitution approach, losses were basically restricted to foreign exporters, and, therefore, from a nationalist perspective there were only winners in the industrialization process. Implicitly, this was perhaps one of the strongest ideological underpinnings of the protectionist nationalism that guided the Brazilian economic policies of the period.

Finally, the new perspective on industrialization also throws new light to the identification of the determinants of industrialization since it is reasonable to assume that a significant part of the effects usually attributed to tariffs and trade policies were, in fact, the result of transportation cost reductions.

The relative importance of import substitution vis-à-vis non-tradable substitution as a source of industrialization depends, of course, on the effects of tariff and transportation cost on the demand and supply of tradables (industrialized exports and imports), which ultimately depend on the elasticities of substitution in consumption and production. The higher the elasticity of substitution in consumption between tradables and non-tradables, the smaller the effect of tariffs and the larger the effect of the reduction in transportation costs (Irwin, 2007).

The distinction between non-tradables at the domestic and international levels is a crucial aspect of the analysis. On the one hand, the decline of transport costs reduced the competitiveness of local non-tradables and, on the other, the imposition of high tariffs and other trade barriers reduced the competitiveness of imported manufactures, therefore expanding the set of internationally non-tradables in the Brazilian industry (Dornbusch *et al.*, 1977). In the long run, the international isolation of the manufacturing industry would bring severe adverse consequences in terms of its efficiency and growth performance, and also for the persistence of the inflationary process as discussed below in Section 4.

4. GDP growth, 1872–1920 and 1920–1940

Though Brazilian historiography highlights the importance of non-tradable activities, output produced by those activities is ignored in the historical estimates of GDP and income. The reasons are the intrinsic difficulties in measuring outputs and inputs of non-tradable goods and services. Produced in small, artisanal and informal establishments to be sold in local markets, they were not transported, did not cross tax barriers and, most of the time, evaded local taxation, thus generating no statistical records whatsoever.

For the historical measurement of GDP growth, the lack of statistical record on non-tradable activities had, as major consequences, to underestimate growth rates in the period associated with primary exports (1872–1920) and overestimate growth rates in the period usually associated with import substitution (1920–1940). For the primary export phase, there is no output data whatsoever. GDP estimates are usually based on the available statistical records of export and import, taxes and money supply which give "excessive" weight to the monetized, formalized and tradable activities of the economy (Contador & Haddad, 1975; Goldsmith, 1986; Suzigan, 1986; Madison, 2001; Tômbola & Sampaio, 2013). The GDP measures are, on the one hand, very sensitive to fluctuation of prices and volumes of exports and imports and, on the other, incapable of capturing the multiplier and accelerator effects on the production of non-tradable goods and services triggered by exports, infrastructure investments and immigration flows. In this way, it should be recalled that the

income elasticity of non-tradables is supposed to be greater than unity since the subsistence basket of goods was basically composed of agricultural tradables (Gollin *et al.*, 2016, p. 41).

For the import substitution period, industrial GDP estimates are based on output of the formal activities and establishments for which annual statistics were collected (Villela & Suzigan, 1975; Haddad, 1978; Suzigan, 1986; Goldsmith, 1986; Abreu & Verner, 1997; Madison, 2001; Tômbola & Sampaio, 2013). However, industrialization in this period took place mainly by the introduction of product and process innovations that displaced and substituted the artisanal production of non-tradable goods and services for the local markets. The sectoral and spatial displacement of non-tradables resulted in a reduction of the growth rates (when not of the levels) of non-tradable output that, definitely, should be accounted for in the overall growth rates of the economy. If the displacement effect is ignored, GDP growth rates will be overestimated. Furthermore, the growth of productivity would be underestimated by not computing the increase in productivity brought by the substitution of the less productive non-tradables by the more productive tradables, or what is usually called the "creative destruction" of the industrialization process [11].

To circumvent the lack of historical data on the production of non-tradables, the methodology proposed is to estimate GDP by the income side based on the data on labor force, employment and wages available in the 1872 and 1920 censuses as well as other sources (Gallman, 1966, Gallman and Weiss, 1969). Based on the GDP estimates, it is possible to calculate new growth trends for the periods 1870–1920 and 1920–1940 [12].

To be more specific, GDP estimates for 1872 are obtained from an econometric model that uses wages of municipal civil servants in 1876 as a "proxy" of labor productivity, which is explained by the characteristics of the demographic structure (sex, age, professional occupation, slave or free, etc.) of each municipality available in the 1872 census (Reis, 2014). Multiplied by the labor force income or GDP obtained in this way includes both tradable and non-tradable activities.
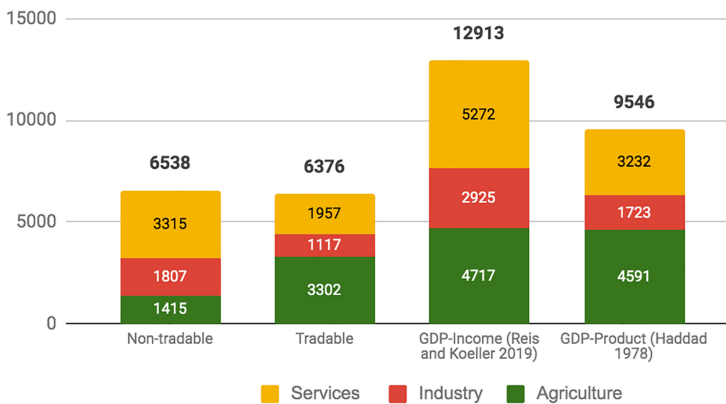
For 1920, census data on labor force, employment, occupation and wages are available, thus allowing a more precise estimation of income and output from tradable and non-tradable activities (Reis & Koeller, 2019). The standard procedure adopted to estimate non-tradable output was to multiply the representative wage of different sectors and/or occupations by the labor force in non-tradable activities of the respective sector and/or occupation. Labor force is calculated as the difference between those who declared to work in the sector and/or occupation and those employed in the formal establishments of the respective sector and/or occupation (Reis & Koeller, 2019). Implicit assumptions are, first, non-tradable activities employ only labor and, therefore, value added is equal to the wage bill and, second, labor mobility ensures equality of wages for the same occupational categories in tradable and non-tradable activities.

In agriculture, the economic census did not record employment, and therefore the output of non-tradables is estimated crops of beans, corn, cassava and bananas, which represented approximately 30% of the value of agricultural production in 1920. The industrial census counted 313,000 workers, while the demographic census counted 1,189,000 people who declared themselves occupied in industrial activities. Services, on the other hand, were not included in the census, despite the fact that the demographic census counted more than 2 million people in the labor force of these sectors. In these two sectors, we considered as representative of non-tradable activities the wages of undetermined or indefinite occupations in industry (which are the lowest), or else the rural wages of related activities such as, for example, cart drivers for transport activities and bricklayers for civil construction.

Figure 3 shows that, adopting the above procedures, the estimate of the value of the GDP in 1920 is 36% higher than that obtained from the product side (Haddad, 1978). Non-tradables account for 50% of the GDP, and tradables for the other 50% [13]. In sectoral terms, there is an increase in the participation of industry and, above all, services. In regional terms, the new

estimates increase the share of rural areas and small towns in GDP. Thus, including non-tradables, the share of industrial and service activities increase but become more dispersed. This is reasonable since industrialization is a process of spatial concentration of production in which small-scale and spatially dispersed craft services are replaced by tradable manufactured goods produced on a large scale in a few localities.

Table 1 and Figure 4 show the GDP estimates in real terms (at prices of 1920). The estimates of GDP by the income side imply a 0.7% p.a. increase in the average rate for the primary export period from 1872 to 1920, and a 1.6% p.a. reduction for the import substitution period from 1920 to 1940. This is reasonable since 1872 estimates were made using the income approach (Reis, 2014) and are significantly lower than those obtained using
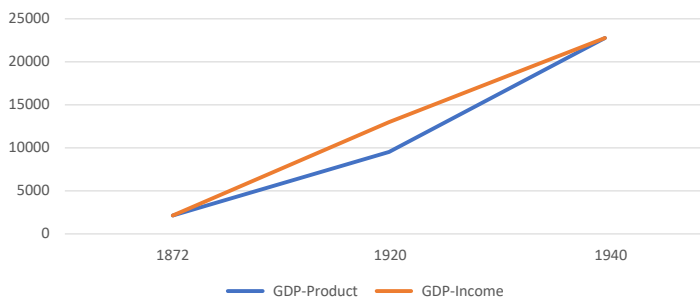

Figure 3.
Brazil: GDP (tradable
+ non-tradable) by the
income approach in
1920 (contos de réis) for
agriculture (green),
services (red) and
industry (orange)
compared to GDP by
the product approach

Source(s): Reis and Koeller (2019)

Table 1.
Income and product
estimates of real GDP
(contos de réis, 1920
prices) in 1872, 1920
and 1940, and real
growth rates (% p.a.) in
1872–1920 and
1920–1940

Year	GDP-product	GDP-income	Growth-product	Growth-income
1872	2,167	2,170		
1920	9,546	12,987	3.14%	3.80%
1940	22,777	22,777	4.44%	2.85%

Source(s): Author's work based upon Reis and Koeller (2019)

Figure 4.
Income and product
estimates of real GDP
(contos de réis in 1920
prices) for 1872, 1920

Source(s): Reis and Koeller (2019)

the product approach (Contador & Haddad, 1975; Tômbola and Sampaio, 2013; Goldsmith, 1986; Madison, 2001). For 1939, estimates made by the product approach were used (FGV, 1951; Zerkowski, 1982; Haddad, 1978), assuming that the production of non-tradable production was properly considered in those estimates.

The higher growth in the primary export period seems plausible given the profuse historical evidence on accelerated expansion of coffee growing, investments in port and railroad infrastructure, international immigration and the beginning of the industrialization process, developments that clash with the slow growth usually estimated for the period (Furtado, 1971, Contador & Haddad, 1975; Goldsmith, 1986, Madison, 2001, Tô mbola and Sampaio, 2013; Reis, 2008).

During the early industrialization period, the lower GDP growth also seems plausible in view of the neglect of non-tradable goods and services that certainly grew at much lower rates than tradables. Evidence in this way is given by the product index of civil construction based on domestic consumption statistics of cement (Villela & Suzigan, 1975; Abreu & Verner, 1997) when, as late as in the 1940 census, more than 60% of Brazilian residences were made of mud or wood which were rapidly being substituted by cement. Similar substitution problems occur, for example, with steel or even with machinery and equipment for the manufacturing industry as estimated by the index of imported machinery for the transformation industry (Suzigan, 1986). Evidence of overestimated growth after 1947 is found in Bacha, Tombolo and Versiani (2022).

5. Non-tradables, indexation and hyperinflation
From industrialization we move to hyperinflation in the second half of the 20th century. The analytical focus shifts to the international non-tradables created by tariff and exchange rate policies and, in particular, to how the monopoly power provided by these trade barriers conditioned the Brazilian inflationary process. In the backstage, the terms of trade continue to play a decisive role in the cycles of activity and inflation.

Figure 5 shows that in the second half of the 20th century, the Brazilian economy was one of the most protected and closed to imports in the modern world. By the mid-1960s, the value of imports represented only 5% of GDP, leaving no doubt as to the disproportionate importance of non-tradables in the economy. Little exposed to foreign competition, non-tradables producers had monopoly power and could raise their prices without losses of market share and of production levels (Coes, 1995, p. 128; Sachs, 1990). Given the high share of non-tradables in aggregate expenditure and output, the effects of the exchange rate on prices and wages were rather limited. Moreover, since prices adjusted faster than wages, inflation supported profits, investment and growth rates of these sectors (see Figure 6).

In this context, monetary policy became compliant with inflation, and the public deficit was systematically financed by printing money. The greater the monopoly power in the non-tradables sector, the greater the expansion of output caused by monetary expansion and, therefore, the greater the tolerance to inflation (Romer, 1993; Lane, 1997; Bowdler & Malik, 2005, Daniels and VanHoose, 2006). Therefore, the highly protected economy constitutes, along with inequality in income distribution, one of the foundations of fiscal irresponsibility and populism whose consequences were increasing trends in the level and volatility of inflation rates.

In an attempt to neutralize the financial distortions caused by the inflationary process, from 1964 onward, the country implemented one of the most perfect price indexation systems in world economic history. Gradually, over the course of a decade, rules for readjusting basic prices according to past inflation rates were implemented, first applying to interest rates, then to exchange rates and finally to wages and rents. The small importance of tradables in the basket of consumer goods made the economy immune to the currency crises and the dollarization process, which are the classic triggers of hyperinflation [14].
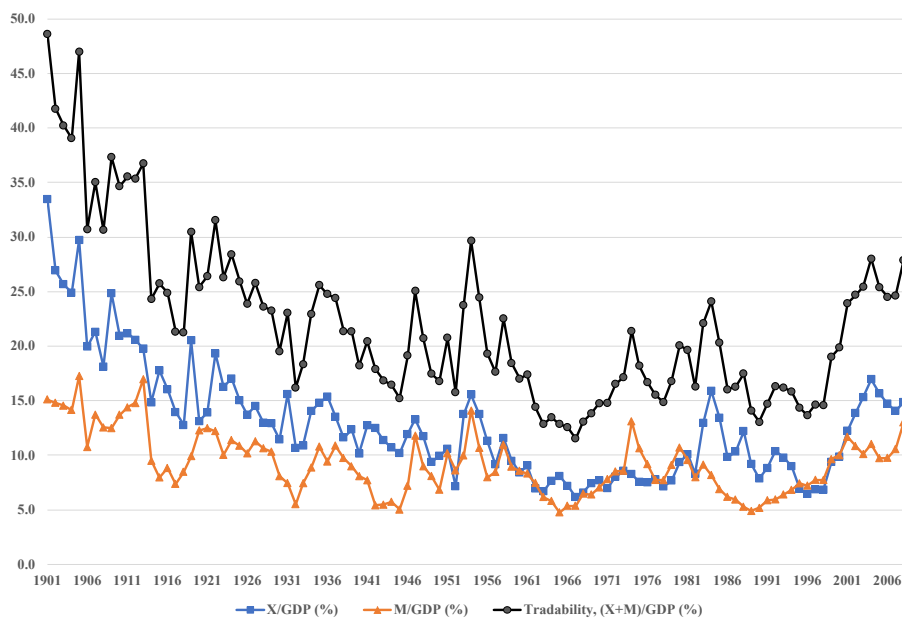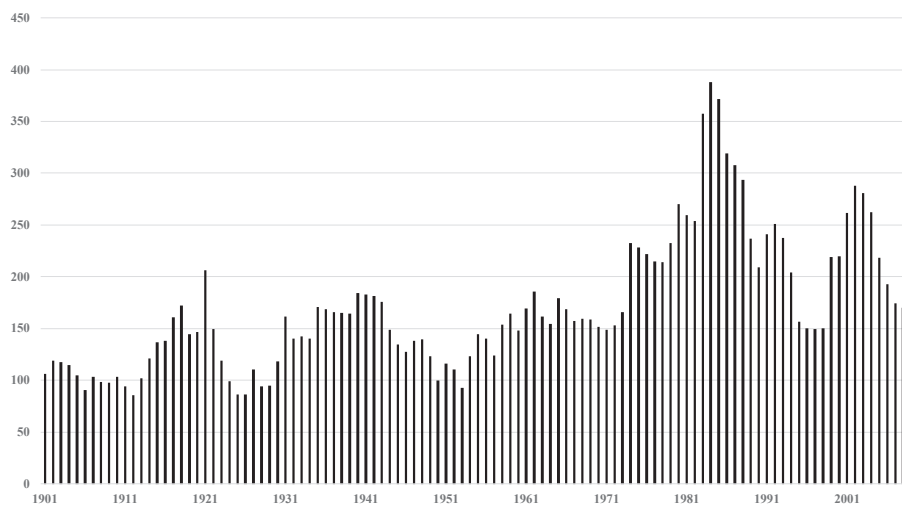
Source(s): Malan 1977, p.382 and author estimates

Naturally, as inflation increased, readjustment lags of basic prices became shorter. The inflationary process became explosive, tending inexorably to hyperinflation. The indexation system reached its peak in the mid-1970s when the recontracting terms for financial applications started to be made on a daily period. Inflation rates (implicit GDP deflator) rose from 19% p.a. in the 1950s, to 40% p.a. in the 1960s and 1970s, to 330% p.a. in the 1980s and 764% p.a. in the first half of the 1990s.

The process of inflation stabilization was long and painful. Showing the other face of the coin, in a closed economy the dollar was not dominant as a medium of exchange or unit of account, except for transactions in the asset markets. Thus, fixing of the nominal exchange rate, or the so-called exchange rate anchor, a classic instrument of stabilization policies, was unable to guarantee price stabilization because it did not restrain price and wage adjustments in the non-tradable sectors that were not exposed to the competition from imported products.

The inescapable strategy for stabilizing inflation was therefore to try to "freeze" prices and wages in the non-tradable sectors at their equilibrium levels to prevent attempts to recompose relative prices from causing the resurgence of inflation. To accommodate the remaining imbalances and contain inflationary pressures, it was necessary to either reduce domestic demand via fiscal contraction or expand domestic supply via increases of the trade deficit and imports. The technical and political difficulties in overcoming these challenges were evidenced by the resounding failures of pre-fixation in 1980, as well as of the Cruzado, Bresser and Verão plans in the second half of the decade [15].

The ingenious strategy of the Real Plan, in December 1993, was to reduce the fiscal deficit in advance and, to further mitigate the imbalances in relative prices, to index all prices and wages to a reference unit of values (URV) which became, in June 1994, the new monetary unit called Real. But a good part of the success of this strategy was due, in the short term, to the virtuous pre-electoral context in which businessmen and workers restricted their demands for prices and wages recomposition in order to avoid harming the prospects of their respective candidates (namely, Cardoso and Lula) in the presidential elections held in October 1994.

In the medium term, the exchange rate bonanza brought about by improvements in terms of trade and generous external financing conditions allowed the adoption of an exchange rate anchor that stabilized prices at the expense of unsustainable external deficits and interest rates in the long run [16]. Figure 7 shows that the exchange rate anchor caused a strong appreciation of the real exchange rate that compressed the profitability and reduced tradable output, causing deindustrialization and high unemployment rates. The interruption of external financing flows led to the exchange rate crisis of 1999, which culminated with a depreciation of the Real against the US dollar of 100%, approximately.

6. Non-tradables and the recent crises
The way out of the 1999 crisis was through the adoption of a flexible exchange rate regime coupled to the fixing of basic interest rates to achieve pre-announced inflation targets.

Figure 7.
Brazil: Real exchange
rate index (non-
tradable prices/
tradable prices,
1995.01 = 100), 1992.01
to 1919.11
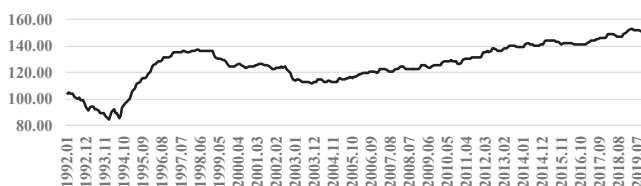
Source(s): Ipeadata

The control of the public deficit would ensure a sustainable trajectory for the public debt. Per se, this macroeconomic tripod was unable to determine the level of economic activity and, therefore, depended on favorable external conditions to sustain acceptable levels of unemployment and growth rates (Oreiro & D'Agostini 2016).

In commodity-exporting countries, macroeconomic performance shows strong and increasing correlation with terms of trade, which are also negatively associated with lower spreads in international interest rates for these countries (Blattman, Hwang, & Williamson, 2003; Drechsel, McLeay, & Tenreyro, 2019). The other notable empirical regularity in recent decades is the shift in demand toward non-tradables and services in particular, which led to the real exchange rate depreciation and the deindustrialization of the economy (Guerra-Salas, 2018; De Gregorio, Giovannini, & Wolf, 1994).

Figure 8 shows the correlation between GDP growth and changes in the terms of trade in the Brazilian case (Cardoso & Teles, 2010). Given the size of the domestic sector, this is perhaps a paradoxical finding partly explained by the deficiencies in transport infrastructure and the lack of integration and competitiveness of domestic markets (Garcia-Escribano, Goes, & Karpowicz, 2015; Dix-Carneiro & Kovak, 2017; Góes & Matheson, 2017) [17]. Under these conditions, the stimuli for technological innovation and increased productivity are restricted to commodity-producing sectors (iron ore, soybean and meat) where the country has comparative advantages.

The improvement in terms of trade and the export growth associated with the super boom commodities in the 2003–2012 period were fundamental to the success of the macroeconomic tripod. On the other hand, starting in 2012, the deterioration in the terms of trade initiated one of the most severe economic crises in the Brazilian economic history.

Starting in 2003, driven by China, the commodity export boom appreciated the exchange rate, dampening inflationary pressures. More expensive exports and cheaper imports allowed income and expenditure to grow more than output, that is, more consumption with less effort. As international prices are given, higher income and spending were transmitted to consumption and, therefore, to the prices of non-tradables, in particular services, which significantly reduced both unemployment rate and the competitiveness of the economy.

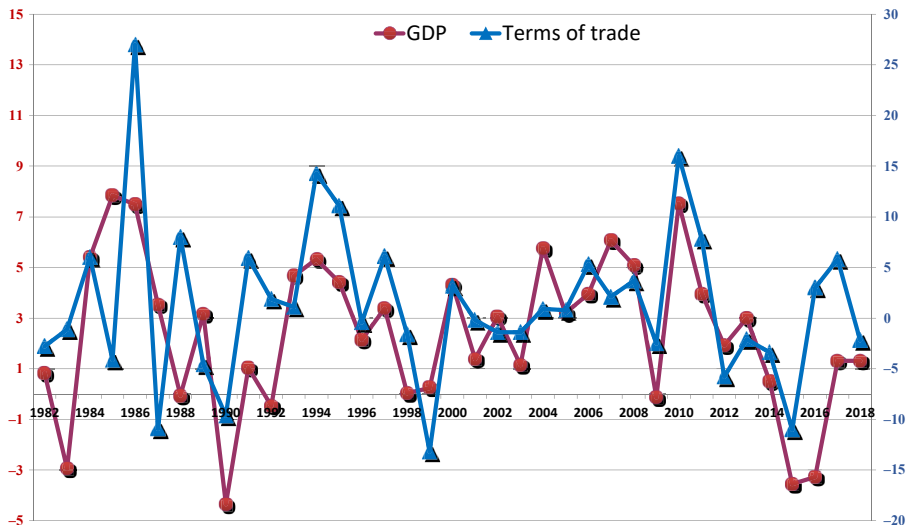Manufacturing Industry value added (% GDP)
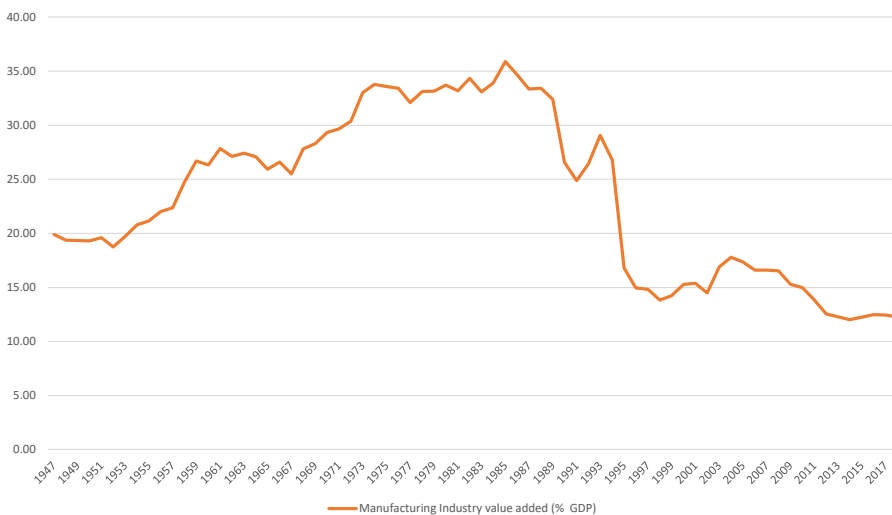
Figure 8.
Brazil: Change in terms
of trade and real
growth of GDP (% p.a.),
1980–2018

This growth pattern based on non-tradables and services resulted, in the labor market, in substantial increases in demand and wages for low-skilled labor, thereby significantly reducing inequality in income distribution (Messina & Silva, 2016; Benguria, Saffie, & Urzua, 2017; Guerra-Salas, 2018). Improved terms of trade also allowed tax revenues to increase, thus enabling significant increases in social transfers and the real minimum wage, and further contributing to the reduction in inequality of income distribution (Epifani & Gancia, 2009).

Figures 7 and 9 show that the real appreciation of the Real with the increase in the relative prices of non-tradables brought substantial losses to the external competitiveness and the compression of profitability and output of tradables, in particular of the manufacturing industries. These effects were, to a certain extent, softened by the higher increase in aggregate spending that, naturally, was also transmitted to tradables. In addition, "protectionist" policies implemented for specific sectors but with flexible exchange rates proved ineffective and inefficient to the extent that they transferred the burden of exchange rate appreciation to other tradable sectors (Corden, 2012). Aggregate demand was also sustained by cyclical effects and institutional innovations introduced in credit policies, both effects exacerbated by subsidized credit provided by state-owned banks. From 2005 to 2014, household debt increased from 0.10 to 0.25 of GDP (Garber, Mian, Ponticelli, & Sufi, 2019).

The drastic deterioration in the terms of trade in 2014 led to the sharp economic recession that provided the political conditions for the 2016 parliamentary coup. The compression of income and the rise in interest with high debt levels caused a drastic reduction in household consumption. Growth retraction brought a substantial increase in unemployment rates and a cyclical reversion to the declining trend of the inequality of income distribution.

The macroeconomic policies implemented after the 2016 coup sought to increase competitiveness by reducing the cost of labor – directly, by the eradication of labor and social security charges and rights, and indirectly, by the fiscal adjustment process implemented through the public spending ceiling which, seeking to maintain the public debt, reduced the "excess" demand for non-tradables. In this way, wage and price pressures in these sectors

Figure 9.
Brazil: Share (%) of the manufacturing industry in GDP, 1947–2018

Source(s): Reis (2016)

were dampened and the real exchange rate devalued. The reduction in capital inflows due to lower interest rates in the economy tended to further devalue the real exchange rate.

7. Conclusion

The purpose of the paper is to highlight the importance of transport costs and non-tradable activities in the Brazilian economic history. Up to the 19th century, high transport costs impeded tradable manufacturing activities which had minimum production size requirements. The economy was indeed an archipelago of self-sufficient localities specialized in non-tradable activities. By the end of the century, railways reduced transport costs, thus expanding market sizes and making profitable manufacturing technologies characterized by economies of scale. Non-tradable activities producing for local markets were outcompeted. As a consequence, they tended to grow slower or shrink, trends that were hardly captured by Brazilian statistical records and economic history. Adopting an income approach instead of an output approach to estimate GDP, it is possible to show that, during the early industrialization process, economic growth was indeed much slower than statistically recorded.

In the mid-20th century, trade protection of manufacturing activities made them increasingly non-tradable in the international perspective. The consequence was an economy prone to indexation and hyperinflation. In the late 20th century, as part of the anti-inflationary policies, the economy opened to trade and, at the same time, new roads reduced transport costs in the economic frontier of the country, thus reinforcing comparative advantages of the country in agriculture and mining. Finally, in the 21st century, the decline of transport costs in frontier regions supported the commodity boom which caused exchange rate appreciation and the rise of non-tradable relative prices, thus doubly compressing the profitability of manufacturing activities and causing deindustrialization.

Notes

1. In the Brazilian economic historiography, an extensive literature (Schwartz, 2001, Ferlini, 1988, Caldeira, 2017, Castro, 1971, Martins, 2018, Linhares and Silva, 1999, Cardoso, 1979, among others) criticizes the primary export paradigm for neglecting the production activities oriented toward the domestic markets. The criticism, however, does not fully recognize the implications of the non-tradable nature of these activities. Inspiring counterpoints are Leff's (1984, 1991) and, in a broader perspective, Hicks' (1969) classical analysis of the role of markets in the rise of capitalism.

2. Deindustrialization is an imprecise word since tradables can be either industrial or agricultural goods.

3. Corden (1984) shows that results may seem "paradoxical" when, in addition to labor, we suppose another mobile factor, say capital. The boom in exports reduces the availability of work, therefore leading to devaluation of the real exchange rate and a proto-industrialization if the tradable sectors are intensive in capital. When the employment of capital is restricted to the tradable sectors, more capital-intensive subsectors may expand even if the tradable sector as a whole contracts.

4. It is noticeable that in Furtado (1971) the words "transport costs" are mentioned only three times. This paucity is repeated in more recent analysis (Cano, 1977; Versiani & Suzigan, 1990). The counterpoints are Leff (1991), Ellis (1958) and Summerhill (2003).

5. Compared to slaves, mules moved faster (3 to 4 leagues per day) and had 4 to 5 times more load capacity. Compared to horses, mules have shorter legs, more arched vertebral column, greater lung capacity, more steady speed and greater restraint in water and food intake. Together, those advantages provide greater muscle resistance, load capacity and a longer productive life, especially on steep routes like those of the Serra do Mar.

6. The hypothesis that the choice of the Caminho Novo was the consequence of a historical path dependence created by the colonial policies despite the lower transport costs of the navigation

routes through the São Francisco (Moog, 1955; Machado, 2002) still needs convincing empirical evidence.

7. Evidence on concentration of artisanal production can be found in the 1872 census data on the distribution of professional activities at parish level. Slaves and ex-slaves were predominant in those activities.

8. It is interesting to contrast with Argentina, where exports (wheat and meat) are important components of wage earners' consumption basket, thus implying trade-offs and sharper conflicts between external balance and price stability (Diaz Alejandro, 1966; Corden, 1984).

9. Estimates of the coefficient of import penetration (value of imports/value added) of the manufacturing sector, including non-tradables, can provide empirical evidence for this hypothesis.

10. It is interesting to recall that the issues of spatial displacement of production and substitution versus growth of output is at the very heart of the classical analyses of the effects of the introduction of railroads in the 19th-century US economy which gave birth to both the new economic history and the cliometric revolution (Fogel, 1964; Fishlow, 1965; Redding & Rossi-Hansberg, 2017).

11. If the productivity in tradable/manufacturing sectors is higher than in the non-tradable/artisanal sectors, the substitution of non-tradables by tradables would necessarily bring productivity growth.

12. Other estimates of GDP by the income side are found in Bértola, Willebald, Castelnovo & Reis (2006) and Bértola, Castelnovo, Rodríguez & Willebald (2009) for the 1872–1920 period, and in Pereira (2020) for 1920.

13. The GDP of non-tradables is probably underestimated since the agricultural GDP is estimated from the product side. Furthermore, the agricultural census in 1920 excluded establishments smaller than 40 ha that certainly produced non-tradables (correction based on the size distribution of the registered establishments is suggested). Finally, it is assumed that all income from non-tradable sectors comes from wages.

14. It is ironic to note that the hyperinflation machinery was assembled by the exponents of orthodox thinking in Brazil, including Gudin, Bulhões and Simonsen, with some help from Delfim Neto and some blessing of none other than Milton Friedman (1974).

15. To predict relative prices in a new equilibrium with reduced inflation rate was practically impossible. The naive hypothesis that the inflationary process was super-neutral, in the sense that it did not alter equilibrium relative prices and quantities, was a big mistake in the Cruzado, Bresser and Verão stabilization plans.

16. The trade liberalization policy, initiated in 1986, led to a gradual increase in the relative share of tradables in the economy and, to that extent, contributed to the effectiveness of the exchange rate anchor in stabilizing prices, as well as to its recessive consequences (Dix-Carneiro and Kovak, 2017). I thank Honorio Kume for drawing my attention to this point.

17. It should be observed, however, that the reduction of transport costs brought by the expansion and improvements of the road network in the Northwest Region was an important factor in the increased profitability of primary commodities exports, therefore contributing to exchange rate valuation and deindustrialization.

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