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Understanding the Latin American Gap during Import Substitution*

Institutions, Productivity, and Distance to the Technology Frontier in Brazil, Argentina and Mexico's Manufacturing Industries, 1935-1975

(* Version prepared for the Southern Hemisphere Economic History Summer School (SHEHSS) in Montevideo, Uruguay, December 2010)

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Abstract

Latin American countries struggled to catch up with the income levels of advanced economies during the twentieth century, largely due to inward-looking strategies, macroeconomic instability, and weak institutional frameworks. Yet, by the mid-century, they managed to industrialise and expand their share in global production, despite limited competitive advantages and low technological capabilities. This paper reassesses these dynamics by providing new estimates of comparative productivity in manufacturing across Brazil, Mexico, Argentina, and the United States. Using official production records and trade statistics, I decompose productivity at the industry level and apply growth accounting techniques together with a distance-to-the-frontier framework to examine the drivers of industrial divergence. The analysis highlights how historical and institutional conditions shaped productivity growth after the Great Depression. I further suggest that a process of learning unfolded in leading sectors depending on their proximity to the technological frontier, enabled, though imperfectly, by institutions and policies. This process produced an uneven, heterogeneous pattern of productivity growth across industries. Nonetheless, deficiencies in human capital formation, misaligned public incentives, and strained trade-union relations significantly constrained the long-term performance of Latin American manufacturing.

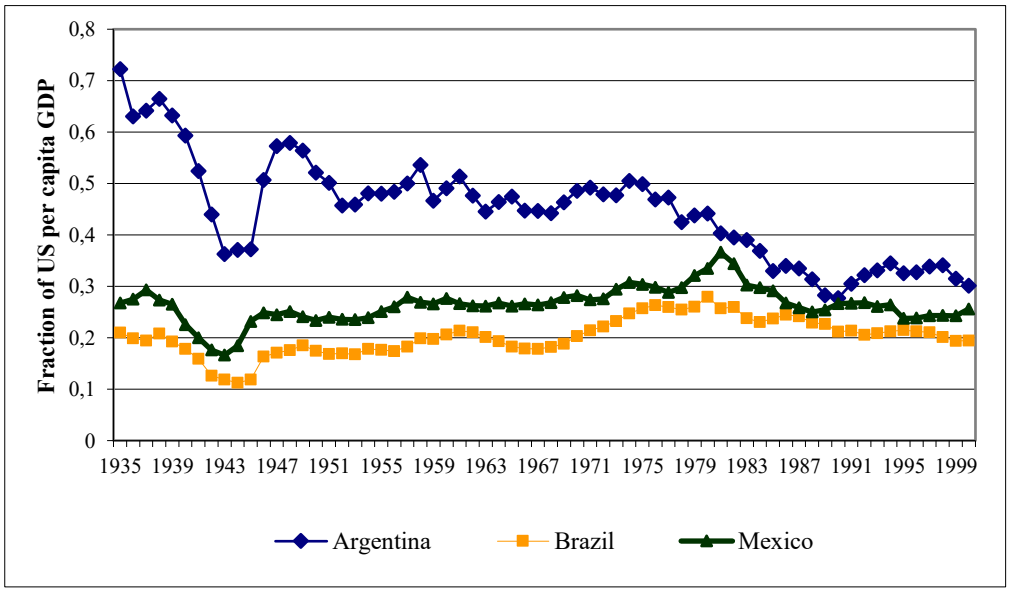
1. INTRODUCTION

Until the mid-1980s, most late-industrialising countries pursued Import-Substituting Industrialisation (ISI) as their main strategy to catch up with the industrial core of Western Europe and the United States. ISI centered on building domestic manufacturing capacity by protecting local producers and limiting international trade. Between the 1930s and the 1980s, however, despite these efforts, Latin American economies failed to close the gap with the industrial leaders. As Figure 1 shows, by 1950 Argentina's GDP per capita was only about half that of the United States, while Mexico and Brazil reached roughly one-quarter or less. This relative position remained broadly unchanged until the downturn of the 1980s.

The persistence of this income gap has generated extensive debate. From the *Dependencia* school to the new economic history, scholars have offered diverse explanations over the past half century. Evidence from the economic historian Leandro Prados de la Escosura (2007) indicates that major Latin American countries actually widened their income gap with leading industrial nations after the 1930s. Similarly, Cole et al. (2003) show that after World War II, productivity, measured as total factor

productivity (TFP), grew more slowly than in the United States, reinforcing Latin America's lag behind the global technological frontier.[1]

Figure 1. Evolution of per capita GDP relative to the United States
(1990 International GK$)



Source: *Total Economy Database*, A. Maddison (2010).

Market distortions generated by the policies of ISI have long been viewed as a central explanation for the region's technological stagnation and sluggish economic growth.[2] However, despite the mixed outcomes of this period, there remains no consensus on how advanced or backward Latin American industrial structures truly were, given case study evidence of highly competitive industries emerging in several modern sectors in Brazil, Mexico, and Argentina.[3]

To further account for the poor performance of these countries under ISI, it is necessary to analyze the sources of economic growth in a more disaggregated manner. During the second half of the century, the United States represented the global productivity frontier, with levels consistently above those of any other region. Following World War II, the productivity gap between the U.S. and most other countries gradually narrowed.[4] At an aggregate level, this pattern did not apply to Latin American economies, which, in broad terms, failed to achieve any significant productivity catch-up.

The aim of this paper is to address a gap in the literature on Latin American industrialisation after the Great Depression by constructing production-side measures of output and productivity for the manufacturing sectors of three major countries in the region. This approach enables a disaggregated analysis of industrial performance within an international comparative framework, shedding light on the economic transformations Latin America underwent during the classic ISI period. The contribution of this research lies not only in the level of disaggregation employed, but

[1] Cole, et. al., 'Latin America in the rearview mirror'
[2] See view from Taylor, 'On the costs of inward-looking development'; and Edwards, 'Crisis and reform'.
[3] Teitel and Thoumi (1986), Katz (1987, 2000) and Colistete (2009) among others, have shown evidence of significant productivity growth and technological advances in manufacturing industries during the post-War period.
[4] Broadberry, 'Technological leadership and productivity'

also in the theoretical perspective adopted to assess the distance of each branch and industry from global 'best practices' and the evolution of this gap over time.

First, we establish benchmark years (1935, 1950, 1975), corresponding to common census years, to enable a reliable and consistent analysis of comparative productivity across the selected countries. To this end, we construct industry-specific conversion factors based on producer output data, developing Purchasing Power Parities (PPPs) following the methodology of the first bilateral comparisons by Maddison and van Ark (1987) for Brazil–U.S. and Mexico–U.S. in 1975. Foreign trade statistics are combined with industrial surveys to derive PPPs from sectoral output values and production quantities. This integration is necessary given the absence of detailed quantity data in the original industrial surveys for earlier years. Using these sources, we compile measures of labor, capital, and total factor productivity.

Second, after deriving disaggregated growth accounting estimates, we systematically analyze the evolution of sectors that either converged toward or diverged from U.S. levels. This allows us to explain productivity differences by assessing whether sectors faced high or low knowledge barriers, shaping their capacity to imitate new technologies and thus determining the degree of absorptive capacity required for technological catch-up.
This document is structured as follows. Section I reviews the recent literature on the period under study. Section II provides a brief overview of the economic performance of the major Latin American countries, alongside their main political and institutional developments after the Great Depression. Section III discusses the theoretical framework, while Section IV addresses data sources and related issues. Section V presents a preliminary comparative analysis of the 1935 industrial census using exchange-rate conversions. Finally, Section VI outlines the industry-of-origin methodology, illustrates the aggregation of the work in progress, and offers some concluding remarks.

2. LITERATURE REVIEW

For a long time, the prevailing view among economic historians was that Latin America's economic underdevelopment originated in the nineteenth century, immediately following independence from colonial rule. However, recent estimates by Prados de la Escosura challenge this interpretation, showing with newly constructed series that the income gap between Latin American countries and the leading economies widened markedly during the twentieth century, particularly after 1938. These findings also contradict the notion of a supposed 'golden age' of development in Latin America after the Second World War.[5]

Several scholars have identified Latin America's trade regime under ISI as a potential source of its limited development.[6] In particular, they argue that these economies remained largely closed to international trade, relying on quantitative restrictions and other barriers while attempting to attract foreign investment. This stands in sharp contrast to countries that, during the same period, succeeded in narrowing their gap with the industrial leaders.

[5] As seen in Thorpe, 'An economic history of Latin America'.
[6] See for instance Balassa (1989), Edwards (1995), Taylor (1998), and Cole et. al. (2005).

Taylor (1998) argues that much of the dismal performance in Latin American countries during ISI was due to the failure to achieve capital deepening (low investment path). This was attributable to a series of market distortions (raising artificially capital prices to subsidize domestic firms) created by wrong policy choices and the lack of trade openness that persisted and worsened throughout the years causing economic divergence.[7] Hofman (1998) stresses another important aspect arguing that the lack of technological progress and underperformance was due to a string of macro/microeconomic misallocations and technical inefficiencies generating factor productivity stagnation, owing mostly to structural differences of the countries (scarcity or abundance of inputs). Moreover, Katz (1987) suggested that the lack of production planning and organization to introduce process change within industries contributed to the inefficiency in manufacturing.

Acemoglu et al. (2003) points out showing the example of Argentina and other countries that those who have pursued distortionary policies, including large budget deficits and misaligned exchange rates, appear to have suffered more macroeconomic volatility and also grown more slowly during the postwar period. However, more interestingly he suggests that these distortionary policies are more likely to be symptoms of underlying institutional problems rather than the main causes of economic volatility.[8]

Haber (2006) argues that governments enacted protectionist policies at he behest of manufacturers, responding to specific political and economic problems, and that they did not have a formal development strategy as such.[9] Nonetheless, ECLAC during the sixties picked up the industrialisation topic trying to formalize the process that was already underway defining import substitution industrialisation in stages.[10] An earlier stage (1930s to mid-1950s) was consisting in substituting consumer goods, to a second one of substituting intermediate goods (1950s-1960s) and finally to a more difficult, substituting capital goods (1960s-) which according to Hirschman (1968) at the end, this one was hardly going to be completed due to the extreme need of external borrowing.

3. ECONOMIC PERFORMANCE IN LATIN AMERICA: AN OVERVIEW

Before the twentieth century started, major Latin American economies were already incorporated into the growth process of the world economic order. The so-called *belle époque* of liberalism during the nineteenth century where the first age of globalisation dominated the scene in world development came to an end with the Great Depression in 1929. Latin American countries that were experiencing fast growth through their export-based economies (see table 1), were forced drastically to turn their production and specialization patterns due to the interruption of international capital flows, the fall in primary products prices, and to protectionist policies that U.S. and the United Kingdom promoted after 1929.

From the 1930s to the 1970s, Brazil and Mexico were among the fastest growing economies of the world. Although Argentina enjoyed its golden years a few decades earlier, these three major Latin American countries succeeded in industrialising and increased their shares in world production during the second half of the twentieth century despite their lack of competitive assets in technology, physical and human

[7] Taylor, 'On the costs of inward-looking development'.
[8] Acemoglu et. al., 'Institutional causes'
[9] Haber, 'The political economy'
[10] ECLAC is the acronym for the United Nations Economic Commission for Latin America and the Caribbean.

capital.[11] While much of the industrial preconditions were established at the closing decades of the nineteenth century, the decades after 1930 represented a period of important macroeconomic and institutional developments in these economies. The Great Depression was felt heavily in the region, reducing drastically the volumes and prices of their main exports.

The decline in Latin American exports and the freely floating exchange rates produced sharp currency devaluations. These depreciations caused high levels of implicit protection for the manufacturing sector due to the increase of import prices, boosting domestic production.[12]A combination of heterodox macroeconomic policies (with the abandonment of the gold standard) in the midst of declining world trade made ISI an implicit phenomenon without an explicit state-planned policy in a first stage.[13] Manufacturing sectors became a big part of the overall production shares of their economies, becoming the leading engines of growth.[14]

Table 1. Export growth in selected regions

Annual rate (%)			
	1870-1913	1913-1929	1929-1950
Latin America	3.6	3.4	1.4
Western Europe	3.2	0.2	-0.3
North America	4.7	3.2	1.8
World	3.4	0.9	0.3

Source: E. Grilli (2005).

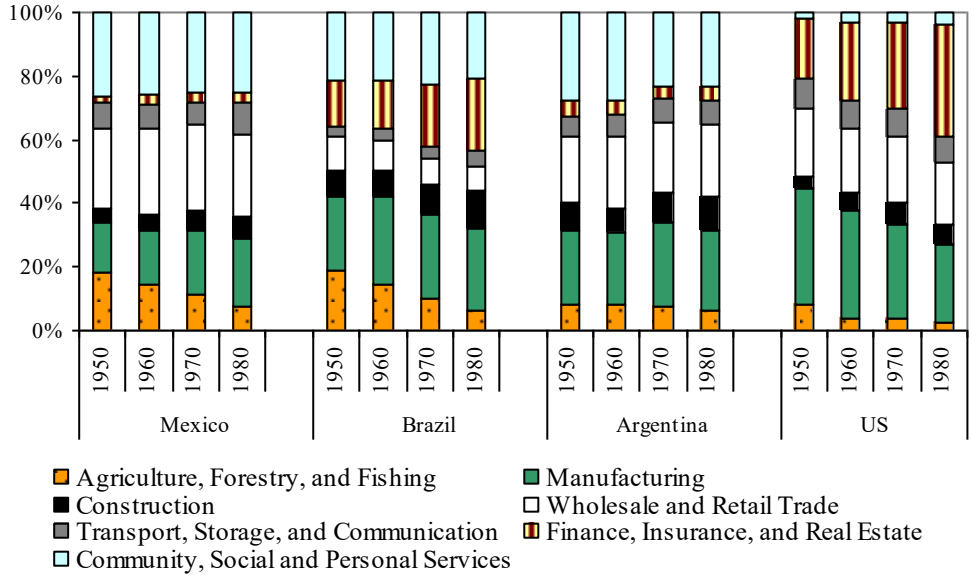
The timing and pace of product specialization played a decisive role in shaping each country's productivity performance. The rise of Brazil's coffee industry and Argentina's earlier expansion of foodstuffs production at the end of the nineteenth century created important preconditions for the rapid growth of manufacturing in the 1930s, enabling large-scale import substitution in sectors such as intermediate and capital goods. Yet these shifts in specialization did not occur automatically. Institutions under ISI evolved gradually, shaped not only by market conditions but also by labor union arrangements within a corporatist state framework—a configuration that differed markedly from that of the United States and Europe, as well as across Latin American countries themselves.

This shift in the development paradigm not only posed a challenge to the world during a time of depression and war but also reflected growing pessimism toward liberal policies and a turn toward self-sufficiency. Although the exhaustion and eventual collapse of ISI was already foreseeable by the 1960s, living standards nonetheless improved during this period.[15] Some scholars have argued that these improvements were mostly acknowledged by an active government intervention of unsustainable government investments and social expenditure which under weak taxation systems lead to high levels of debt accumulation unleashing a debt crisis and a 'lost decade' of

[11] Hikino and Amsden, 'Staying behind, stumbling back' (p.287)
[12] Haber, op cit.
[13] Díaz-Alejandro, 'Latin America in the 1930's'; Maddison, 'Two crises'; Haber, 'The political economy of industrialization'.
[14] Timmer and de Vries (2009) have argued a significant presence of sectoral productivity accelerations not only in manufacturing but in market services as well.
[15] Astorga, et al., 'The standard of living in Latin America'

macroeconomic adjustment during the 1980s.[16] Although some scholars argue that Latin America experienced a process of 'truncated industrialization,' later disrupted by the 'shock therapy' policies and economic reforms of subsequent decades, the prevailing interpretation attributes the region's persistent productivity underperformance primarily to the market distortions and competitive barriers established during the second half of the century.[17]

Figure 2. Sectoral composition of gross value added



Source: Derived from data by Timmer and de Vries (2009).

Table 2. Commodity composition of Latin American exports in 1929 (% of total)

Argentina	Wheat 29.2; maize 17.6; meat 12.8; linseed oil 12.6
Brazil	Coffee 71.0
Mexico	Silver 20.6; other minerals 47.0
Chile	Nitrates 42.1; copper 40.4

Source: A. Maddison (1991)

It is also important to emphasize that the region's overall performance was shaped by the institutional developments of this period. The adverse shocks of war and depression reinforced import substitution and increased the share of manufacturing, but often at the expense of an efficient expansion of productive capacity.[18] Nonetheless, industrial production continued to grow during the thirties reaching levels of more than 60 percent above the 1929 levels by the end of the decade. This was possible by the continued protective mantle of the weak foreign trade position.[19] A significant proportion of industry in GDP can be observed in table 3. As it is shown, industry was an important component of growth even before 1929, this might contributed to the economic recovery in the following years.

[16] Dornbusch, R. and Edwards, S., *The Macroeconomics of Populism in Latin America* (Chicago, 1991).
[17] Taylor, 'On the costs of inward-looking'.
[18] Fishlow, 'Brazilian development'.
[19] Baer, *Industrialization and economic development in Brazil*, pag. 16.

Table 3. Ratio of Manufacturing in Total GDP and Growth Rate (%)

	Manufacturing/GDP			Annual Rate of Growth	
	1928	1939	1945	1932-1939	1939-1945
Mexico	11.8	16.0	19.1	10.3	8.0
Brazil	12.5	14.5	17.2	6.7	4.5
Argentina	19.5	22.7	24.7	6.4	3.1

Source: ECLAC, *Series Históricas de Crecimiento de America Latina*, (1978).

As Table 4 indicates, GDP growth in the selected economies was relatively strong compared to the United States. In Argentina, negative rates of labor productivity growth turned positive after 1929, while Brazil and Mexico experienced sustained take-off thereafter. As noted, the manufacturing sectors functioned as the "engine of growth," with governments recognizing that positive linkages in these industries could generate high levels of employment. Consequently, policies such as tax exemptions, trade tariffs, and other non-tariff barriers, often demanded by industrialists, were widely implemented to promote industrial expansion. Yet the sectoral structure was not exclusively dominated by manufacturing. Tertiary activities also accounted for a significant share, and in subsequent decades this trend became more pronounced, with diversification into areas such as retail and wholesale trade and less primary activities such as agriculture (see in previous figure 2).

Table 4. Growth and productivity
(Average annual compound growth rates)

	1913-1929	1929-1950	1950-1973
Total GDP			
Brazil	4.7	5.0	6.9
Mexico	0.8	4.0	6.5
Argentina	3.5	2.5	4.0
US	3.1	2.6	3.7
	1929	1938	1950
Labor productivity (GDP per man hour)			
Brazil	3.0	3.9	3.9
Mexico	1.0	3.4	4.2
Argentina	-0.2	2.7	2.6

Source: Hofman and Mulder (1998).

4. POLITICS AND INSTITUTIONS AFTER THE GREAT DEPRESSION

Productivity not only comes from the production process itself, it is also the outcome of individual and collective decisions undertaken by economic and social actors. In this sense, in the policymaking process some actors can be favored by economic decisions that provide them with rents leading to negative/positive effects on productivity. [20] Moreover, these decisions may have to do with changing institutions and economic

[20] Stein et. al., 'Policymaking'

policies over time, which in the case of major Latin American countries, key economic sectors such as manufacturing, experienced important institutional changes throughout the twentieth century and some crucial ones after the 1930s.

Protectionist policies enacted from the US and UK, such as the Smoot-Hawley tariff in 1930 and the British Commonwealth Preferences settled in Ottawa in 1932, changed the pattern of international trade in nearly every single country. The highly trade-dependent Latin American countries were affected heavily. Exports, net incomes and employment collapsed, making 'reactive countries' such as Mexico, Argentina and Brazil in Diaz-Alejandro's terminology to respond abandoning the gold standard rules in order to promote their products and to reactivate their economies.[21] A period of industrial interventionism started in the region, still without a structural element that could have been considered strictly as a national strategy in Latin America.

However, the state expanded its influence in many economic sectors, especially in agriculture and manufacturing, creating special programs directed to stimulate domestic investment. Supporting manufacturers was part of a program of export substitution, where price support schemes were intended to internalize the economic activity.[22] Rural exodus to industrial cities, created a large workforce demanding participation in national policies. Labor unions gained importance in the political structures, and around the thirties at the time when newly Latin American polities entered into power, these were forced to have a mandatory membership to the state. Labor rights and benefits were implemented; such as a social security program and minimum wage for urban workers.

Governments headed by Getúlio Vargas (1930-1945) in Brazil, Lázaro Cárdenas in Mexico (1934-40) and Agustin Justo in Argentina (1932-1938), followed in separated contexts state interventions in which 'corporatist policies' understood as social arrangements where employers associations and labor representations in unions were attached to the state, playing a major role in policymaking during these years.
This corporate model had the aim of controlling labor relations at the firm level, limiting wage demands to the growth of productivity. According to Eichengreen, manufacturing wages in Western Europe and Japan grew by 3 percent per year after the Second World War, allowing rapid growth in tandem with their high productivity levels.[23] However, in Mexico, Argentina, and Brazil, these relations evolved in a different way.

In 1930, the Brazilian Revolution brought to power a coalition led by Getúlio Vargas, marking the beginning of an era of economic nationalism amid intense conflicts of interest between landowners, industrialists, and workers. Vargas promoted a program of social reform and economic modernization, including the use of tariffs to protect domestic manufacturers. In the subsequent years, under the regime known as the *Estado Novo*, a new constitution granted the president sweeping powers. Although Vargas's early agenda appeared to favor left-leaning groups, his government repressed communist labor movements. New legislation further subordinated labor unions to the state by transforming them into government-controlled agencies under the supervision of the Ministry of Labor.

[21] Díaz-Alejandro argued a distinction between reactive and passive countries; reactive were the ones that could depreciate their exchange rate and speed up the relative price adjustment faster than others and viceversa.
[22] Lewis, 'Industry in Latin America'.
[23] Eichengreen, 'Institutions and economic growth'.

Labor relations in Brazil after WWII were very complex. Industrialists (employers) and labor representations in Sao Paulo were in constant tension and conflict, and left-wingers controlled the national agenda towards social reform that industrialists rejected. This lack of 'social compact for growth' in turn prevented industrial real wages to grow in tandem with productivity.[24]
During the same period, the Mexican economy was experiencing a decline in mining and oil activities which where the leading sectors at the end nineteenth century, in turn, these were being replaced by agriculture and manufacturing.

The corporate-state model surged in Mexico after the Revolution during a period called *Maximato*.[25] During this period, a new party emerged - Partido Nacional Revolucionario - or PNR, later renamed PRI. However, when Lázaro Cardenas was addressed as President, he gave a leftist ideology to the party, involving land reform, state control of natural resources, insurance, and a strong labor wing in the party. The *Confederación de Trabajadores de México* or *CTM* was formed, in which most of labor unions were organized and subsequently integrated into the official party. The consolidation of the party provided the basis of both popular support for the new state and control over the labor force.[26] Despite its nationalist and interventionist rhetoric, the government succeeded in fostering effective cooperation between industrialists, both foreign and domestic, and workers' organizations. Manufacturers were granted fiscal privileges, protection, and state favors, provided they aligned themselves with and supported official policy.

In the case of Argentina, the depression years witnessed substantial changes in its industrial base, including certain branches of manufacturing such as textiles and metallurgy. These new factories produced for the domestic market and most of them had foreign, especially British interests.[27] Conservative governments before the period of populist leader Juan D. Perón began to intervene directly in the economy. The *infamous decade* (1930-1943) had significant changes in the labor politics of the country. Left-wing trade unions began to occupy a space in public life and strengthened a labor movement, which at the time was founded the *Confederación General del Trabajo (CGT)*, having a strong influence in labor contract decisions.

This brief overview of the political environment in these countries raises questions about its impact on industrial performance and the distinct evolution of industries compared to the United States and other advanced economies. Labor unrest in Latin America reflected various aspects of the labor market context, but a common feature in Brazil, Mexico, and Argentina was the strong ideological orientation of labor unions, which sought to exert decisive influence in wage bargaining. The extent of political pressure on industrial wages, however, varied across countries, reflecting differences in the specific configurations of the corporatist state model promoted under ISI.

[24] Colistete, 'Productivity, wages and labor politics'
[25] Name given to the period in which Plutarco Elías Calles, referred as 'the "Maximum" leader of the Mexican revolution' and who was president from 1924-1928, had indirect power in the following years to name his presidential successors and maintaining his political power.
[26] Maddison, et al. 'The political economy of poverty.'
[27] Rapoport, 'Argentina'.

5. THEORETICAL BACKGROUND

Policy choices and weak institutions are a major part in the complex evolution of the development gap, not only at the international level, but also within their societies, where income inequality has played a major role for centuries restricting the creation of 'good institutions' and growth.[28] However, the unequal conditions on the continent have not been always the same. Inequality levels in Latin America were lower than Europe during colonial times but since 1800, dramatic increases can be detected in the twentieth century.[29] These inequalities are inexorably related to the differences in industrial performance over the years.

From the production side, it is difficult to identify a uniform pattern of performance across the continent. Countries such as Argentina and Chile had developed strong export-oriented industries by the mid-nineteenth century, while Brazil and Mexico exhibited distinct economic structures and institutional arrangements compared to the developed world. Yet even from an international perspective, Latin America's major economies displayed divergent growth trajectories during the twentieth century. In some cases, episodes of global downturn paradoxically served as catalysts for growth in the region.

Unlike developed countries, were long-term economic growth comes mainly from technological innovation, the dynamics of growth in developing countries, comes less from approaching the world technological frontier and more from the promotion of activities with higher levels of productivity, adapting or adopting the existing technology and entering the world markets for manufactures and services.[30]

In the neoclassical Solow model, the long-run rate of economic growth is only determined by 'exogenous' technological change and by changes in the rate in population growth. However, the way in how this variable of technology change is conceived within the model, is what has led to many theorists to believe that this component is endogenous, varying depending on the research efforts by firms, the level of schooling and, more generally, the existence of an appropriate institutions that foster the operation of market forces playing a prominent role in explaining the observed uneven process of technical change across countries (Fagerberg, 1994).

Early literature from economic historians on convergence such as Gerschenkron (1962) and Abramowitz (1986) have described how by pushing out the technological frontier, countries in the lead create opportunities of international technological diffusion. This allows backward economies to catch up, mainly because imitation is easier than innovation. Productivity levels will, thereby, tend to converge. This convergence is, however, conditional upon the settings like 'social capabilities' of absorption of these more advanced technologies, which at the same time, depends on factors comparable to those underlying technical change. These ideas have been further developed in the neo-Schumpeterian growth model on technical change, emphasizing on the accumulative

[28] Robinson, James A., 'The Latin American equilibrium', in *Falling behind: Explaining the development gap between Latin America and the United States*, Fukuyama, F., ed. (Oxford, 2008); Engerman S. and Sokoloff, K., 'Factor endowments, inequality and paths of development among new world economies' *NBER WP*, no. 9259 (2002).
[29] Williamson, G. Jeffrey, 'Five centuries of Latin American Inequility'; and Frankema, 'The historical evolution'
[30] Ocampo J.A., Jomo K. and Vos, R. 'Explaining growth divergences' in *Growth divergences*, Ocampo, J.A., Jomo K, and Vos R., eds. (United Nations, 2007).

nature of technological change, constraining firms on the possibilities of what they can do by their past behavior.

5.1. Distance to the Frontier Approach

Recent contributions emphasize the different roles that "appropriate" institutions and policies may play in both backward or advanced economies, and the distinction between innovation activities and adoption of existing technologies from the (world) technology frontier (Acemoglu, et al., 2006).
Following a standard Cobb-Douglas type production function, with constant returns to scale and augmented by a variable reflecting the level of Total Factor Productivity, (TFP) and this can be represented as follows:

$$Y_{it} = A_{it} K_{it}^{\alpha} L_{it}^{1-\alpha} \qquad 0 < \alpha < 1$$

where A_{it} is a productivity parameter attached to the technology used in industry *i* at time *t.* K_{it} represents the flow of a unique intermediate product used in this sector, each unit of which is produced one for one by final output or in an aggregate version, by capital. And L_{it} is the labor input used in that industry. Therefore, aggregate output is the sum of the industry-specific outputs Y_{it} measured by value added at factor costs.

In this standard neoclassical model, the rate of growth of A_{it}, is determined by the rate of exogenous technical progress. To the extent that it is equally accessible, this is assumed the same for all countries in each sector under consideration. Once one does, however, allow for technological diffusion between countries, one has to allow for the fact that countries with a less advanced technology can benefit from the possibility of imitation from countries that are technologically more advanced.

Consequently, one should expect that the further a country's technology is behind the technological frontier, the greater are its possibilities of technical advance through imitation, and, therefore, the stronger will be its TFP growth. As the Schumpeterian scheme followed by Aghion and Howitt (1998), where an innovation leapfrogs the best technology available before the innovation resulting in a new technology parameter A_{it} in the innovating industry *i*, which is some multiple γ of its preexisting value. Moreover, it encompasses the case of an innovation that catches up to the world technology frontier $\bar{A}$. We can consider a country in which in any industry leading edge innovations take place at the frequency μ_n and the imitation take place at the frequency μ_m. Thus, the rate of growth of TFP of country it is expressed as follows:

$$A_{it+1} - A_{it} = \mu_n(\gamma - 1)A_{it} + \mu_m\left(\bar{A_{it}} - A_{it}\right)$$

and hence the growth rate will be

$$g_{it} = \frac{A_{it+1} - A_{it}}{A_{it}} = \mu_n(\gamma - 1) + \mu_m\left(a_{it}^{-1} - 1\right)$$

where

$$a_{it} = \frac{A_{it}}{\bar{A}_{it}}$$

is an inverse measure of the "distance to the frontier."

This scheme allows analyzing how an industry's growth performance will vary with its proximity to the technological frontier a_{it}, and to what extent the industry will tend to converge to that frontier and what kinds of policy changes are needed to sustain convergence (Aghion and Howitt, 2009).

6. DATA

Data continuity and availability have been one of the main impediments of the progress of the so-called 'new economic history' approach in Latin America.[31] Statistical series suffer from important discontinuities during crucial periods of international economic change. For instance, there is not a single homogenous and uninterrupted annual data series of Gross Domestic Product (GDP) for the first half of twentieth century that comes directly from an economic survey without any manipulation by interpolation or extrapolation techniques. Nevertheless, there have been many efforts to collect and reconstruct statistical information with a standardized time span. ECLAC (established in 1948), assembled official country-based statistics on economic, social and demographic variables. Unfortunately, most of this information suffers from the problem of aggregation and standardized data typically is available from 1950 onwards.

Aggregate economic figures hide important information about specific phenomena. GDP at aggregate level by itself does not capture sectoral dynamics in a changing economy. However, the scope of decomposing statistical information depends mostly on the methodology survey design of the original source. The famous long span figures of Maddison (2005, 1998, 1987) have contributed in offering a standard use of long term data (most of it is focused on GDP levels and aggregate population measures) to make international comparisons. Recently the Groningen Growth Development Centre built a 10-sector database for Latin America extracted from the Systems of National Accounts (SNA) and other official sources of these countries. Unfortunately, there is no industry detail and the initial year in the majority of the cases starts after 1950.

Scholars at Oxford University along with the Inter American Development Bank (IADB) constructed a database for Latin America (OxLAD) of economic and social indicators covering twenty countries for the period 1900-2000. Their collections come from different international offices, national accounts and data from renowned scholars. Even though this represents a good source in terms of comparability, it lacks completeness. For instance, the industry sector includes only electricity, cement and beer, which are not the exactly the strong manufacturing branches in terms of overall production shares of these countries.

[31] Haber, S. 'Introduction', in *How Latin America fell behind? Essays on the economic histories of Mexico and Brazil, 1800-1914,* Haber, S., ed. (Stanford, 1997)

However, if we focus only on industry, the so-called 'censos industriales' (renamed afterwards *censos económicos*) are a complete survey covering the extractive and transformation industries, manufacturing sector, construction, commerce, transport and communication, and services. These are collected every five years, but its initial year varies in each country. In Mexico, the first one started in 1930. In Argentina, it starts since late nineteenth century until 1917 and then was interrupted for many years and collected again since 1935. In Brazil the collection started in 1940 which corresponded to the previous year (1939). Nonetheless, an important limitation arises from these surveys: currency convertibility. All values from these surveys are expressed in their own currencies and the structure of the survey does not provide the elements (quantities) to make a PPP conversion. We solve this limitation collecting export prices on the most important items of the manufacturing sector from Mexico, Argentina and Brazil during the selected years and weighting them with our available production records and foreign trade statistics:

Censo Industrial de México, 1930, 1935. 1940. 1945, 1950, 1955, 1960 and 1975.
Censo Industrial de la República de Argentina, 1935, 1947, 1954 and 1975.
Censo Industrial do Brasil, 1939, 1950, 1955, 1975.

Foreign trade statistics:

- *Estadísticas de Comercio Exterior de los Estados Unidos Mexicanos* (1935, 1950, 1975)
- *Estadísticas de Comercio Exterior de la República de Argentina* (1935, 1950, 1975)
- *Estatisticas do Comercio Externo do Brasil* (1935, 1950, 1975)

7. DISAGGREGATED COMPARATIVE MANUFACTURING USING EXCHANGE RATES CIRCA 1935

International comparisons using exchange rates conversions are questionable since they represent at best the relative price of tradables, and not that of non-tradable sectors. Moreover, sometimes they are not even representative for relative prices of tradables, as these tend to be affected by capital movements, monetary policy and speculation. However, in this attempt to measure and compare manufacturing, it is important to point out the differences between raw estimates (nominal) and real calculations using different methodologies and also offer a general view of the production shares and performance in a highly heterogeneous industry.

Industrial heterogeneity in manufacturing is related to many factors, natural resources, composition of human capital, policy orientation, among others. Therefore, employment distribution varies across major Latin American countries. For instance, Brazil's food sector is one of the largest in employment share compared to the US, as well as Mexico's textiles where these sectors (in Brazil and Mexico) covered more than a third of the manufacturing labor force. It is possible to detect labor concentration in some industries due to patterns of specialization.

As table 5 shows, US manufacturing employment had a large share in engineering, shipbuilding and vehicles trade, which in part indicates how the capital good industry was being developed compared to Brazil. Mexico incipient capital goods industry was

not even registered in the official industrial census. However, Argentina's earlier period of industrialisation during the XIX century with large amounts of British investments allowed it to develop some industries in car assembly and electricity.

Table 5. Distribution of Manufacturing Employment c.1935 (Percentages)

Branch/Country	Mexico	Argentina	Brazil	US
Textile Trades	34.8	8.5	23.1	14.8
Leather Trades	1.6	2.8	1.9	1.1
Clothing Trades	8.5	5.5	4.7	10.4
Iron and Steel Trades	9.5	7.1	6.3	10.7
Engineering, Shipbuilding and Vehicles Trades	2.3	20.0	3.9	19.6
Food, Drink and Tobacco Trades	23.5	20.6	35.9	11.9
Chemical and Allied Trades	4.5	3.4	9.1	5.3
Building Materials Trades	5.3	11.0	4.7	2.8
Timber Trades	5.4	8.5	2.8	6.8
Paper Trades	5.1	6.6	1.8	9.0
Miscellaneous Trades	2.4	7.1	5.8	3.8
Unassigned Trades	-	-	-	1.0
Non-ferrous Metals Trades	-	-	-	2.9
Total	100	100	100	100

Source: See appendix.

However, employment allocation is not always related to productivity levels in the short-run. For instance, Brazil's chemicals and engineering sectors had an important contribution in productivity levels, covering together more than one third of the valued added per person in manufacturing which was very similar to the US distribution (Table 6). In the case of Mexico, the food, drink and tobacco sector covered itself more than a third of the share of value added per person, even though the textile sector employed more workers and employees overall.

Table 6. Distribution of Manufacturing Value Added per Person Employed by Branches (Percentages)

Branch/Country	Mexico	Argentina	Brazil	US
Textile Trades	27.3	7.3	6.4	8.9
Leather Trades	0.9	3.9	4.5	0.9
Clothing Trades	5.1	4.1	3.4	7.3
Iron and Steel Trades	3.3	9.6	6.1	10.2
Engineering, Shipbuilding and Vehicles Trades	5.1	10.9	11.5	20.1
Food, Drink and Tobacco Trades	31.9	21.2	16.1	2.9
Chemical and Allied Trades	8.3	13.7	21.0	15.8
Building Materials Trades	6.4	11.4	6.7	9.2
Timber Trades	2.2	9.3	2.6	2.9
Paper Trades	4.1	3.2	4.3	4.3
Miscellaneous Trades	6.4	5.4	10.6	11.7
Unassigned Trades	-	-	3.6	5.1
Non-ferrous Metals Trades	-	-	3.2	0.8
Total	100	100	100	100

Source: See appendix.

As many scholars have noted, industrialisation in Latin America during the 1930s was labor-intensive and heavily reliant on medium and small firms in manufacturing. A

closer examination of the labor force, using the human capital indicators presented in Table 5, shows that the textile industry employed more than ten times as many workers as employees in manufacturing overall—and as much as twenty times more in Argentina's textile sector. This highlights not only the labor-input intensity of the industry but also provides a rough indicator of skill levels, given that workers generally earned less than employees and had lower levels of education. In all cases, textiles absorbed a large share of unskilled labor, in contrast to sectors such as chemicals, engineering, and food processing, where the workforce was relatively more skilled.

Table 7. Worker/Employee Ratio in Manufacturing

Branch/Country	Mexico	Argentina	Brazil	US
Textile Trades	16.5	21.9	12.7	16.4
Leather Trades	9.0	9.3	0.8	9.6
Clothing Trades	11.0	9.9	4.8	11.4
Iron and Steel Trades	14.3	12.6	7.2	8.2
Engineering, Shipbuilding and Vehicles Trades	4.2	7.1	5.3	6.2
Food, Drink and Tobacco Trades	9.4	8.1	3.8	5.8
Chemical and Allied Trades	5.2	4.7	3.2	6.5
Building Materials Trades	11.1	15.4	7.3	4.2
Timber Trades	14.4	19.8	3.4	8.3
Paper Trades	6.1	6.3	6.4	10.6
Miscellaneous Trades	8.8	7.6	5.2	2.7

Source: See appendix.

In Argentina, labor unrest during this period was particularly common in the building materials, food, and engineering industries. Yet average wage levels in these sectors were, in some cases, nearly double those observed in Brazil. From a comparative perspective, the wage demands advanced by Brazilian labor organizations had a degree of justification. Nevertheless, these figures primarily reflect employer costs and do not account for the purchasing power of a Brazilian consumption basket. Even so, they offer useful insights into wage dispersion and the heterogeneity that characterized industrial labor markets across the region.

Table 8. Average Wage by Branch (at 1935 US Dollars)

Branch/Country	Mexico	Argentina	Brazil*	US
Textile Trades	195	298	112	792
Leather Trades	177	497	122	1019
Clothing Trades	175	637[a]	136	882
Iron and Steel Trades	300	374	172	1126
Engineering, Shipbuilding and Vehicles Trades	192	518	200	1246
Food, Drink and Tobacco Trades	147	113	115	1089
Chemical and Allied Trades	180	403	135	972
Building Materials Trades	181	332	170	1101
Timber Trades	147	296	139	971
Paper Trades	284	413	128	778
Miscellaneous Trades	125	403	139	1255
Unassigned Trades	-	-	-	1130
Non-ferrous Metals Trades	-	-	-	602

* Converted with 1939 US official exchange rate

[a] In the clothing branch was included clothing workshops and 'roperos'.

Source: See appendix.

According to table 8, a Mexican average wage in textiles was a quarter of the US levels which was in the middle between Brazil and Argentina, which the latter had more than a third of the American levels. The high level of the Argentinean clothing average wage (0.72) can be explained due to the inclusion of the clothing workshops and roperos that that industrial census recorded in their statistics. However, in Mexico and Brazil, the differential of average wage in this sector was around one fifth of the US levels.

Table 9. Wage differentials with US levels (1935 US Dollars)

Branch/Country	Mexico	Argentina	Brazil
Textile Trades	0.25	0.38	0.14
Leather Trades	0.17	0.49	0.12
Clothing Trades	0.20	0.72	0.15
Iron and Steel Trades	0.27	0.33	0.15
Engineering, Shipbuilding and Vehicles Trades	0.19	0.42	0.16
Food, Drink and Tobacco Trades	0.13	0.10	0.11
Chemical and Allied Trades	0.19	0.41	0.14
Building Materials Trades	0.16	0.30	0.15
Timber Trades	0.15	0.31	0.14
Paper Trades	0.37	0.53	0.16
Miscellaneous Trades	0.10	0.32	0.11

Source: See appendix.

As shown in Tables 9 and 10, manufacturing productivity levels displayed considerable dispersion across industries. High productivity was evident in Brazil's chemicals and engineering sectors, as well as in Argentina's textile industry. Mexico's relative strengths, compared to the United States, were concentrated in food, drink, and tobacco. The observed gap between productivity and wage levels across these industries provides insight into both the profitability of certain sectors and the relatively limited bargaining power of labor unions, despite ongoing conflicts between industrialists, governments, and labor organizations during the period. Argentina maintained a notable lead in wage differentials relative to Mexico and Brazil, particularly in engineering, leather, and clothing. By contrast, wages in Mexico's iron and steel sector were relatively high for the time, approaching Argentine levels. Brazil, however, while characterized by low average wages in manufacturing, compensated with superior productivity in engineering and chemicals, where it significantly outperformed both Mexico and Argentina.

Table 10. Manufacturing Productivity by Branch
(Value added per person employed at 1935 US Dollars)

Branch/Country	Mexico	Argentina	Brazil	US
Textile Trades	234	473	255	1359
Leather Trades	172	204	363	1947
Clothing Trades	177	254	273	1583
Iron and Steel Trades	92	187	327	2169
Engineering, Shipbuilding and Vehicles Trades	304	322	695	2324
Food, Drink and Tobacco Trades	455	155	390	3000
Chemical and Allied Trades	550	241	1053	3963
Building Materials Trades	356	226	453	2302
Timber Trades	103	306	215	1414
Paper Trades	241	187	349	2942
Miscellaneous Trades	427	57	282	2996

Source: See appendix.

Table 11. Manufacturing Productivity as Percentage of US levels (Value added per person employed at 1935 US Dollars)

Branch/Country	Mexico	Argentina	Brazil
Textile Trades	0,17	0,35	0,19
Leather Trades	0,09	0,10	0,19
Clothing Trades	0,11	0,16	0,17
Iron and Steel Trades	0,04	0,09	0,15
Engineering, Shipbuilding and Vehicles Trades	0,13	0,14	0,30
Food, Drink and Tobacco Trades	0,15	0,05	0,13
Chemical and Allied Trades	0,14	0,06	0,27
Building Materials Trades	0,15	0,10	0,20
Timber Trades	0,07	0,22	0,15
Paper Trades	0,08	0,06	0,12
Miscellaneous Trades	0,14	0,02	0,09

Source: See appendix.

VI. THE INDUSTRY OF ORIGIN APPROACH

The foundations of the industry of origin approach for international comparisons comes from the work of Rostas (1948) and Paige and Bombach (1959), and then was further developed by scholars at the University of Groningen led by Angus Maddison (1988). This approach derives purchasing power parities from values of output and quantities produced by sector of the economy, combining data on labour and capital, allowing to measure total factor productivity. Most of these comparisons have been bilateral, with the United States and/or the United Kingdom and Germany as benchmark countries[32], though multilateral techniques have also been applied to manufacturing and agriculture comparisons.

These comparisons aim to develop industry-specific conversion factors using producer output data instead of final expenditure information. Using product unit values which are derived from value and quantity information for product groups, each one has a quantity counterpart, as quantities times 'unit prices' equal the value equivalent. By matching as many products as possible, unit value ratios are derived which can be weighted up to industry, branch and total manufacturing levels. These can then be used to express output of different countries in a common currency.

One major advantage of this approach is that in general all necessary information can be derived from a single primary source, which for manufacturing is the census of production or industrial surveys. These sources contain a great detail on the output and input structure by industry and information on the sales values and quantities of most products. For the Latin American case, as has been mentioned earlier, the data can be derived from the latest census of production from the so-called 'censos industriales'.

As the production censuses are not well harmonized across countries, our comparisons will be done in a three-country basis Argentina/US, Brazil/US and Mexico/US. As we have mentioned before, the advantage of comparing these three economies with the US is that this will provide an indication of the productivity gap between the countries and as such the potential of catch-up.

In this method, relative prices are referred to as unit value ratios (UVR's) instead of PPP's as they are based on ratios of unit values (UV's) of products. These unit values

[32] See for instance de Jong, Herman, and P. Woltjer, 'Depression dynamics'.

are derived by dividing ex-factory output values (o) by produced quantities (q) for each product i in each country:

$$UV_i = \frac{o_i}{q_i}$$

The unit value is a kind of average price at which a similar group of products was sold by all manufacturers in a given year. In each bilateral comparison, products are matched according to more or less detailed product descriptions, e.g. frozen fruits, infants' underwear, aluminum window frames, and car tires. For each matched product, the ratio of the unit values of both is calculated:

$$UVR_i^{XU} = \frac{UV_i^X}{UV_i^U}$$

with *x* being either Argentina, Brazil or Mexico and *u* the base country, the United States. The UVR indicates the relative producer price of the matched product in both countries. Product UVR's are used to estimate UVR's at more aggregate levels: industries, branches and total manufacturing. Manufacturing output is the sum of output of branches, which in turn is the sum of the industries' output value. The value of an industry's output equals the sum of the values of the produced products. Within the comparison of each industry between two countries, only part of products can be matched as quantity information often lacks, it may be difficult to find comparable products, or countries produce unique products. The matched products can be considered as a sampled subset of products within an industry which relative price, under certain conditions, may be considered representative for the non-matched part.

Example of Aggregation: Paper and Manufactures, Argentina/USA, 1935

	Product matches	US			Argentina			UVR of product matches		
		Value (million US$)	Quantity (lbs)	Unit Value	Value (million Arg pesos)	Quantity (lbs)	Unit Value	At US weigths	At Arg weights	Fisher
Paper and Manufactures	7	**171048**			**476000**					
Printing paper	1	**52480**			**153797**			**167**	**167**	**167**
Standard newsprint		52480	104965	**0.50**	153797	1842	**83.5**	167.00	167.00	167.00
Writing paper and envelops	6	**118568**			**322203**			**1315**	**1252**	**1252**
Surface coated paper		15110	2900	**5.2**	21400	4	**5350**	1027	1027	1027
Uncoated paper		12720	1105	**11.5**	85727	5	**17145**	1489	1489	1489
Paperbound law books		11149	490	**22.8**	53750	2	**26875**	1181	1181	1181
Tissues		67162	11100	**6.1**	59342	6	**9890**	1635	1635	1635
Pulp in rolls		11292	4818	**2.3**	92054	28	**3288**	1403	1403	1403
Cigarrete paper		1135	1315	**0.9**	9943	7	**1420**	1646	1646	1646

FINAL REMARKS

Latin America's relative backwardness has deep historical roots, making its study both complex and contested. Assessing the region's long-run performance is further complicated by the uneven availability and reliability of historical documents and primary sources, which for decades limited the scope of systematic comparative analysis. This paper argues that the industrial relative backwardness was shaped by long-standing structural and institutional legacies. These legacies were reinforced during the twentieth century by inward-looking strategies, macroeconomic instability, and weak institutional frameworks, which constrained the region's ability to converge with advanced economies. Yet, despite limited technological capabilities and competitive advantages, Brazil, Mexico, and Argentina experienced significant industrialization by the mid-century, expanding their share in global production.

This paper builds on previous quantitative research by constructing new production-side estimates of productivity in manufacturing for these three countries, benchmarked against the United States. By combining official production records, trade statistics, and growth accounting techniques, it provides a disaggregated comparative analysis that uncovers the heterogeneous patterns of productivity growth across industries. The findings show that while historical and institutional conditions strongly shaped industrial performance after the Great Depression, learning processes did emerge, particularly in sectors closer to the technological frontier. These processes, however, were uneven and mediated by state policies and corporatist institutional arrangements, producing divergent trajectories within and across countries.

At the same time, persistent deficiencies in human capital, misaligned public incentives, and contentious labor relations limited the absorptive capacity of Latin American industries and constrained the potential for sustained productivity growth. Thus, industrialisation under ISI represented a partial and uneven transformation: it expanded manufacturing capacity and fostered growth in certain sectors, but ultimately fell short of bridging the gap with the industrial leaders.

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APPENDIX

Data presented for 1935 was based in official industrial censuses as follows:
- Mexico: *II Censo Industrial de los Estados Unidos Mexicanos*, *1935.*
- Argentina: *IV Censo Industrial de la República de Argentina*, *1935*
- Brazil: *II Censo Industrial do Brasil*, 1939.
- US: *Biennial Census of Manufactures of 1935,* extracted from appendix in de Jong, H., and Woltjer, P., 'A Comparison of Real Output and Productivity for British and American Manufacturing in 1935', *Research Memorandum GD-108*, University of Groningen (March, 2009).

US dollar conversions were using official exchange rates for 1935 in Mexico and Argentina and for 1939 in Brazil:

Mexico: 3.59998416 =1 USD
Argentina: 3.061989999= 1 USD
Brazil: 16.65917004=1 USD (1939)