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Manufacturing performance in international perspective: New evidence for the Southern Cone

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Resumen

El objetivo de la tesis es arrojar luz sobre el desempeño del sector manufacturero en tres países latinoamericanos de ingresos medios (Brasil, Chile y Uruguay) durante el período de industrialización dirigida por el Estado entre 1930 y 1980. La inclusión de dos países ricos con trayectorias diferentes (Estados Unidos y Suecia), nos permite evaluar el desempeño de la industria en una perspectiva comparativa.

Esta tesis: i) caracteriza las estructuras productivas de cada país, ii) mide el cambio estructural y analiza su relación con el crecimiento de la productividad manufacturera e iii) identifica patrones de crecimiento industrial relacionados con diferentes subperíodos. Además, se estima la brecha de productividad entre Brasil, Chile y Uruguay en relación con Estados Unidos y Suecia, para revelar si hubo procesos de convergencia a nivel de la industria.

Los resultados identifican cambios dentro del sector industrial en los tres países latinoamericanos. Sin embargo, el grado de transformación fue más débil y limitado en el tiempo en el caso de Uruguay, seguido por la experiencia chilena con avances moderados y, finalmente, el caso brasileño que mostró cambios profundos y sostenidos en el tiempo.

El éxito de Brasil se reflejó en una reducción de la heterogeneidad estructural y en sus logros en términos de cambio estructural. Además, la convergencia manufacturera se aceleró en Brasil en los años sesenta, cuando se profundizó el modelo de desarrollo basado en la industrialización y se adoptaron características diferentes de las registradas en la primera etapa de la industrialización. El cambio estructural fue más débil en Uruguay y moderado en Chile, y la capacidad de reducir las brechas tecnológicas con los líderes se limitó a algunos sectores industriales asociados con los recursos naturales y con niveles medios y altos de protección industrial. Esto último también debe vincularse al diferente ritmo de la industrialización en estos dos países, especialmente en Uruguay, donde el impulso industrializador se agotó muy tempranamente.

Palabras claves: cambio estructural, heterogeneidad, brechas de productividad laboral, políticas industriales, perspectiva comparada.

Abstract

This dissertation aims to shed light on the performance of the manufacturing sector in three Latin American middle-income countries (Brazil, Chile and Uruguay) during the state-led industrialization period between 1930 and 1980. The inclusion of two rich countries with different trajectories (United States and Sweden), allows us to assess the manufacturing performance in a comparative perspective.

This thesis: i) characterizes the productive structures of each country, ii) measures structural change and analyses its relation to manufacturing productivity growth and iii) identifies patterns of industrial growth related to different sub-periods. In addition, it estimates the productivity gap between Brazil, Chile, and Uruguay relative to the US and Sweden, in order to reveal whether convergence took place at the industry level.

The results identify changes within the industrial sector in the three Latin American countries. However, the degree of transformation was weaker and limited in time for the case of Uruguay, followed by the Chilean experience with moderate advances, and finally the Brazilian case which showed profound and sustained changes over time.

The Brazilian success was reflected in a reduction in structural heterogeneity and in its achievements in terms of structural change. Moreover, manufacturing convergence accelerated in Brazil in the 1960s, when the development model based on industrialization was deepened and different characteristics were adopted from those recorded in the first stage of industrialization. Structural change was weaker in Uruguay and mild in Chile, and the ability to reduce technological gaps with leaders was restricted to some industrial sectors associated with natural resources and with medium and high levels of industrial protection. The latter must also be linked to the different pace of industrialization in these two countries, especially in Uruguay, where the industrializing impulse was exhausted very early on.

Key words: structural change, heterogeneity, labour productivity gaps, industrial policies, comparative perspective.

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Chapter 1. Introduction

There is a great deal of consensus that industrialization in much of Latin America took place between the thirties and seventies. At the initial stage this was stimulated by the movement of relative prices and urgent needs to balance the trade account. Subsequently, industrialization was the result of deliberate strategies, with the application of a set of instruments, giving rise to developmentalism. During the 1970s this model became very problematic, for domestic and international reasons, of an economic and political nature.

Industrialization strategies were always met with resistance and there are still arduous confrontations around the evaluation of them. Very different perspectives about the experience remain. Some, from a liberal point of view, understand industrial policy to be a great mistake, since it separated Latin American countries from their natural export vocation supported by the exploitation of their comparative advantages. On the other hand, a broad spectrum of positions understands that industrialization was not only a necessity imposed by international conditions, but also the project that could lead the Latin American region to development, in the way that developed countries would have done and which, more belatedly, the Scandinavian countries, Korea, China and others would do.

These debates have been based on a significant weakness of empirical information. This doctoral thesis attempts to contribute to reducing this limitation with different methodological approaches.

1.1. Aim of the dissertation

The dissertation aims to shed more light on the performance of the manufacturing sector in three Latin American, middle-income countries (Brazil, Chile and Uruguay) during the state-led industrialization period in an historical and comparative perspective.

This thesis focuses on the manufacturing sector, under the assumption that it plays a key role in economic development. Historically, manufacturing has been highlighted by its dynamic productivity growth rate, greater absorption of technical progress and innovation, and capacity to promote structural change (Kaldor, Hirschman, Cornwall, Prebisch, Szirmai).

One of the major contributions of this thesis is new estimates of manufacturing labour productivity for the 1930-1980 period, thus deepening our understanding of a key period that is not captured in most datasets, which usually begin in the 1970s (ECLAC[1] 2007). In addition, the dissagregation by industries allows for a detailed analysis of the productive structure. The inclusion of two rich countries with different trajectories (United States and Sweden), allows us to assess the manufacturing performance in a comparative perspective.

The central **research question** is: *How did the manufacturing sectors in Brazil, Chile and Uruguay perform relative to developed countries during the industrialization period?*

This thesis: i) characterizes the productive structures of each country, ii) measures structural change and analyses its relation to manufacturing productivity growth and iii) identifies patterns of industrial growth related to different sub-periods. In addition, it estimates the productivity gap between Brazil, Chile, and Uruguay relative to the US and Sweden, in order to see whether convergence took place at industry level.

Primarily in Uruguay, followed by Chile, both failed to maintain over the period a diversified manufacturing sector with a higher weight of industries intensive on engineering. Furthermore, total manufacturing in Uruguay and Chile was unable to converge towards the American productivity level. However, some industries performed better than total manufacturing and narrowed the gap with the world frontier.

In contrast, for the case of Brazil there is evidence of productivity growth in modern industries, such as steel, machinery, and transport equipment. Brazil achieved a favourable structural change measured as the shift of labourers from lower to more productive industries within the manufacturing sector. The latter also implied that Brazilian industries showed a better relative productivity position and managed to catch up with the United States and Sweden.

Finally, there are a series of issues that I do not delve into deeply, even though I have been tempted to do so: wages, income distribution, institutions, and industrial policies. All of them are of great importance in making a global assessment of the industrialization stage, but are beyond the scope of this thesis.

[1] I refer to ECLAC as the abbrevation of: Economic Commission for Latin America and the Caribbean, (in Spanish: *CEPAL, Comisión Económica para América Latina y el Caribe*).

1.2. Historical context

In Latin America, and in other undeveloped regions, the debate over the role of productive structure, industrial development and industrial policies has been reopened in the last two decades[2]. This has occurred in the context of a 21st century marked by China's strong economic growth, with its significant implications for foreign trade: increased demand for raw materials and food, and the consequent increase in their international prices (ECLAC 2016).

Motivated by favourable international conditions, primary sector activities (agriculture, forestry, mining) have become more important in Latin America. This phenomenon is known as the economic reprimarization, which has its counterpart in the weight loss of the industrial sector. At the same time, reprimarization is associated with governments that took advantage of economic growth due to the situation without directing sufficient resources towards strategic sectors and generators with greater value added (ECLAC 2015).

This type of growth, which favours less technology-intensive activities and shapes a less diversified productive structure, has been the subject of discussion at the academic level, policy makers, and international organizations. In the region, the works of ECLAC are the ones that have dealt with this issue since the fifties, and they have added more reflections in the same direction (Cimoli et al 2008, Chang 2009, Rodrik 2005, Rodrik 2012, Szirmai 2012, Naudé and Szirmai 2012). The intervention of policies in the economy is no longer frowned upon, as it was by academics in the 1980s and 1990s, and is positioned as necessary in order to achieve a better productive structure that contributes to economic growth.

Starting from these dilemmas and challenges of the XXI century, this thesis aims, among other things, to contribute to the current debate with evidence about the only historical period in which Latin America deliberately bet on industrialization.

The concept of industrialization that is followed in this thesis is the simplest to measure, referring to the greater weight acquired by the manufacturing sector in the economy, calculated through its added value.

The literature marks the 1930s as the beginning of the period of industrialization in Latin America, that is, after the Great Depression; and 1980 as the year of completion, a moment from which the region entered the so-called “lost decade”[3].

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[2] Industrial development is understood as a broad set of productive activities that include the industrial sector in a key role, as well as scientific-technological laboratories, the production of different energy sources, genetic transformation, nanotechnology, different areas of information technology (Bértola and Bittencourt 2017).

[3] This term refers to the 1980s, in which the economy did not recover the previous levels of product, employment and

The emergence of this new stage in the thirties is explained by profound changes worldwide: economic crisis of the central countries, fall in the flow of world trade, abandonment of the gold standard, withdrawal of foreign capital in the periphery, and greater prominence of the state in the economies (Bértola and Ocampo 2012). This closed the stage of the years 1870-1930 known as "outward growth", "first globalization", or "growth led by exports", and opened another known for "inward growth", "import substitution", or "industrialization led by the State". Throughout this thesis I will adopt this last term to refer to the period of industrialization, which was coined by Thorp (1998) and Cárdenas et al (2003). They characterize the industrialization of Latin America through two central features: the presence of a State which was actively involved in the economic and social life of the country, and the prioritization of the industrial sector as a driver of growth and development[4].

What do we know about the performance of the economy in the industrialization period?

One of the first questions asked by an economic historian is to know what happened to the performance of the Latin American economy as a whole during those years. It is useful to divide the response into two sub-periods: 1930-1945, and 1945-1980. In the first sub-period, GDP per capita remained almost stagnant (0.6 percent per year) due to slow economic growth and an expanding population. Import substitution and the recovery of domestic demand were two characteristics of these years. The following sub-period, however, showed the fastest growth in the history of Latin America (5.5 percent annual GDP growth and 2.7 percent per capita, Bértola and Ocampo 2012). The industrialization process in this second stage had a different pattern, based on a greater strengthening of the domestic market, and to a lesser extent by import substitution, while maintaining the need for foreign exchange via exports.

This economic result can also be measured in relative terms. Figure 1.1 shows the evolution of GDP per capita taking the United States (US = 1) as a point of comparison, it reflects the average of the region and the three Latin American countries on which I will focus my thesis: Brazil, Chile and Uruguay.

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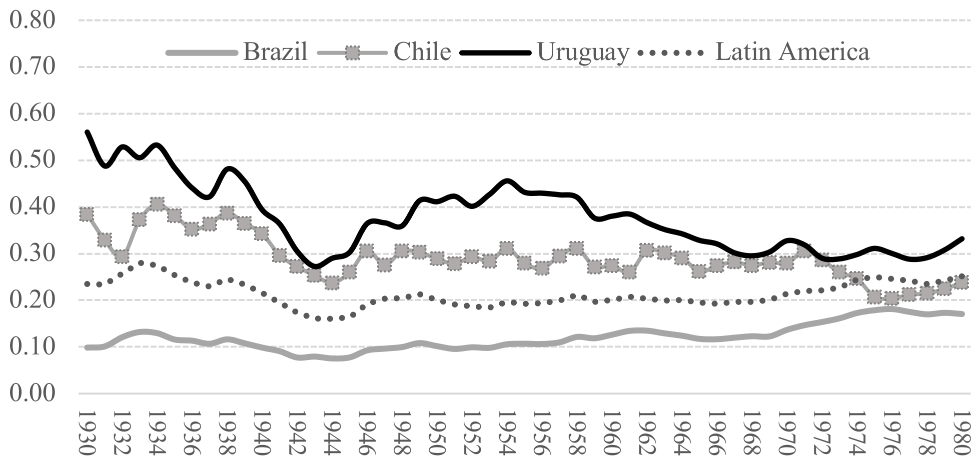
poverty reduction.

[4] For more detail of the discussion of these terms see Bértola and Ocampo (2012).

Figure 1.1. GPD per capita Brazil, Chile, Uruguay and Latin America versus the US (US=1)



Source: Maddison Project Database, version 2018. Bolt, Jutta, Robert Inklaar, Herman de Jong and Jan Luiten van Zanden (2018), "Rebasing 'Maddison': new income comparisons and the shape of long-run economic development", Maddison Project Working paper 10.

In the graph, three stages can be distinguished in terms of income convergence. Between 1930 and 1943/44 the three countries and the region as a whole, despite ups and downs, end up with a worse position relative to the United States. From the end of the Second World War up until the 1970s there are different trends: in Uruguay there was a process of convergence until 1955 and then divergence; while Chile, Brazil and Latin America recovered slightly towards 1950 and maintained a stable relative position (with levels of 30%, 10% and 20% of the GDP pc of the US, respectively). This occurred in the context of the golden years period, where the American economy maintained sustained growth. Finally, in the seventies Chile diverged from the US, Uruguay remained at a lower and stagnant level, and, on the contrary, Brazil showed an improvement in their relative position.

In short, in the period of industrialization, and more precisely after 1945, the Latin American economy performed favourably, with its differences by countries. However, when it is contrasted with what happened in the center (with the US as a reference), convergence "spasms" are observed, also called "truncated convergence" by other authors. This should not surprise us: long-term economic history research for Latin America has found this same pattern throughout different periods (Bértola and Porcile 2000[5], Bértola and Ocampo 2012).

[5] The income convergence results differ from those found by Bértola and Porcile (2000), since its reference point is the United States together with Germany, France, and Great Britain.

And what do we know about the behavior of the industry in those years?

First, as is obvious, the weight of the manufacturing sector in the Latin American economy grew throughout the period (20 percent of total GDP in 1950), and reached its highest level in terms of value added in the seventies (27.2 percent in 1974, Bértola and Ocampo 2012). From there it stagnated during the second half of the seventies and reverted towards a decreasing trend in the eighties. I will help to illustrate later, with the three countries of this thesis, the differences hidden behind the Latin American average.

This is accompanied by an increase in industrial value added growth rate (more than 5 percent per year) that exceeds the rate of total GDP, reinforcing the argument that the manufacturing sector led the growth process (Bénétrix, O'Rourke and Williamson 2012).

On the other hand, there are works by country that individually present manufacturing sector productivity indicators for the entire industrialization period (Bértola 1991, Aldrighi and Colistete 2015). However, these mostly show evolutions and not relative levels of performance. From the seventies onwards, the ECLAC database does allow us to compare productivity levels of Latin American countries in relation to reference countries (United States). In addition, the work of Bértola and Ocampo (2012) offers a valuable description by countries and by industry groups for this period.

Another vast body of evidence gathered in both past and current works refers to the institutions and policies adopted in the region in that period. The emergence of theoretical approaches in the forties that put the interventionist and regulatory nature of the state at the center of the discussion mark a difference with the type of liberal economic policy carried out during the outward growth stage. It was argued, then, that the state could be able to stabilize the economy by using a set of economic policy instruments, being industrialization one of the objectives in order to balance the current account deficits (Rodríguez 2001).

There were various policy instruments. Trade protectionism translated into differentiating import tariffs according to the production that was sought to encourage and/or discourage it, establishing import quotas, as well as controlling exchange rates and multiple exchange rates. Some of these instruments were backed up by the emergence of new state controlling institutions. In turn, the State supported private industry through subsidies, with financing from the new development banks, or directly went on to provide the service via public companies. The expansion of infrastructure and public services contributed to consolidating the local market, something which was necessary for industrial expansion (Thorp 1998).

Additionally, in this period, the implementation of social policies and the construction of the so-called Welfare States, led to an alteration in income distribution. To the extent that the income of the middle and lower classes (via wages, social security payments, social benefits) grew, this would allow for boosting domestic demand, something necessary for national production, and at the same time generate positive results in terms of social equity[6]. Formally, the link between income distribution and the degree of industrialization achieved by Latin American countries has recently been addressed in Bértola (2018)[7].

The industrial policies implemented in those years have always generated controversies. On the one hand, the high costs associated with maintaining an excessive type of protectionism that caused inefficiencies have been noted (Bulmer Thomas 1994). Fajnzylber (1983) called protectionism "frivolous", that is, the application of protectionist measures that did not generate interest from industrialists to implement new production techniques or adopt some kind of innovation. Unlike what occurred in Asian countries (South Korea, Japan), in Latin America there were no conditions required to receive state support and protectionism was not aimed at promoting certain technology-related industries[8]. Bértola and Ocampo (2012) also added the absence of an adequate innovation system to promote structural change to this idea of protectionism. Cimoli et al (2008) also emphasized innovation, and contrasted the different experiences between Asia and Latin America: while in the first one they managed to create national innovation systems, in our region they did not prosper. For their part, Katz and Kozacoff (2000) explored certain long-term dynamic aspects linked to technological capabilities within firms with a microeconomic approach. They found significant technological learning efforts in certain Latin American firms during the period of industrialization, however, the trajectories achieved in Asian countries turned out to be more successful and dynamic.

Without the pretense of covering the whole discussion about the failures of the industrialization period, other elements that have also been raised have to do with the high dependence of foreign exchange on the exports of primary goods, the low accumulation of human capital, the absence of an entrepreneurial class with an industrialization vocation, reduced domestic market, and anti-export bias.

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[6] On this point, nuances can be pointed out: the case of Brazil is one of them, which moved away from the use of this mechanism in 1964, and instead favoured the consumption of goods linked to the higher income economic groups (Furtado 1986, Morgan and Souza 2019).

[7] There are numerous works that present evidence for countries in the region on different measures of income distribution covering the industrialization period (Fajnzylber 1990, Rodríguez Weber 2017, De Rosa et al 2017, Alvaredo 2010, Ferreira de Souza 2017, Morgan and Souza 2019).

[8] Fajnzylber (1983) called the type of protectionism applied in these Asian countries “protectionism for learning”, contrary to frivolous protectionism.

Briefly, what happened in the 1980s and onwards?

A new international scenario was set in the eighties due to the consequences of the oil shocks in the seventies, plus the fall of the Bretton Woods agreement, economic crisis of developed countries and their return to liberal policies. The industrialization experience had already shown great weaknesses, which, in this new context, led to a change of course in the development model. The application of policies of strong commercial and financial openness went hand in hand with a model oriented towards the export of traditional primary goods, to the detriment of the industrial sectors.

The literature calls 'premature de-industrialization' the contraction process of the manufacturing sector in the peripheral countries that occurs before a development has been experienced, which could reap the benefits of achieving certain levels of consumption and welfare through such productive structure (Dasgupta and Singh 2006, Rodrik 2016). The trajectory of Latin America since the 1980s is in line with this concept of premature de-industrialization (Palma 2005). Recent evidence showed how during the years of the dismantling of the industry 1975-1990 there was also a drop in productivity for Brazil and Chile, a situation contrary to that registered between 1950 and 1975 (Castillo and Martins 2017). In the 1990s, the structural shift towards a greater predominance of sectors based on the export of natural resources deepened, and the region under this pattern again generated a mediocre productivity performance away from convergence trajectories (McMillan and Rodrik 2011).

In summary, the region had a unique industrialization experience led by the State between the 1930s and 1980s. The performance of the model as a whole has been assessed from different aspects (economic, social, institutional), under different theoretical approaches and over different periods. However, the literature is scarce about what happened in the industrial sector during those years, particularly before the 1960s, in terms of relative economic performance. Generating new quantitative evidence is important not only to assess this period more completely, but also in light of recent debates about what it could offer to industrial development and its policies.

1.3. Conceptual framework

Historical evidence reveals that the economies that can be considered more advanced nowadays had an industrialization stage in the past (Szirmai 2009, Rodrik 2013). Not only should we refer to the cases of European countries, the United States, Japan, but also those known as late industrialization in the Asian region such as South Korea, Province of Taiwan (Amsden 2001). Together with other items that were developed in point 1.1, the importance of studying the historical period of industrialization in Latin America is clear.

This section focuses on the theoretical arguments that link the manufacturing sector and industrialization with the processes of structural change and trajectories of convergence and divergence.

The role of industry and the productive structure

First, the idea that the manufacturing sector has been the engine of modern economic growth comes from Kaldor's research, followed by Cornwall, among others. The growing returns to scale in the manufacturing sector, and the positive relationship between the growth of industrial product and the product of total economy, are two empirical regularities observed by Kaldor for developed countries (1967). Continuing this idea, Cornwall (1976) analyzed the linkages and the spillover effect of the manufacturing sector, that is, when productivity growth in this sector leads to productivity growth in other sectors of the economy[9]. For a more recent period (1950-2009), Szirmai (2009) confirmed the existence of increasing returns to scale in the industrial sector, as well as the positive effects of spillover and linkages. There are other factors that also explain the importance of the manufacturing sector, such as those related to technological advances and the investment in R&D carried out there (Lavopa and Szirmai 2012)[10].

Starting from the idea that industry is a key sector for economic growth, other theoretical approaches went even further by proposing that industrialization would be the possible way out of underdevelopment and poverty.

The structuralist school was the first to propose industrialization for Latin America as the way in which to alter the form of international insertion, and overcome internal structural barriers to economic development. This heterodox approach originated from ECLAC in the

[9] Hirschman (1958) analyzed the forward and backward linkages generated by the manufacturing sector, which exceed those observed by other sectors such as mining and agriculture.

[10] Lavopa and Szirmai (2012) concluded that the intensity of R&D in the manufacturing sector is higher than that in other sectors of the economy.

mid-twentieth century and is part of the so-called theories of Development Economics[11].

The concern from ECLAC in the fifties was centered on the strong balance of payments deficit, to the extent that the countries of the region are inserted from their peripheral condition in the international division of labour as suppliers of raw materials and food, and buy manufactured goods from the central countries, with a trend of deteriorating terms of trade (Prebisch 1950)[12]. The problems derived from the "disparity of elasticities" is added to this; that is, the differences in income elasticities of demand for goods produced in both regions. The initial lag of the productive structure of the peripheral economies, and their low rates of technical progress in relation to the center, would explain the lower income elasticity of exports from those economies in relation to the income elasticity of imports (which are the center's exports) (Rodriguez 2001). Therefore, deliberate industrialization would fulfill the role of resolving such macroeconomic imbalances. In order for this to be achieved, policies should be oriented in search of: replacing imports with national production (in a first stage, non-durable consumer goods), promoting investment in technology, discouraging the consumption of luxury goods, and achieving regional integration capable of overcoming limited domestic markets.

Prebisch (1950) introduced the key idea of productive specialization to analyze the problems of underdevelopment, which is linked to the need for industrialization. While the countries of the periphery are characterized by a heterogeneous and specialized productive structure, the central countries have a homogeneous and diversified structure. The conventional measurement of the heterogeneity of the productive structure looks at the productivity distances that exist between the different sectors within the economies. This analytical element remains in all stages of cepaline thought, and will be specifically addressed in the thesis.

The concept of structural heterogeneity is closely linked to that of structural change. Kuznets (1955) defined structural change in the economy as a whole from the fall of the weight of agriculture in total product, and the change of low productivity workers in primary activities to others of higher productivity linked to industry. Economies betting on more modern sectors, such as manufacturing, would lead to more diversified and homogeneous

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[11] Development Economics is a very diverse subdiscipline of economics. In it, the structuralist approach of ECLAC coexists together with Rostow's theory of modernization (1960), Lewis's dual model (1954), Rosenstein-Rodan's "Big Push Model" (1943), among others.

[12] This idea was initially developed by Hans Singer (English economist) in 1948-1949, and expanded shortly thereafter by Raúl Prebisch.

production, which could reduce internal gaps and structural heterogeneity (Rodríguez 2001).

Although the influence of the ECLAC´s message is evident in the political project of several countries in the region post-World War II, criticism of the weaknesses of the industrialization pattern adopted did not take long to arrive. New concerns and recommendations arose in the 1960s and 1970s (Sunkel and Paz 1970, Furtado 1974, Pinto 1976, Cardoso and Faletto 1977). The structuralists were concerned by the industrial anti-export bias, problems caused by external dependence, the absence of certain reforms (agrarian, social), and the concentrating vocation of national income.

Since the 1980s, ECLAC has renewed its thinking under the so-called neo-structuralist current. This occurs within the framework of a different ideological context in the region, where the application of neo-liberal economic reforms, including the dismantling of the industrial sector, predominates.

The axis of analysis of neo-structuralism went through the transformation of the productive structure with social equity (Fajnzylber 1983, 1990). The difference with classical structuralism is that here the manufacturing industry is important in so far as it articulates with other sectors of the economy. In addition, following a critical analysis of the industrialization stage, this approach gives importance to other elements such as innovation and technical progress, competitiveness, and education. Throughout the thesis, I will discuss the concepts of competitiveness and protectionism seen from this theoretical perspective: authentic competitiveness versus spurious competitiveness, and frivolous protectionism versus learning protectionism. Once again, policies play a central role for development, either by developing a national innovation system, promoting technical progress and productivity, training human resources, investing in science and technology, among others.

Neostructuralism from the nineties to the present has been supported by other heterodox approaches, including the evolutionist, and the Post-Keynesian. In particular, the theoretical model developed by Cimoli and Porcile (2013) formalizes the relationship between the center and the periphery by taking the classical structuralist concepts and incorporating new analytical elements: the innovation and diffusion of technology that is emphasized by evolutionists and which is Schumpeterian-inspired, and the effective demand emphasized by the Keynesians. Other ECLAC works also build efficiency indicators (called Keynesian and Schumpeterian) that reflect these influences. These indicators cannot be built in this thesis due to insufficient data for the period, but the Krugman index and the relative participation index are estimated, which, as we will see later, are two measurements that provide inputs to analyze the productive structure from a Schumpeterian perspective.

The ECLAC´s approach of today maintains structural change as its object of study, which is both a promoter of greater equality and contemplates environmental sustainability. Through the absorption of a greater proportion of the labour force in the modern sectors of the economy, identified with the industry, it would be possible to reduce structural heterogeneity and generate a virtuous structural change (Cimoli 2005). As stated at the beginning of this Chapter, the concept of industry today is broader than in the past. While the manufacturing sector is important, other sectors are added, such as scientific technology laboratories, the production of different energy sources, biotechnology, nanotechnology, and information technology areas.

Finally, the academic debate around industrialization and the promotion of industrial development policies has returned to the fore. More researchers trained in different schools of thought are adhering to the theoretical postulates that productive structure and policies are important for economic growth and development, which is reflected by the generation of new international evidence (Fagerberg and Verspagen 2002, Rodrik 2009, Szirmai and Verspagen 2011, Fagerberg 2000, Rodrik 2005, Hausmann and Rodrik 2006, Chang 2009, McMillan and Rodrik 2011, Stiglitz and Lin 2013, Szirmai 2012, Naudé and Szirmai 2012).

The industrial sector and the convergence and divergence approaches

The historical and comparative approach of this thesis aims to contribute to a better understanding of the convergence and divergence processes that have taken place in Latin America. Different theoretical perspectives converge in the studies of these economic processes; from neoclassical, cepaline structuralism, and other heterodox views that incorporate technological and institutional dimensions, among others.

The orthodox literature offers three ways to calculate convergence: absolute, conditional, and convergence clubs. The first hypothesis of the neoclassical theory, which is formalized with the Solow model, predicts absolute economic convergence between countries if there are other similarities, such as the savings rate, investment rates and population growth. The neoclassical model assumes increasing returns to capital to predict that the poorest economies will grow more than the rich ones until they reach them in the same stationary state. The evidence has been far from being able to confirm convergence both worldwide and for the countries of the region. Later, another convergence hypothesis was postulated that refers to the manufacturing sector and not the economy as a whole.

In his 1993 paper, Broadberry developed the idea of why it is important to study the relative performance of the manufacturing sector. Broadberry concentrates his discussion precisely on the idea that the income convergence can be explained by technology and its spillovers. In turn, he assumes that it is in the manufacturing sector where more technology is incorporated, therefore, knowing the relative levels of manufacturing productivity would lead to an understanding of the potential of global convergence. Like other works (Dollar and Wolff 1988), its results are focused on rich countries. I will stop here with two recent contributions on this subject, for the inclusion of Latin American countries in the comparative analysis: Bénétrix, O'Rourke and Williamson (2012) and Rodrik (2013).

Bénétrix et al (2012) studied the unconditional convergence[13] of per capita manufacturing production in less industrialized regions (Latin America, Asia, Africa and the European periphery) in relation to the leaders (United Kingdom, United States and Germany) for the period 1870-2007. These long-term estimates suggest that convergence in Latin America occurred between 1950 and 1972, which coincides with the highest point of industrialization. In addition, they indicate that the region experienced rapid manufacturing growth from the 1870s, which increased during the period of state-led industrialization and decreased after 1972[14].

For its part, Rodrik's paper (2013) focuses on a more recent period (1965-2005), with a greater coverage of countries (a total of 100). The paper tests the unconditional convergence in labour productivity at the two-digit level of the industry. Its main result is that modern industrial sectors achieve unconditional convergence, rather than the economies as a whole. These sectors are characterized by producing tradable goods that compete in world markets. In his conclusions, Rodrik suggests that the point would be to study how countries can transfer resources to modern industrial activities that promote convergence, which would allow policies to intervene. This message therefore culminates by connecting convergence with productive transformation.

It is necessary here to introduce what arises about convergence from the structuralist view itself. Based on what I have already written in the previous point, divergence is predicted from the structuralist perspective, not economic convergence. The message of this trend is

[13] Convergence is calculated as the difference between the per capita product growth rates of the peripheral country and that of the group of leading countries.

[14] In the same direction, Durán, Musacchio and della Paollera (2017) calculated the convergence of manufacturing production for Argentina, Brazil, Chile and Colombia with respect to the United States, and to an average of 3 countries (Germany, Great Britain and Japan). They found that the greatest process of convergence for Brazil, Colombia and Chile took place between 1930-1972, while in Argentina it was observed in the previous years (1920-1930).

that through a virtuous structural change, where workers move from the least productive to the most productive sectors, the foundations are set to close the external technological and productivity gaps. Again, structuralism begins to dialogue with other heterodox approaches, such as the post-Keynesian, the evolutionist, which contributes to enriching the analysis. Two theoretical formalizations can be highlighted: Thirlwall's law and Verspagen's model. Thirlwall (1979), based on ideas previously raised by Prebisch, relates the relative growth of income between peripheral and central countries with the balance of payments restrictions measured through the income elasticities of demand for exports and imports. The pattern of specialization of peripheral economies makes it impossible for a growth path beyond what the balance of payments restrictions allows.

For its part, in his evolutionary model, Verspagen (1993) states that technological change depends on the accumulation of technological scientific knowledge (technological supply) and the induction of technological change due to the expansion of demand (a la Kaldor Thirlwall). The countries which are behind, in addition to those two sources, have a third, which is copying, or imitating. While the first two sources widen the gap between poor and rich countries, the counterbalance to divergence is copying or imitating. In order to catch up one can copy, but it is also necessary to reduce the gap in the supply of knowledge and in the induction of technological change by demand, which means a structural change towards more dynamic sectors in terms of demand. It also states that growth trajectories are determined by the domestic institutional and technological capacities of the countries to imitate existing technologies, a weak capacity prevents a reduction of the technological gap even if the technology is available to be adapted. At the empirical level, the analysis of technological gaps can be addressed by taking labour productivity gaps as their proxy[15]. The latter point will be explained in subsection 1.4 of this chapter.

Several works from ECLAC (2007, 2010, 2012) provide evidence in this direction for Latin American countries from the 1960s onwards. They fail to find examples of countries in which a productive transformation has been achieved that is also a promoter of a catching up process with leading economies. Inspired by the same theoretical approaches, Bértola and Porcile (2000) analyzed the income convergence along with technological learning and structural change, for Argentina, Brazil and Uruguay in comparison with four leading countries (England, Germany, France and the United States) between the years 1870-1990.

[15] For a more recent period, Lavopa (2015) takes the labour productivity gap of modern activities, which, along with others, includes the manufacturing sector.

They found different convergence and divergence regimes. The industrialization period stands out for being the moment where, for certain years, structural and income convergence coincide in the three countries.

In sum, the theoretical path taken is conclusive about the importance of analyzing the characteristics of the productive structure, including structural heterogeneity, with an emphasis on the industrial sector, and its link with the convergence and divergence processes. There are few works for Latin America that provide this information for the entire period of industrialization, with a historical and comparative perspective.

1.4. Methodological issues

For this research I have selected a quantitative approach with a historical and comparative perspective. This section describes the main methodological issues and concepts related to this dissertation: i) productivity, ii) the comparative analysis ii) conversion factors using the industry of origin approach iii) structural heterogeneity and structural change, iv) convergence trajectories.

The meaning of productivity

Productivity is a difficult concept to grasp. Simplified, it is usually defined as the relationship between inputs and product obtained. Productivity can be calculated at the level of a single production factor (land, labour, capital) or as a result of the combination of all productive factors, the latter known as total factor productivity (TFP). Under this measurement, then, a resource or a combination of them is more productive if a higher level of product is obtained with the same level of inputs (Helpman 2004). This leads us to attempt to know through which mechanisms resources can be more productive, and there the concept of technical change appears.

The question of productivity, and more precisely of labour productivity, has a background in classical political economics, in Adam Smith and David Ricardo, which is then resumed by Carlos Marx. In these three authors, the accumulation of capital boosts the potential of the productive capacities of work and allows a small amount of work to create a greater amount of product, that is, through this mechanism, higher levels of economic growth are achieved (Smith 1776).

Later, in the mid-twentieth century, Solow's work (1957) takes up the analysis of the sources of growth, under a neoclassical perspective. Labour productivity is no longer the only important factor as it was in the classics, and is measured along with capital productivity and total factor productivity within the growth accounting model. Beyond the simplifying assumptions used, this measure of the contribution of each factor to economic growth is widely used. The growth rate of the total product of an economy is broken down into the contribution of the used and measurable factors - capital and labour - and the one that cannot be accounted for by observable changes in the use of all factors (calculated by residue). The unobserved part of GDP growth represents the total increase in productivity, and is associated with technical progress. This last point is where the greatest weakness of Solow's theory lies, since technical progress is considered exogenous. The endogenous growth approach has incorporated this variable into the model since the 1980s, and therefore, policy measures in science, technology and innovation can alter technological change and thereby contribute to economic growth (Romer 1986, Romer 1990, Grossman and Helpman 1991, Aghion and Howitt 1992). This change in endogenous growth models finds points in common with heterodox approaches (evolutionist, neo-schumpeterian, neo-structuralist) such as those already mentioned in point 1.3.

In this thesis, I approach the concept of productivity from only the labour factor (van Ark 1990). I define labour productivity as the value added per worker. This also means leaving aside differences in the quality of this factor, for example, those that refer to the educational level. The difference between using the number of employees and hours worked cannot be explored here due to lack of data; other comparable works for developed countries had the same limitations (Broadberry 1993). The statistics available for the period do not allow to analyse the labour factor using different variables such as education or sex, nor for calculating capital measurements. Therefore, the reader must keep in mind that I always refer to labour productivity measured in number of workers, and in some cases I will use it as a proxy for total factor productivity.

The comparative perspective

One relevant question to answer in this subsection is: why compare developing and developed countries? Why compare Latin American countries with the United States and Sweden? In the case of the United States, for the whole economy and in virtually every industry it was the world´s productivity leader during much of the twentieth century (Nelson and Wright 1992). Previous works offer empirical evidence to support this fact: the average level of labour productivity favoured the American economy over other advanced economies, such as the United Kingdom and Germany (Broadberry 1997, de Jong and Woltjer 2011, Veenstra 2014). Therefore, evaluating Latin America with the United States would mean a comparison with the world frontier economy.

The comparison with Sweden turns out to be complementary, in the sense that this country showed a convergence trajectory with the US, though at its starting point previous to its industrial revolution it was also a peripheral country (Bolt et al 2018). At the beginning of the twentieth century, the Scandinavian economy exhibited a level comparable to that of Chile and Uruguay. Over the twentieth century, and specially from the 1950s, Sweden reached an income level close to that of the US (around 80 per cent) and much higher than that of the Latin American countries.

Blomström and Meller (1990) pointed out that although Sweden and the Latin American countries shared a similar productive base, supported by natural resources, particular Swedish features allowed for a different development process. Some dissimilarities might be crucial, for instance the exploitation of natural resources (wood and iron) in Sweden boosted industrialization and promoted modern and internationally competitive industries related to primary goods (pulp and paper, steel and machinery production). In turn, the State intervened with commercial and industrial policies which were different from those implemented in the Latin American countries, and since an earlier period the Swedish State gave priority to technical education dependent on the production system.

The industry-of-origin-approach

Comparisons of productivity performance at industry levels can reveal gaps between a country's labour productivity and that of the leaders, and makes it possible to discuss differences in technology, capital intensity, human capital, policies, and other institutional factors.

The comparative perspective requires us to find a suitable conversion factor to express the value of product and value added of different countries in a common monetary unit. The most direct way is using the exchange rate. Exchange rates are affected by capital movements, monetary policies, and other fluctuations. Therefore, they represent a suitable conversion rate for tradable goods and services, but not for non-tradable sectors (van Ark and Maddison 1988, van Ark 1993). The second alternative consists of using purchasing power parities (hereinafter PPPs) to establish the conversion rate. PPPs can be estimated using two alternatives.

The first method, known as Expenditure PPPs, estimates relative prices by the same product groups of final expenditure (goods and services) in national currencies in different countries. Expenditure PPPs are based on the retail consumption prices of goods produced by the country and imported goods, but exclude goods produced for export and price ratios of intermediate sectors (Mulder et al 2002), and are affected by trade and transport margins. Such points make this method less accurate when comparing value added at industry level. Conversely, the so-called industry-of-origin method provides a more sophisticated conversion rate to compare specific economic sectors. One major advantage of this method is that the data required is obtained mainly from a single primary source. In the case of manufacturing the sources are censuses of production or industrial surveys. After matching the goods produced in both countries, the second step consists of valuing a comparable basket in terms of their costs of production. Therefore, these conversion factors represent the relative price of the same industrial basket in both countries based on their production costs. They are known as unit value ratios (UVRs).

Different works have employed expenditure PPPs or exchange rates to provide an international comparison for the manufacturing sector in Latin America. Hofman (1998) reported estimates of labour productivity between Latin American countries in relation to the United States for the total economy for several years during the twentieth century using PPPs. In 1938 the labour productivity level in Chile was 32 percent compared to the United States, one of the highest ratios in the region. On the other side, Frankema and Visker (2011) and Azar and Fleitas (2010) employed exchange rates. The first paper analyzed the manufacturing industry in Argentina and Australia from 1907-1973, and the second one examined the manufacturing performance of Argentina, Brazil, and Uruguay compared to the United States for the period 1930 to 1960.

Although there are several works which employ the industry-of-origin approach to compare developed countries over the twentieth century, the comparison between developing economies and leader countries has been very limited. In any case, it is more likely to find evidence after the 1970s. Dealing with different data constraints, this thesis is one of the first works that presents estimates of unit value ratios between Latin American countries and developed countries (Sweden and the United States), with two benchmarks in the first half of the twentieth century, presented in Chapter 3.

Structural heterogeneity and structural change

As discussed in 1.3, structural differences in the total economy as well as within manufacturing contribute to understanding why some countries follow a successful path of economic growth, while others could not achieve it. Therefore, sectoral heterogeneity and structural change are useful conceptual elements included in this thesis with the aim of understanding the economic differences among countries.

For this purpose, I employ several methods. In Chapter 2 I introduce two indicators in order to measure the structural change associated with technical progress: the Krugman Index (KI) and the Relative Participation Index (RPI). In Chapter 3 I present a shift share analysis to measure structural change, as well as Harberger diagrams to analyse patterns of industrial growth during the period 1930-1980.

The Schumpeterian view recognizes that technical progress is the main driver of growth, which is, in turn, inherent to structural change. Technical progress implies the creation of new sectors and processes that redefine the productive structure, making it more diversified, dense and complex. The Krugman Index is calculated as the sum of the differences (in absolute terms) between the participation of each industry in the total industrial value added of a country and the participation of the same industry in the industrial value added of another country taken as a reference (the US in this case).

The Index of Relation Participation (RP) is the relationship between the share of the engineering sectors (as a proxy of the share of technology-intensive industries) in the value added of total manufacturing of a certain country and that same participation in the reference country (US). It is assumed to be a proxy of the technological intensity of the industrial sector. Both indexes are complementary and were used in other work for Latin American countries after the 1980s (ECLAC 2007). Both indexes are based on industrial censuses and industrial surveys.

In order to carry out the shift share analysis and the Harberger diagrams it is necessary to collect time series of labour productivity at constant prices, time series of labour, and value added at current prices for several benchmarks.

The shift share method is based on a decomposition of labour productivity growth rate following Fagerberg and Verspagen (1999) and Fagerberg (2000). They analysed labour productivity within the manufacturing sector and between different industries.

Labour productivity growth rate is the result of three components: within-industry effect, static effect and dynamic effect. The first one measures the contribution of productivity growth within industries by considering the initial weight of these industries in the total labour structure. The static effect shows the change in the employment structure by considering the initial fixed productivity and, ultimately, the whole effect of the change in productivity due to the reallocation of labour between industries (static effect). The static effect will be positive if the share of high productivity industries in total labour increases at the expense of industries with low productivity. Finally, the dynamic effect is the result of two effects: within-industry and the static effect. This component will be positive if the industries which increase their productivity more rapidly than average productivity also increase their share of total labour. The results obtained through using this disaggregated approach would help us to understand how these Latin American countries performed in terms of structural change and comparing to the United States and Sweden.

On the other hand, the distribution of productivity growth across industries follows an approach proposed by Harberger (1998) whose main purpose is to analyze whether productivity increases are concentrated in a few industries or are widespread, covering all the productive structure. This approach, known as the "yeast and mushroom" analysis, was followed by several papers (Inklaar and Timmer 2007, Lavopa 2011, Prado 2014, Bakker et al 2015). This expression refers to the patterns of industry contribution to aggregate productivity growth: a mushroom distribution implies that few industries contribute more to the aggregate productivity growth while a yeast distribution means that industries contribute evenly to total productivity growth. Following previous works, I also calculate the Harberger coefficient. This is the area between the curve and the diagonal divided by the total area under the curve. Therefore, it measures the degree of concentration of industry contributions to total labour productivity growth. This ranges from 0 to 1, and a lower value indicates higher equality among industrial contributions to labour productivity growth.

Convergence trajectories and technology gap approach

Structural heterogeneity is easily linked with the literature on convergence and the technology gap approach, as the differences among sectors and between countries may lead to a catching up process related to technology. The more modern the sectors, the higher the productivity they would have, and they would be closer to the leading countries.

Convergence can be measured in different ways. A simple measure of convergence-divergence is defined as the standard deviation of the logarithm of value added per labour in the sample of countries for different years. In this thesis, making use of the time series built at industry level, I test convergence as catching up through the use of an econometric exercise. Following the conceptual framework already mentioned in 1.3, industrial trajectories correspond to the evolution of technological gaps, which are measured by a proxy of relative labour productivity levels. The benchmarks of relative labour productivity levels in the binary comparisons presented in Chapter 3 are moved backward and forward using data of value added at constant prices and labour.

The time series of relative labour productivity levels by industry are studied under Unit Root Tests in order to identify convergence or divergence trends. The United States and Sweden are taken as the reference countries. The existence of a unit root is tested by employing the augmented Dickey-Fuller (ADF) regression including constant and time trends.

From the rejection of the null hypothesis (there is a unit root), the series can be characterized as stationary, and it is possible to calculate whether the industry is catching up or lagging behind in the chosen period by using a deterministic trend. However, other works have showed that the ADF test may fail to reject the null if the series had structural breaks (Perron 1989). To deal with this, when the null hypothesis cannot be rejected using the ADF test, I employ the Zivot and Andrews' (1992) test for a unit root in the presence of an endogenously determined structural change.

In the event that the test is statistically significant (comparing the ZA result with the corresponding critical values), it also identifies a breaking year in the series. The deterministic trend is estimated in both sub-periods (before and after the breaking point) to find a positive or negative coefficient trend (convergence or divergence trends).

This exercise is applied to industrial series of labour productivity in Brazil, Chile and Uruguay, compared to the United States, and Brazil compared to Sweden.

1.5. Outline of the chapters

Chapter 2 investigates the productive structures of three countries in the region (Brazil, Chile and Uruguay) and two rich countries (United States and Sweden) between the 1930s and 1980s. Specifically, the analysis focuses on the value added, employment and productivity variables within the manufacturing sector, which are disaggregated into 19 industries for these 5 countries. To this end, I work with economic censuses, yearbooks and industrial surveys. There is a first task to homogenize the same categories of industries that will be maintained throughout the period in every country.

The first section of this chapter is dedicated to the historical context of the countries involved in the thesis. And the second one to analyzing their manufacturing sector in a comparative perspective using different indicators (coefficient of variation[16] of labour productivity, Krugman Index and Relative Participation Index, among others).

The main purpose of **Chapter 3** is to present estimates of unit value ratios and labour productivity levels in a benchmark year by industries for Brazil, Chile and Uruguay compared with the United States and Sweden, using the industry-of-origin approach. In terms of its empirical contribution, this is one of the first works which presents such estimates between Latin American countries and developed countries based on this method with two benchmarks in the first half of the twentieth century.

In the case of Brazil, estimates comparing with the US and Sweden in 1949 and 1975 respectively are taken to an extent from my own previous works (Lara and Prado 2018a, Lara and Prado 2018b). The new Chilean estimates were built for 1939 and are presented for the first time in this thesis. Finally, the Uruguayan benchmark was built for 1988 and it is taken from my own previous work (Lara 2012). Using these benchmarks, it is possible to construct time series of labour productivity levels by industries and to analyze convergence or divergence trajectories.

The aim of **Chapter 4** is twofold. First, it intends to explore the patterns of productivity growth in the manufacturing sector in the Latin American countries and in the United States and Sweden during the period circa 1930-1980, as well as whether their manufacturing sector was able to carry out structural change. Second, this chapter analyses the existence of convergence in productivity across industries in Brazil, Chile and Uruguay compared to the United States and Sweden.

The distribution of productivity growth across industries is analyzed following the "mushroom and yeast" analysis proposed by Harberger (1998), and structural change is measured within the manufacturing industry using a shift share analysis (Fagerberg and Verspagen 1999, Fagerberg 2000). Finally, Unit Root Tests (ADF test and Zivot and Andrew test) let us examine the existence of convergence/divergence at aggregate and disaggregate level in Brazil, Chile, Uruguay compared to the US and Sweden.

Chapter 5 presents the main conclusions of this work.

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[16] It is calculated by dividing the standard deviation of labour productivity by the average of labour productivity.

Chapter 2. A descriptive analysis of the manufacturing industry

2.1. Introduction

This chapter investigates the structure of industrial production of three countries in the region (Brazil, Chile and Uruguay) and two high income countries (United States and Sweden) between the thirties and eighties. It is indebted to ECLAC's assesment that Latin American economies have become active within the world economic system while keeping structural heterogeneity, during a period of time when the core countries achieved substantial changes in their production structure.

The aim is to provide insight to understand the structural heterogeneity in Latin American countries during the stage of state-led industrialization, and in the case that it has changed, the direction and magnitude. An important contribution of the work is the effort to present estimates througout the whole period of industrialization, including the interwar period.

In addition, an industrial disaggregation is expected to contribute to explaining the changes and the differences by country. The inclusion of two rich countries, in the same time period but with different initial trajectories (United States and Sweden), allows us to assess the structural change in a comparative perspective.

Specifically, the analysis focuses on value added, employment and labour productivity as variables in the manufacturing sector, and the opening of 19 industries in these five countries. As was defined in Chapter 1, labour productivity is the ratio between value added and total employment. For this purpose, I work with economic census data for all countries, with the exception of Chile for which I also include yearbooks and industrial surveys. Since each country presents the information in a different way, and also its classification changes over time, first there is substantial work to homogenize to have the same categories of industries throughout the period in every country.

Moreover, I followed the classification proposed by Katz and Stumpo (2001) who divide the manufacturing sector into three types of industries according to the production factor used more intensively: natural resources, labour and engineering (Katz and Stumpo 2001, ECLAC 2007, Lavopa and Szirmai 2011). The first group includes food, beverages, tobacco, paper, chemicals, petroleum, rubber and plastics. The second group is comprised of textiles, apparel, leather, wood, furniture, printing, non-metallic minerals and miscellaneous. The third group includes metals, electrical and non-electrical machinery, vehicles and transport equipment.

It is expected to find lower structural heterogeneity when observing the countries individually, however, it seems unlikely that there will be major gains to narrow the gap relative to rich countries. It seems that Brazilian manufacturing has reduced its structural heterogeneity over a longer timeframe relative to Chile and Uruguay, and the gap between Brazil and the United States and Sweden has narrowed moderately.

This chapter contains two sections after the introduction. The first is dedicated to the historical context of the countries involved in the thesis. The second analyzes the productive structure of the five countries throughout the selected period. Both subsections provide the basis for what will be shown in Chapter 4.

2.2. Historical context

By the end of the First World War, and in particular after the Great Depression starting in 1929, Latin American countries were unable to sustain economic growth based on primary goods exports. The world had changed; international trade had decreased as had external investment.

Furthermore, other political and economic ideas opposed to liberal policies had gained momentum. In developing economies, anticyclical policies can be primarily expected to stabilize balance of payments (BOP) instead of aggregate demand. Governments mainly had to take actions to overcome the BOP restrictions associated with the reduced availability of foreign exchange (Bértola and Ocampo 2012).

Due to this international situation and the current account deficits, Latin American governments encouraged industrialization for the domestic market via inward-looking economic policies, especially after the 1940s (Hofman 1998).

However, there is vast evidence supporting the idea that "early industry" already existed in countries such as Argentina, Uruguay, Chile and Brazil before the 1930s. According to Lewis (1986), Bulmer-Thomas et al. (2007), Bértola and Ocampo (2012), manufacturing was clearly well established by 1930.

Industrialization and urbanization were two strongly related phenomena from the last decades of the XIXth century on. As more people migrated to cities, the supply of workers for industry and services increased, as did demand for consumer goods, thus providing a growing internal market for industrial production. In this sense, the three Latin American countries analysed in this thesis shared similar patterns, such as developing infant industries before the 1930s, a period of industrialization from the 1930s forward with a substantial state-led support, and deindustrialization after the 1980s.

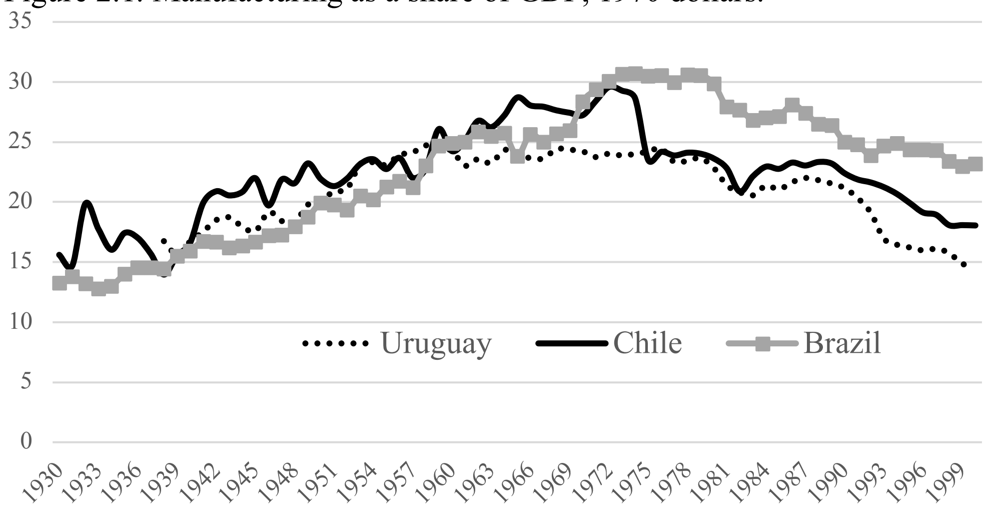
There are also specific characteristics related to local institutions, the role of the state and policies, as well as different income distribution patterns. For these reasons, in the next subsection I present a brief description of the historical context of each country throughout the period under analysis.

To have an idea of how important manufacturing was in the economy of these Latin American countries, Figure 2.1 shows the manufacturing share of GDP over the period. From the 1930s to the 1970s, Latin American economies and especially Brazil were characterized by an expanding role of the manufacturing sector.

While in both Brazil and Chile the manufacturing share of GDP[17] reached its highest point at the beginning of the 1970s at around 30%, in the first country it remained stable for ten years and started to decline in the 1980s, whereas in Chile it dropped sharply in the mid-seventies and then continued to decline.

In Uruguay, manufacturing reached its highest share at the end of the 1950s (25% of GDP in 1959-1960) and then remained stable for two decades at around 23%. After the 1970s this rate declined steadily in Uruguay to levels lower than in Brazil and Chile.

Figure 2.1. Manufacturing as a share of GDP, 1970 dollars.



Source: MOXLAD.

[17] Industrialization can be measured as manufacturing GDP divided by GDP of the entire economy.

This dramatic change since the eighties happened in the context of the debt-crisis. A new institutional environment and neoliberal policies were implemented in Latin American economies. The neoclassical perspective supported the idea that outward-oriented policies would improve competitiveness and productivity. However, some authors questioned these new recipes: following Thorp (1998), the limitations experienced by the state-led industrialization model could have been solved with efforts to create more capacity to generate technology, for example with national innovation systems and a stronger educational system. Possibly even more important, the debt crises that ushered in the new policy era coincided with the end of economic convergence.

Some underlying questions in this chapter are: when these Latin American countries reached the highest levels of industrialization in the long run, did it happen together with a change in the production structure? If the answer is yes, in which direction and magnitude? What happened from an international comparative perspective?

2.2.1. Brazil

In Brazil, the Great Depression marks the end of the old era of reliance on coffee exports and the beginning of a new era, where great efforts were made to develop domestic industry behind tariff walls. Even though the adverse effects of the volatile world market on coffee prices had long been felt, the catalyst of change was the major fall in world demand for Brazilian coffee in the wake of the Great Depression.

The early origins of industrialization in Brazil date from the late nineteenth and early twentieth century. Even though there are differences in interpretation and emphasis, the general judgment is that Brazilian pre-WWII industrialization was slow in coming and largely relied on foreign technology and income generated by coffee exports. It seems likely that the coffee boom fuelled the rise of domestic manufacturing plants when industrialization was still at its infancy (Dean 1969).

Most authors highlight the preponderance of consumer goods industries, above all textiles and food, and the deficiency of capital goods industries, like the iron and steel industry and also mechanical engineering. The textiles industry dwarfed most other industries, accounting for one-quarter of industrial output in 1920. It was rivalled only by food industries, which accounted for 33% of output (Fishlow 1972: 322-323). Electricity usage lagged other countries in Brazil. In 1907, only 4.2% of the power used by industry was based on electricity. The state mainly promoted industrialization via tariffs and taxes: ad valorem tariffs applied to selected goods averaged 400% in 1901. Taxes to improve harbour facilities and roads, and tariff exemptions, were very frequent in Brazil at the beginning of 20th century (Abreu et al. 1997).

Until the 1930s, when the domestic production of many capital goods began to substitute for imports, Brazil was dependent on imports of a wide range of machines and sophisticated equipment (Suzigan 1986). A corollary to the lack of experience in the production of capital goods was the decisive role played by foreign entrepreneurs in the development of more sophisticated manufacturing processes, as well as in the establishment of heavy industries like steel and cement. Whatever sign of sophistication one might come across, it almost certainly came from abroad. Yet the foreign element would only exercise a significant impact on industrialization in the post-World War II decades, above all in São Paulo, once foreign entrepreneurs, this time *en masse*, were willing to make the long-term commitments required to develop manufacturing plants (Dean 1969, Colistete 2001).

Abreu et al. (1997) distinguish two stages in Brazilian industrialization: between the 1930s and 1960s and from the 1960s to 1980s. The first period can be considered a proper import substitution industrialization, while the second stage was characterized by expanded production of more technologically sophisticated goods.

Under the governments of Getúlio Vargas[18], and especially after 1937, interventionist economic policies became gradually more prevalent in order to speed up industrialization and structural transformations. The value added of manufacturing increased as a share of GDP from the beginning of the 20th century forward, and was 16% by 1940. In addition to tariff discrimination, import controls were the most important industrial policy until the 1940s in order to favour exports and discourage imports.

As shown in Table 2.1, the share of value added in natural resources- and labour-intensive industries of manufacturing each represented 44% of all manufacturing in 1939. Concerning their labour shares of total employment, they were 33% and 57% respectively, in 1939. Although over time these ratios dropped steadily, up to the 1950s growth in industrial production was due to expanded production of traditional goods with significant inputs from natural resources (food, beverages and tobacco) and labour-intensive industries (textiles, apparel, footwear, and leather). Despite these industries having been the most protected

[18] Vargas was the Brazil's president during four periods: 1930-34, 1934-37, 1937-45 and 1950-54.

during the period[19] (Arvin-Rad et al. 1997), food, beverages and tobacco always registered higher labour productivity[20] than textiles, apparel, footwear, and leather.

In general, the group of industries related to natural resources showed better performance than the labour-intensive ones, which can be explained to an extent by the inclusion of chemicals, petroleum, paper, rubber and plastics, in the first group. While the labour productivity of natural resources intensive industries was 34 percent and 51 percent higher than the manufacturing average in 1939 and 1949 respectively, labour productivity in labour intensive industries was equivalent to 77 percent of the manufacturing average in 1939 and 82 percent in 1949.

Up to the 1940s, engineering intensive industries such as metals, machinery and transport equipment had value added and labour shares of around 15% and 12%, respectively, and labour productivity above the manufacturing average (37% higher in 1939).

Between the 1940s and the early 1980s, Brazil carried out a massive state-promoted effort to modernize its economy and industrialize (Baer and Kerstenetzky 1964, Suzigan and Villela 1997, Hofman 1998). Starting in the 1950s, new industries related to durable consumption goods (such as automobiles and household appliances) were supported by public subsidies and the state also participated in the generation of energy, construction and transport in order to provide infrastructure to the industrial sector (Thorp 1998).

Financial intermediaries such as the National Economic Development Bank (the *BNDES*) founded in 1952 were key to financing infrastructure projects as well as the expansion of selected industrial sectors. Moreover, although protective industrial policies had moved toward multiple exchange rates[21], in 1957 very high ad valorem import duties were established, in some cases reaching 150%.

The building of *Compañía Siderúrgica Nacional (CSN),* a government-owned modern steel mill located in the city of Volta Redonda, resulted from an absence of private firms interested in the project, and thus the need for state intervention. This state-owned company was established in 1946, with its main purpose being to provide steel to the Allies of WWII. *CSN* positively fuelled the metals sector and also the entire economy through forward and backward linkages.

[19] During Vargas' government, the textiles industry was highly protected by tariffs (Fishlow 1972).
[20] Relative labour productivity is calculated by dividing the labour productivity of the industry by the average labour productivity of the entire manufacturing sector.
[21] A multiple exchange rate system is the market divided into any number of segments, each with its own exchange rate.

In the petrochemicals sector, the state also intervened strongly, supporting the production of petroleum products and alcohol. In 1953, the government of Vargas created *Petrobras*, a state-owned monopoly devoted to oil, natural gas and derivatives. This sector had also received special attention in the preceding two decades. For example, in 1931 and 1933, laws were passed to promote the industrial consumption of alcohol[22]. However, despite this strong state commitment toward industrialization, from the mid-1950s forward the Brazilian state also began to apply new industrial policies oriented to attracting foreign direct investment.

In this context, we should expect changes in the industrial structure beginning in the late 1950s. Table 2.1 confirms this. According to the industrial census of 1959, natural resources and labour-oriented manufacturing saw their shares of manufacturing value added drop, whereas in engineering industries (metals, machinery and transport equipment) this rose by 14 percentage points, from 13 to 27%. Both natural resources and engineering industries performed better than the industrial sector average, although the first group retained relatively higher productivity.

Starting in 1964, Brazil began a development strategy as a more open economy: many distortions were removed pursuant to a policy reform. Given the international context, this new industrial strategy enabled Brazil to industrialize further. Under a military government, the 1968-1973 period was known as the "miracle years": substantial economic growth as a result of an aggressive program. In this new stage, policies were more oriented toward the private sector. Export-oriented firms, many of them multinational enterprises, were exempted from duties on imports of capital goods, which contributed to strengthening the alliance among the state, domestic capitalists and foreign capital (Alarcon and Mcckinley 1992). Incentives for manufactured exports led to their expansion, especially in motor vehicles, transport equipment, metals, chemicals, shipbuilding and aircraft. In 1969 the government created *Embraer*, the first national enterprise devoted to producing aircrafts.

In turn, Teitel and Thoumi (1986) found that capital-intensive industries, such as metallurgy and metalworking, increased their export volumes and achieved higher efficiency thereby increasing productivity rates. This achievement ran counter to the litany of criticism against import substitution industrialization. In fact, it illustrates how state-led policies fostered development of heavy industries, which played an important role in promoting

[22] The Institute of Sugar and Alcohol was created in 1933, and in 1931 a law obliged the use of alcohol in fuel production.

exports. As opposed to other small Latin American countries, the large domestic market in Brazil allowed firms to reap the benefits of economies of scale, and made it profitable to produce capital goods, durable consumption goods and transport equipment.

Between the industrial censuses of 1975 and 1980, the change toward engineering industries is more evident. Natural resources and labour-intensive industries respectively represented 36% and 28% in terms of value added, and 25% and 43% in terms of employment in 1975-80, whereas the engineering-intensive industries had increased to around three times their share of value added and labour of 1939, reaching approximately 36% and 33%, respectively, in 1980. This change occurred steadily between 1939 and 1980. Also, labour productivity in this more technologically-oriented group was higher than the manufacturing average. To sum up, if we compare the distribution of value added and labour in 1939 and 1980, the shares of industries more intensive in natural resources and labour dropped, while the share of engineering-intensive industries increased dramatically (Table 2.1).

Viewed from the vantage point of the late 1970s, it would have been reasonable to argue that the achievements of the previous decades were largely the outcome of policies implemented by the Brazilian state, whether under democratic or military rule. Nonetheless, already by the late 1960s and early 1970s, some authors voiced their dissatisfaction with industrialization, arguing that protectionism and selected subsidies had brought into existence inefficient firms and high-cost industries (Hirschman 1968, Baer 1972, Bulmer-Thomas 1994).

In Brazil, two camps offer conflicting views to explain the causes of the economic crisis in the 1980s and the later stagnation. The first camp blames the accumulated failures of the state-led industrialization model (Macario 1964) and the adjustment strategies adopted to deal with negative external shocks in 1973 and 1979 (Balassa 1980). Contrary to South Korea and Taiwan, Brazil did not adopt a permanent outward-orientated model to increase manufactured exports as a share of GDP. The second camp focuses on debt growth during the 1960s and 1970s. Fishlow (1981) argues that Brazil implemented a debt-led growth model between 1967 and 1973: external debt increased from 10% to 17% of GDP in 1973 in order to support the second National Development Plan. Apart from this debate, what is evident is that the debt crisis led to a reorientation in economic policy, away from protectionism and state regulations, and toward liberal policies (Baer 2008).

Table 2.1. Distribution of value added and employment by industries for selected years, Brazil.

	1939			1949			1959			1970			1975			1980		
	VA	L	LP	VA	L	LP	VA	L	LP	VA	L	LP	VA	L	LP	VA	L	LP
Food & beverages	27.6	23.3	118.8	24.9	20.9	119.4	19.3	17.7	109.3	15.8	16.4	96.5	13.1	14.5	90.2	11.3	13.8	81.3
Tobacco	2.3	1.7	135.2	1.4	1.0	143.4	1.3	0.8	173.3	1.3	0.6	238.5	1.0	0.6	184.0	0.7	0.4	185.3
Textiles	21.8	28.6	76.3	19.6	25.8	75.9	12.0	18.7	63.9	9.3	13.0	71.8	6.1	8.7	70.2	6.4	7.7	83.4
Apparel Footwear Leather	6.5	7.8	82.6	5.6	7.5	74.7	4.6	7.0	66.4	4.0	7.2	55.1	4.3	8.9	48.6	5.3	10.2	52.0
Rubber & plastic	0.6	0.6	115.0	2.1	1.1	201.6	3.8	1.7	218.2	3.8	2.9	133.6	3.9	3.3	118.9	3.7	3.6	103.9
Wood	3.2	4.6	69.3	4.2	5.2	80.4	3.2	5.0	64.5	2.5	5.2	48.8	2.9	5.3	54.6	2.7	5.3	50.3
Furniture	2.1	3.5	60.3	2.2	3.0	72.7	2.2	3.6	60.6	2.1	4.0	52.4	2.0	3.6	54.7	1.8	3.6	50.3
Paper	1.5	1.5	96.2	2.2	1.9	117.8	3.0	2.3	126.9	2.6	2.5	100.7	2.5	2.2	112.4	3.0	2.2	138.6
Printing	3.5	3.9	91.5	4.0	3.8	105.4	3.0	3.5	86.6	3.7	3.7	99.7	3.7	3.3	110.2	2.6	2.9	89.9
Non metallic minerals	5.3	7.0	74.7	7.1	9.8	72.5	6.6	9.3	70.2	5.9	9.0	65.5	6.2	8.4	74.4	5.8	8.9	65.4
Chemicals Petroleum	11.6	5.6	207.0	9.7	5.6	172.6	12.5	6.7	185.1	14.9	5.9	255.0	15.8	4.7	333.2	17.2	4.5	379.8
Metals & metal products	7.5	7.5	100.4	9.4	7.9	119.1	11.8	9.9	118.4	11.6	10.1	114.1	12.6	11.6	109.0	11.5	10.8	106.5
Non-electrical machinery				2.1	2.0	104.9	3.4	3.5	97.2	7.1	6.8	102.9	10.3	10.3	100.7	10.1	10.9	92.7
Mechanical engineering	5.4	3.1	173.5	1.6	1.2	132.6	4.0	3.3	120.7	5.4	4.4	122.8	5.8	4.6	124.4	6.4	5.0	128.4
Transport equipment				2.2	1.5	144.2	7.6	4.7	162.6	8.0	6.0	132.5	6.4	5.8	109.3	7.6	5.7	132.2
Miscellaneous	1.1	1.3	82.4	1.6	1.8	88.6	1.8	2.2	81.2	2.1	2.4	88.8	3.3	4.0	80.8	4.0	4.5	87.6
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Sources: See Appendix A: table A.1.

2.2.2. Chile

In Chile, industrial activity appeared in the middle of the nineteenth century and expanded in the 1880s due to the nitrate boom after the War of the Pacific[23]. The economic prosperity driven by mining, transportation and agriculture, together with demographic changes, expanded the scope of possibility for industrial development[24].Also, higher national income and the expansion of an urban middle class generated demand for a wide range of manufactured goods[25].

Among the most important industries, previous literature identifies concrete, sugar, flour-milling, brewing, textiles, paper and wine. Protective tariffs, state production and export subsidies were instruments implemented by the state to protect the infant industries. Kirsch (1977) argues that the tariff system of 1897, despite being moderate, may be considered a milestone in the protectionism scheme.

On the other hand, domestic industries depended on foreign machinery, technology and technicians. Europeans and Americans invested directly in manufacturing in Chile, and immigrants from these regions helped to cover the needs to employ a qualified labour force.

During the first stage of globalization, world trade was the main engine of growth and Chile recorded growth rates well above the average of Latin American countries (Bértola and Ocampo 2012)[26]. However, the collapse of the nitrate industry after 1930, precipitated by the appearance of cheap synthetic nitrate, showed the fragility of an economy highly dependent on primary exports. Previous works claim that the Chilean economy was the most affected in the world during the crisis of 1929. While the index of world trade between 1929 and 1932 fell from 100 to 75, in Chile this trade index dropped from 100 to 24 in exports and to 25 in imports (Palma 1984).

Besides this international context, after the 1930s the new stage of industrialization in Chile was facilitated by three domestic factors: economic groups interested in promoting the manufacturing sector, the development of an ideology favourable to an active role of the state, and the balance among political forces (Muñoz 1986).

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[23] The Pacific War, also known as the Salitre War, was an armed conflict between 1879 and 1884 that pitted Chile against its allies Bolivia and Peru.

[24] Ortega (2005) and Yáñez & Jofré (2011) argued that the industrial activity during the nineteenth century was related to coal, which also enhanced sectoral linkages.

[25] Palma (1984) also supports the idea that the industrial sector existed before the 1930s. His evidence shows that, between 1914 and 1929, domestic production increased whereas imports declined in relative terms. Besides, the industrial policies oriented the demand toward the local production.

[26] Chile, together with Argentina and Uruguay, was among high-income countries in the region.

Muñoz (1971) distinguishes between two different periods of industrial growth in Chile: before and after 1940. In the first period, industrial firms were led primarily by the private sector, produced non-durable goods and absorbed workers from other economic sectors. Urbanization involved displacement of the workforce from rural workshops to manufacturing establishments in the cities, which in turn led to expansion of the domestic consumer market (Mamalakis 1965). Geographically, specific zones in Santiago, Valparaiso and Concepcion were transformed into dynamic centres of manufacturing (Mamalakis 1976, Badía-Miró and Yáñez 2015).

After 1940, high rates of productivity growth in aggregate manufacturing were obtained due to greater capital intensity and less intensive use of labour. During this second period, chemicals, paper, non-metallic minerals and textiles played key roles in the industrialization process. Especially in chemicals and paper, high investment and technical progress increased productivity rates. The paper industry was one of the oldest industries in Chile, and its production capacity grew in response to mechanical and chemical pulp production. The comparative advantages of the paper industry also explain their performance in domestic and foreign markets in this period.

Under the government of President Pedro Aguirre Cerda (1938-41), a member of the Radical Party, different mechanisms to protect manufacturing were developed. The most common instruments were tariff discrimination, import licenses, quotas, prohibitions, exchange controls and multiple exchange rates (Pinto 1959). However, this protectionism was not homogeneous. Food, tobacco and textiles were the most protected industries with a net effective protection of 100 percent. On the other hand, the rates of net effective protection in non-metallic minerals, furniture and basic metals were between 50 and 100 percent, and chemicals and durable goods had low effective protection (Muñoz 1971, Mamalakis 1976).

In 1939, the government created the Production Development Corporation (in Spanish: *Corporación de Fomento de la Producción de Chile,* henceforth CORFO). CORFO aimed to create a strategy to promote economic growth and development in Chile, and was financed by a tax on the copper industry. This organization encouraged private and public investment, stimulated technological research and supported new industries in strategic fields, namely electricity, oil and steel (Lagos 1966). In so doing, CORFO intended to achieve a more diversified manufacturing structure and faster industrial growth with less external dependence.

Regarding investment, between 1940 and 1954 CORFO controlled more than 30 percent of total investment in machinery and equipment and 18 percent of total gross domestic investment (Mamalakis 1965). However, from a macroeconomic perspective total investment was comparatively low in Chile and constituted one of the bottlenecks of economic development. Whereas in the 1960s the rate of gross domestic fixed investment as a percentage of GDP averaged 17 percent in Latin America, this ratio was barely 9 percent in Chile (ECLAC 1961).

A consistent policy of industrialization was followed until 1952, the year in which the Radical Party was defeated. As a result of the policies implemented by the government of General Carlos Ibáñez, the economy grew but without a dynamic manufacturing sector (Mamalakis 1965). In the 1950s, this pattern of development faced several difficulties.

One line of research suggests that domestic factors had a negative effect on manufacturing performance: excessive protectionism based on tariffs, weak private investment, lack of qualified workers, inconsistency of industrial policies, insufficient foreign currency to import capital goods and inefficiency, as well as complexity of the public administration that lacked direction (Pinto 1959, CORFO 1967, Lagos 1966, Sunkel 2011). However, other authors provide different explanations. Ffrench-Davis et al. (2003) explained that the main problems were not caused by the inefficiencies of protectionism, but by social inequalities, and by high inflation and the orthodox plans carried out to control it. In addition, Thorp (1998: 213) claimed that industrialization in Chile failed mainly because of political problems.

Moreover, inflation worsened in the 1950s. One of the explanations supported by the policymakers of the time was based on greater fiscal and current account deficits, which became even larger due to the end of the Korean War, thereby leading to the highest inflation rate in the economic history of the country (an annual inflation rate of 84 percent in 1955) (Ffrench-Davis et al. 2003). Due to this fact, the government hired the American consulting firm Klein-Saks to design and implement an anti-inflationary program.

The main conclusions of the Klein-Saks mission were that Chile should reduce its fiscal deficit, and eliminate the system of multiple exchange rates, subsidies, price controls and automatic adjustment of salaries in the public and private sector. The government followed Klein-Saks stabilization policies and managed to control inflation by 1960[27]; however,

[27] The inflation rate dropped from 30 percent in 1959 to 7 percent in 1960 (Central Bank of Chile).

industrial production declined and the unemployment rate increased due to the recessionary impact of such policies. One year later, broad political and social opposition induced government to cancel these liberal reforms (Frank 1972).

Despite the progress and setbacks in industrial production, toward the end of 1950s it is possible to observe some changes in the output and labour distribution. The structure of value added and employment in 1939 was 60% concentrated in natural resources, 34% in labour intensive industries and only 8% in engineering industries (Table 2.2). However, this structure changed steadily over the period. In the industrial census of 1957, the value added shares were 43% in the first group, 36% in the second group and 21% in the last group. Regarding employment, the ratios were higher for the first and second group (31% and 51%, respectively, in 1957) and lower for the third group (19% of total employment).

In terms of labour productivity, in tobacco and petroleum it increased exorbitantly over the period, while between 1939 and 1957, food and beverages, paper, chemicals, metals and electrical machinery performed better than the average. As for apparel, footwear, wood and furniture, these industries had the lowest labour productivity. This is consistent with a labour productivity level above the manufacturing average for natural resources and engineering industries and below average for labour intensive industries.

Between 1958 and 1964, under the liberal government of Alessandri, economic development in Chile was led by sustained industrial growth. The National Mining Company (Enami), the National Telecommunications Company (Entel) and the Port Company of Chile (Emporchi) were created in this period. Nevertheless, during the tenure of the Christian Democrats (1965-70), with Frei as president, industrial growth slowed (Mamalakis 1976). The economic policies aimed to liberalize markets and encourage the private sector. Despite that, industrialization policies were aimed at stimulating the telecommunications and petrochemicals industries. Meanwhile, political and ideological conflicts arose, weakening the institutional environment, and during his presidency Frei was accused of being too reformist by the right and too conservative by the left.

In 1968, CORFO claimed that due to its small domestic market Chile should increase manufacturing exports, reduce protectionism and monopolies, and liberalize the economy. Contrary to these ideas, in 1970 the Popular Unity Party[28] (in Spanish: *Partido Unidad Popular*) won the election with its candidate Salvador Allende, and it re-established and

[28] A left-wing political alliance.

deepened the reforms based on state intervention, agrarian reform, nationalization and industrialization, in a highly polarized political context (Ffrench-Davis et al. 2003). As Figure 2.1 depicts, the manufacturing share of total value added reached its highest point between 1970 and 1973 (25 percent).

This accelerated industrial growth was accompanied by changes in the structure of production. In 1979, the share of value added and employment in engineering industries reached 29% and 22%, respectively. Both ratios still remained below those related to natural resources intensive industries. Tobacco and petroleum showed an excessively high level of labour productivity relative to the average, positively affecting the result in this group.

The greatest drops in terms of shares of value added and employment are recorded in textiles and footwear, whereas food and beverages recorded the highest shares of total manufacturing value added and employment over the period. In terms of labour productivity, textiles and footwear were below average and had a decreasing trend over the period. One of the most remarkable changes is the increase in value added of paper (from 2% in 1957 to 4% in 1979) and its labour productivity being much above the average, and the declining share of non-metallic minerals between 1957 and 1979. The favourable performance of paper contributes to explaining, together with chemicals and petroleum, the comparatively high labour productivity of its group.

Regarding engineering intensive industries, in 1967 there was a notable increase in value added and employment explained by metals, machinery and transport equipment. However, these shares dropped between 1967 and 1979. Concerning labour productivity, metals and electrical machinery are the industries which pushed labour productivity up.

The development strategy oriented to the domestic market and led by the manufacturing sector ended in 1973. The democratic regime was disrupted by a military dictatorship and Chile followed the neo-liberal recipes promoted by international financial institutions, such as privatization of state enterprises, trade liberalization and exchange rate deregulation. This new economic policy dismantled the national manufacturing sector and favoured the exporters of natural resources. Not until the late eighties did the new model implemented manage to boost economic growth again (Ffrench-Davis et al. 2003). Import liberalization and overvaluation led to a high death rate of enterprises, which, in turn, implied that surviving firms were more productive than those which disappeared. Both commercial and exchange-rate strategies drastically modified relative prices and led to a higher accumulation in the export sectors related to natural resources: mining and agriculture.

Table 2.2. Distribution of value added and employment by industries for selected years, Chile.

	1939			1947			1957			1967			1979		
	VA	L	LP	VA	L	LP	VA	L	LP	VA	L	LP	VA	L	LP
Food & beverages	27	25	111	24	20	116	23	20	114	21	20	104	23	26	90
Tobacco	7	2	438	6	1	620	5	1	934	3	0.4	719	4	0.3	1,182
Textiles	16	17	99	19	18	102	13	18	75	10	13	75	5	11	47
Apparel	2	4	49	3	4	72	4	7	58	3	5	59	3	6	45
Footwear	4	7	55	4	6	57	3	6	56	2	4	46	2	3	56
Leather Rubber & plastic	4	4	116	3	4	71	2	3	99	4	4	101	4	5	79
Wood	6	8	75	5	8	60	3	5	58	3	9	32	4	8	48
Furniture							2	2	69	1	2	45	1	2	39
Paper	8	9	93	6	6	98	2	2	117	2	1	150	4	2	205
Printing							4	4	97	3	3	86	4	4	104
Non metallic minerals	5	8	60	7	8	87	5	6	88	3	4	75	4	4	90
Chemicals	11	6	198	12	7	159	8	6	138	7	5	146	10	5	178
Petroleum							3	1	590	2	1	275	4	1	536
Metal & metal products							15	11	131	21	12	180	21	13	165
Non electrical machinery	8	11	70	12	15	78	2	2	71	4	5	92	2	3	68
Mechanical engineering							2	2	110	3	2	138	2	2	94
Transport equipment							2	3	71	6	7	95	3	3	100
Miscellaneous	1	1	193	0.4	0.2	197	1	2	72	1	1	59	0.5	1	56
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Source: See Appendix A: Table A.2.

2.2.3. Uruguay

Before the 1930s, the infant industry in Uruguay was mainly supported by cheap inputs and simple technology, in addition to state protectionism through commercial tariffs. The changes in the structure of external demand and related impacts on domestic production, as well as migration and urbanization, and advantages of localization for different industries, benefitted the domestic market (Bértola 2000).

The first protectionist laws were approved in the last decades of the nineteenth century, although the dominant economic model oriented to exporting agrarian products remained unchanged. The first law which increased tariffs was passed in 1875, and in 1886 and 1888 tariffs were raised again (Jacob 1981). In the 1890s, several norms modified the law of 1888 in order to generate benefits for specified sectors, for example, alcoholic beverages and cigars. These partial modifications created an extremely complex system of both general and specific rights. However, the new law on imports of raw materials approved in 1912 in Batlle y Ordoñez' second presidency can be thought of as the first definitively protectionist law.

Between the 1930s and the mid-fifties, this model strengthened domestic production oriented toward the local market, which was sustained by an increase in domestic demand, by the expansion of the state and the rise in worker's income. In addition, imports of consumer goods were replaced by domestic production and imports of industrial inputs became cheaper.

The state had a greater presence in the economic sphere: it provided goods and services, created public jobs and implemented policies (multiple exchange rates, control of the foreign exchange market, tariff restrictions on certain imports) to favour the national industrial sector. This industrial protectionism through subsidies, preferential exchange rates and tax exemptions was characterized by non-selectivity and unconditionality (Bértola 1991, Bertino et al. 2001).

The multiple exchange rates regime ensured low cost of material and capital goods for industrial production, and at the same time protected domestic production from international competition by making imports more expensive (García Repetto 2014).

All these policies favoured non-durable consumer goods industries such as food, beverages and textiles. Given their high share of manufacturing industries (50% of value added in 1936), they contributed significantly to aggregate manufacturing growth. In particular, the growth in textiles was attributed to both the production of woollen textiles goods and access to international markets (Camou and Maubrigades 2006). However, the performance of this sector was shaped by the restructuring of the agricultural sector to provide the necessary inputs for its production.

According to the industrial census of 1936, the shares of value added and employment of industries related to natural resources were 53% and 45%, respectively. Food and beverages recorded 10% higher productivity than the manufacturing sector average. As for rubber and plastics, it had a 1% share of both value added and employment and comparatively low labour productivity in 1936. By 1968, it had reached 5% of both value added and employment in manufacturing, having performed consistently above average. In the case of the paper industry, its share of value added and employment was also low (around 2-3%), and had a labour productivity level similar to the average of total manufacturing. A noteworthy change was observed in chemicals: its share of value added and employment doubled during the period (up to 9 and 6% respectively), and its labour productivity was throughout the period around 50% above the average. Labour productivity in natural resources related sectors during the period was at all times above the manufacturing average (Table 2.3). This result is also influenced by oil refining production, which started to operate under a state enterprise (ANCAP) in 1937 and its labour productivity was much higher than the average of total manufacturing.

Labour intensive industries had a stable share of value added and employment between 1936 and 1968, at around 35% of value added and 45% of employment. Their relative performance in terms of labour productivity declined steadily from 1936 forward. In both wood and furniture, value added and employment were around 1-3% of the total manufacturing over the period. While their labour productivity was 108% of the average in 1936, this figure declined from 1939 forward, to 63% in 1968. In printing, its shares of value added and labour were 3-4%, and non-metallic minerals recorded value added and employment of around 4-5% of total manufacturing throughout the period.

Concerning engineering intensive industries, their shares of value added and employment increased slightly between 1936 and 1968 (from 13% and 15%, to 15% and 18%), and then remained stable up to 1978 around 15% in both indicadors. The shares of metals fell from 1936 onwards and its value added per labourer was at all times below the average. Non-electrical and electrical machinery more than doubled their shares of value added and employment, starting from values below 1% in 1936. However, their value added per labourer was close to and better than the average in 1936 with a declining trend thereafter.

Transport equipment recorded a stable share of value added of around 5%, while its labour share had a decreasing trend, from 6 to 4%, with comparatively low labour productivity.

All the changes described above occurred in a context of state-led industrialization (Figure 2.1). These changes went hand in hand with social and political changes such as the expansion of a welfare state based on rising wages[29] and reducing income inequality, as well as a process of democratization and also development of the educational system. In addition, the implementation of the Wage Councils in 1943 contributed to an improvement of real wages and, in so doing, a sustained and growing demand for locally produced consumer goods (Bértola 2000).

An important institutional difference between Uruguay and both Brazil and Chile pertains to an industrial development bank. While Brazilian industrialists were supported by BNDES and those in Chile by CORFO, in Uruguay the only official institution devoted to extending development credits had several limitations. Although BROU (in Spanish: *Banco de la República*) did provide financial credits to industrialists[30], it operated under traditional banking criteria without adjusting to firms' needs. Two unsuccessful initiatives, in 1948 and 1950, sought to create an industrial bank with the aim of promoting domestic industry (Moreira 2017).

The 1936-1955 period was one of a favourable international context with high external demand for raw materials and food, with a consequent positive impact on the terms of trade which translated into more foreign currency. Following the end of the Korean War in 1955 and the changes it brought to the global economy, the terms of trade became unfavourable, and the income derived from exports fell. These short-term factors, together with others of an institutional and domestic nature, led to an economic stagnation beginning in the mid-fifties (Bértola 1991, Bertino et al. 2001). Between 1955 and 1961 the manufacturing sector stagnated, slowing the expansionary boom of previous years, and then during 1968-1973 it grew at a very slow pace. At the macro level, the economic situation experienced by the country starting in the mid-fifties was characterized by economic stagnation and high inflation, which remained in the following decade.

Despite this stagnation, the economic census of 1968 evidenced some shifts in the industrial structure. The most remarkable change was a drop in the share of value added and employment, particularly in food and beverages (42% of manufacturing in 1939 to 24% in

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[29] Between 1945 and 1955, real wages in manufacturing increased by 43 percent (Lara 2010).
[30] Between 1943 and 1958, industrial credit grew by 14 percent and total credit by 11 percent.

1968). In the case of tobacco, while the share of value added remained stable, increases were associated with a reduced labour share in the industry.

The textiles sector expanded in both absolute and relative terms, accounting for around 15% of total value added and employment, alongside comparatively faster productivity gains up to 1968, although with the exception of that year, its productivity remained below average. By 1968, apparel, leather and footwear, and rubber and plastics, each accounted for around 5% of total value added, and the labour shares were respectively 10, 6 and 4%. Regarding labour productivity, in the first two industries, they dropped dramatically after 1968, recording among the worst performances of all industries. Whereas rubber and plastics had value added and employment shares of 1% in 1939 and also comparatively low labour productivity, its value added per labourer grew faster than average over the period.

Concerning engineering intensive industries, their shares of manufacturing value added and employment were respectively 15% and 19% in 1968. Expanded production in transportation equipment was particularly strong among these industries, while labour productivity was below average.

The year 1973 was the beginning of a prolonged dictatorial period, in which the National Development Plan (1973-1977) was put into practice, which aimed to boost the economy; not so for the living conditions of workers whose real wages were severely affected. As Notaro (1984) pointed out, the Plan sought to develop a model of "restructuring interventionism", increasing traditional and non-traditional exports with involvement of foreign capital, higher exchange rates in real terms, and lower wages, and thereby to get the country out of economic stagnation.

Among the instruments used by the de facto government to boost the economy were investment promotion, reduction of restrictions on imports, promotion of new export items through subsidies and rebate policies, among others (Bértola and Bittencourt 2005).

The signing of trade agreements with Argentina in 1974 (Argentine Uruguayan Agreement on Economic Cooperation - *CAUCE* in Spanish) and with Brazil in 1975 (Commercial Expansion Protocol- *PEC* in Spanish), gave privileged access to these markets for traditional Uruguayan exports and also non-traditional ones (Finch 2005).

Implementation of these policies between 1974-1978 was followed by an exit from economic stagnation. Industries based on natural resources were among the main loci for economic recovery. However, Macadar (1982) noted that there was no centrally directed industrial policy, and such industries grew in response to the impulses in the external and internal demand. In particular, in the case of non-traditional products (dairy products, rice, barley, citrus fruits, oil, textiles, chemicals) external demand played a key role in stimulating production, and also led to a favourable diversification of the basket of exportable products (Macadar 1982).

Regardless, the industrial structure of 1978 did not differ significantly from that of 1968. In the case of food and beverages, and also textiles, their shares of value added dropped, and that of petroleum increased from 2% in 1968 to 15% in 1978 (but not its share of employment). In terms of labour productivity, this rose by more in engineering intensive industries while it increased more slowly in those industries related to labour.

Starting in 1978, there was a shift in economic policy toward an accelerated process of financial opening in the country, removal of incentives for industrial production through reduction of tariff protection and elimination of export promotion. In turn, the redirection of foreign capital to financial and construction sectors resulted, to a high degree, in more speculative activities (Macadar 1992). This was accompanied by the establishment of an exchange rate regime of periodic mini-devaluations ("*tablita*") devoted to controlling inflation, since government priority became price stability over economic growth. When the inflation rate exceeds the depreciation rate, it causes an overvaluated currency in real terms. A real currency overvaluation led to a significant increase in imports, a loss of export competitiveness and an increase in the trade deficit. All of this, along with the rise in interest rates in the United States, contributed to capital outflows alongside speculative inflows and the economic crisis that would lead to the lost decade. The recessionary effects reduced output in all economic sectors, most especially in construction and manufacturing.

After 1982, economic policy began to deepen trade liberalization and increase intervention to support financial capital (Notaro 1984). Between 1985 and 1987, manufacturing had strong growth based on reducing idle installed capacity, serving a larger domestic market, taking advantage of favourable international prices and an increased demand in neighbouring countries. However, the industrial sectors that managed to grow in these years (mainly those export-oriented sectors which could increase production with existing installed capacity) retreated later. Beginning in the nineties, the influence of the Washington Consensus was evident in Uruguay. An important production transformation was consolidated based on expanded capacity of the services sector, largely explained by the deepening of financial and commercial openness.

Table 2.3. Distribution of value added and employment by industries for selected years, Uruguay.

	1936			1968			1978			1988		
	VA	L	LP	VA	L	LP	VA	L	LP	VA	L	LP
Food & beverages	42.2	37.0	114.0	27.35	23.35	117.13	23.4	27.7	84.4	28.10	31.13	90.25
Tobacco	3.8	1.7	225.7	5.45	0.53	1,030.73	4.0	0.4	1,060.5	3.72	0.36	1,035.59
Textiles	7.9	10.7	73.8	15.89	14.42	110.20	9.3	11.8	78.8	9.87	12.15	81.25
Apparel	7.2	6.6	109.0	4.99	10.74	46.43	4.5	9.7	46.1	3.91	9.18	42.62
Footwear Leather	5.4	6.7	80.0	4.1	5.7	71.5	5.0	9.6	52.3	4.8	6.0	80.1
Rubber & plastic	0.8	1.2	60.8	4.90	3.85	127.05	5.0	4.4	114.3	4.53	4.39	103.16
Wood	1.7	1.6	107.6	1.34	2.66	50.49	1.2	2.5	49.0	0.68	1.60	42.54
Furniture	2.1	3.4	62.6	0.94	2.56	36.59	0.7	1.6	41.0	0.65	1.77	36.67
Paper	1.4	1.4	96.6	1.47	1.45	101.59	1.6	1.9	84.2	2.65	2.24	118.52
Printing	4.0	4.4	90.4	2.50	3.41	73.47	2.6	3.0	85.4	2.62	4.30	60.98
Non metallic minerals	5.0	5.5	90.6	5.28	4.87	108.54	3.9	4.7	82.8	3.59	4.56	78.70
Chemicals	4.6	3.2	143.2	7.51	4.61	163.07	8.0	5.2	153.3	9.33	5.58	167.18
Petroleum				2.41	2.17	111.28	15.5	1.1	1,458.6	10.78	1.49	725.94
Metals & metal products	6.6	7.7	85.8	4.48	5.40	83.11	4.8	6.3	76.0	4.32	5.61	77.04
Non-electrical machinery	0.7	0.6	132.8	1.23	1.48	83.38	1.8	1.9	96.9	0.99	1.61	61.08
Mechanical engineering	0.9	0.9	97.7	3.44	3.82	89.98	3.3	3.4	98.9	2.92	3.12	93.55
Transport equipment	4.9	6.2	79.5	5.59	7.80	71.70	4.6	3.5	132.8	6.02	3.65	164.77
Miscellaneous	0.8	1.1	69.5	1.13	1.18	95.25	0.8	1.3	57.8	0.54	1.28	41.91
Total	100.0	100.0	100.0	100.00	100.00	100.00	100	100	100	100.00	100.00	100.00

Sources: See Appendix A: Table A.3.

2.2.4. Sweden

Early industrialization in Sweden grew swiftly mostly thanks to increased foreign demand for timber in the third quarter of the nineteenth century. In addition, the introduction of the steam engine made it possible locate the saw mills closer to the coast as the generation of motive power no longer required running water. This phenomenon occurred in conjunction with the expansion of textiles production and also steel and iron production. Overall, however, it did not achieve bringing about productivity convergence in manufacturing with the UK and the US (Prado and Sato 2019). There was a large backlog of productivity to catch up on relative to these two forerunners: the US/Sweden productivity ratio was about 240 and the UK/Sweden ratio was 170. The gaps in GDP per capita were similarly wide (Edvinsson 2013). It would require an intensification of the industrialization process for the steam engine to enable economywide progress to the extent that the distance to the leader could be diminished.

In the fourth quarter of the nineteenth century, an era which economic historians coined the Second Industrial Revolution (Landes 1969), industrialization in Sweden gathered speed. The composition of output and industries moved up the value added chain, exemplified by the output expansion and exports of pulp and paper, accompanied by exports of timber which continued to grow. At the heart of this acceleration and reallocation of industrialisation lay the ironware and foundry industry and mechanical engineering. The ironware and foundry industry delivered iron and steel products, either in the fairly crude form of manufacturing plates, rails, tubes, wires and nails, or further processed into various machine-made products.

Mechanical engineering developed in close proximity to the iron and steel production, and this development is a stellar example of how processing and adding additional value to the raw materials and semi-finished goods, such as tack pig iron and bar iron, vitalized industrialization. Mechanical engineering had its roots in the 1830s, grew steadily in the latter half of the nineteenth century, and blossomed in the 1890s into being an industry that was highly competitive in the world market and yet also able to supply the domestic market up to World War I with a wide variety of manufacturing machines, some of which were based on Swedish inventions.

Electricity was at the heart of the swift transition. Schön (1988) argues that electricity was the new technology on which a new development block was created in the 1890s. Few countries could match the pace at which the Swedish manufacturing adopted electricity as a source of motive power in production processes. In 1912, about half of installed horsepower came from electric motors, whereas the US and Germany had a corresponding share of about 20 percent. This spurt in the use of electricity stemmed from the country's abundant supply of suitable sites for harnessing energy from water.

Parallel to the rise of electricity and development of the mechanical engineering industry, the electromechanical industry grew vigorously in importance, accompanied by successive improvements in productivity and an unending flow of product innovations. It would become one of the most important export industries in the twentieth century. The favourable evolution of prices in electric motors makes it easier to appreciate the attractiveness of this new prime mover. However, prices of electric motors plummeted in the two decades preceding the First World War. It is most probable that dramatic price declines were commonplace because the Swedish company ASEA met stiff competition in the world market for electric motors, in particular from German firms.

The heyday of Swedish manufacturing occurred in the 1950s and 1960s. The peak in manufacturing's share of employment occurred in the mid-1960s. Labour productivity gains in Swedish manufacturing outpaced that of the US in the 1960s, with the US-Sweden labour productivity ratio dropping from 200 to 150 (Prado and Sato 2018). The foundation for that boom was laid in the previous growth of manufacturing from the fourth quarter of the nineteenth century forward, and the growing demand for consumer goods and capital goods from the war ravaged countries of Western Europe in the 1950s. We need to keep in mind that Sweden in the 1950s had labour productivity in manufacturing equal to that of the UK (Prado and Sato 2018). In a sense, the Swedish growth regime of this era conforms well to the expression "golden years" used to describe the experiences of Western Europe and North America.

The demand for labour was so high that imports of labour from Finland in particular but also from Yugoslavia and Southern Europe was deemed necessary (Lundh and Ohlsson 1994). The mechanical engineering industry was again the foremost engine driving output and productivity levels. In particular, the segment of mechanical engineering which produced transport equipment put its mark on this development. Two car manufacturers, Volvo and Saab, grew swiftly as the frequent use of private cars spread across Sweden. They were also early users of the assembly line, which spread across much of the mechanical engineering industry in the post-World War II period. The assembly line would transform workplaces as much as the use of small electric motors had reshaped the design of factories in the first quarter of the twentieth century.

International competition grew as technological improvements in shipping lowered transportation costs. At the same time, successive efforts to lower tariff levels meant that many industries faced (much) stronger international competition. Some of these tariffs dated back to the last quarter of the nineteenth century, whereas others had been erected, or increased, in the 1930s (Bohlin 2005). For consumer goods, such as textiles, shoes and clothing, this competitive environment was completely new. In Sweden, the clothing and shoes industries sprang up only after the introduction of tariffs in the 1890s. It is fair to say that these industries did not fare well without protection as consumer goods industries developed quickly in Southern Europe, where workers earned a fraction of what Swedish workers earned.

These consumer goods industries became the first victims of the dawning globalisation. The next Swedish victims were the shipyards. They had grown vigorously in the 1950s and 1960s and by the 1970s had deeply marked the city ports of Gothenburg, Malmö and Uddevalla. The Swedish shipbuilding industry was specialised in building large oil tankers. Stiff competition from shipyards in Japan lowered profitability, and the oil crises of the early 1970s inflicted heavy losses to these shipyards. Attempts were made to save them through a public holding company, Svenska Varv, but the fate of the shipyards was sealed, and they disappeared in the 1980s (Bohlin 2014).

Robert Gordon (2016) argued that the technologies of the Second Industrial Revolution also continued to push economic development in the post-World War II era. No major new innovations can explain the rapid growth of productivity that most developed countries enjoyed in the 1950s and 1960s. Instead it was the spread and refinement of the macro innovations of the early twentieth century, in particular electricity and the combustion engine, that explain the golden years. When the potential of these innovations to serve as a lever of productivity became exhausted, many countries' productivity growth rates decelerated significantly. This appears to be an apt characterisation of the Swedish economy. From the vantage point of the present, the forces propelling the economy forward appear to have petered out in the 1970s, even though successive governments attempted to circumvent the problems through generalized and industry-specific subsidies (Bohlin 2014). As in most of the countries pioneering industrializations in nineteenth century, economywide productivity growth rates decelerated in the 1970s and 1980s, as did growth rates in manufacturing industries. Yet, the Swedish rate continued to grow faster than that of the US and the UK, two other countries that suffered structural crises during the 1970s. Convergence with the US was a fait accompli in the 1980s.

The historical context described above is consistent with the changes observed in the economic censuses of 1926, 1952, 1975 and 1985 for Sweden (Table 2.4).

At the beginning of the analysed period, in 1926, the structure of manufacturing was divided in equal parts among the three big groups in terms of value added and employment. However, this picture had changed by 1952: the industries based on natural resources and also labour intensive industries had shrunk dramatically as a share of manufacturing (to around 26%) and engineering intensive industries increased their share to 47% (mainly explained by metals, non-electrical machinery and transport equipment). After that, the trend is toward a strengthened role of engineering intensive industries to the detriment of labour intensive industries: by 1975 the first had almost doubled its 1926 share of value added and the second group had lost 15 percentage points.

As for the industries based on natural resources, food and beverages accounted for around 10% of manufacturing value added and had higher than average manufacturing labour productivity; rubber and plastics increased their modest shares (from 1% to 2 and 3%) with a poorer relative position in terms of productivity (from 106 in 1926 to 81 in 1985). Paper was also important in this group, and although its relative share of production was decreasing over time, its labour productivity was much higher than the manufacturing average (51% higher in 1952 and 1975, and 28% higher in 1985). In chemicals, the shares of manufacturing value added and employment more than doubled between 1952 and 1985, reaching 8 and 6% respectively by the second of those years. Natural resources intensive industries grew faster than the manufacturing average for the period as a whole; this was so in all industries included in the group (excepted for rubber and plastics) with particularly strong performance by tobacco, petroleum, paper and chemicals.

Concerning the labour-intensive group, the greatest relative decline in terms of value added and labour was recorded in textiles, apparel, footwear and leather. In terms of labour productivity, their performance also worsened during the period, reaching one of the lowest relative levels (represented 45 and 67% of the manufacturing average in 1985). Meanwhile, value added and employment shares in furniture and non-metallic minerals declined between 1952 and 1985; printing remained stable (a 5% share), and the relative shares in wood fell by around 50% over the same period. Labour productivity of this group remained around

20% below the manufacturing average, and with the exception of printing and non-metallic minerals in some years, all the industries performed worse than the average in terms of labour productivity.

Finally, for the period after 1952, we see that electrical machinery and transport equipment strongly increased their shares of manufacturing value added and employment. The shares of valued added and employment rose from 9 and 6% in 1952 to 15 and 9% in 1985 for transport equipment and electrical machinery, respectively. In metals, these shares remained stable, and they fell in non-electrical machinery. For the group as a whole, labour productivity was close to the manufacturing average.

Despite the structural change evidenced in Sweden between 1926 and 1985, in the early 1990s, the country was struck by a severe economic downturn. Although the real estate and banking sector was hardest hit, manufacturing also experienced substantial losses between 1989 and 1993 (20%) (Krantz and Schön 2007). The growth in labour productivity had already started as the economic crises of the early 1990s unfolded. To some extent, the crises itself was the catalyst for acceleration in productivity. Hordes of unprofitable firms went out of business and those that remained raised the average level of productivity. A similar productivity boost occurred in the US during the Great Depression (Field 2003). However, the most important factor behind the surge in productivity was information and communication technologies (ICT) as reflected by a similar productivity spurt also identifiable in countries that unlike Sweden did not plunge into a severe crisis in the early 1990s.

The foundation of the ICT revolution did not appear out of nothing. The roots of these technologies begin in the late 1960s. Swedish industrial statistics allow us to trace the beginning of the ICT revolution by product category. From the late 1960s, one can trace the emergence of computers under the heading “office machines”. The technologies were not ripe to reap the benefits. It took a while for firms to figure out how to gain from this new technology. In addition, the use of networks required complementary investments in infrastructure. There are reasons to believe that Swedish firms were among the forerunners in the development and application of ICT technologies. Van Ark and Smits (2007) note that ICT investment as a percentage of GDP was as high in Sweden as in the US in 2004, enabling Sweden to rank highest in terms of ICT usage in industry and services. Thus, the legacy of the structural change during the golden years enabled the Swedish economy to recover and find new strategic sectors to continue to improve productivity.

Table 2.4. Distribution of value added and employment by industries for selected years, Sweden.

	1926			1952			1975			1985		
	VA	L	LP	VA	L	LP	VA	L	LP	VA	L	LP
Food & beverages	14.8	10.8	136.8	8.6	8.0	108.5	9.6	7.6	125.6	9.6	8.7	111.2
Tobacco	3.0	0.7	406.7	0.4	0.2	163.4	0.3	0.2	189.2	0.4	0.2	242.5
Textiles	7.6	10.1	75.6	4.9	7.2	68.1	2.1	2.8	76.1	1.5	2.1	72.8
Apparel	3.1	3.6	85.3	3.8	5.9	64.8	1.5	2.6	56.1	0.6	1.4	45.4
Footwear Leather	3.3	3.9	84.2	2.0	2.8	69.7	0.5	0.7	65.5	0.3	0.4	66.8
Rubber & plastic	1.1	1.0	106.1	1.6	1.5	107.3	2.3	2.8	83.0	2.3	2.8	81.0
Wood	6.8	10.4	64.7	3.2	4.0	80.6	5.9	6.5	90.3	4.7	5.8	81.9
Furniture	3.0	4.0	74.3	3.1	4.4	69.7	1.4	1.8	79.3	1.2	1.5	75.4
Paper	13.8	10.0	137.9	10.4	6.9	151.6	9.9	6.5	152.0	9.1	7.1	127.7
Printing	5.2	3.4	152.4	4.8	4.6	103.4	5.0	4.7	106.0	6.2	5.5	111.9
Non metallic minerals	6.2	9.8	62.7	4.8	5.2	92.7	3.5	3.6	97.0	2.9	2.8	102.1
Chemicals	3.7	2.6	143.2	4.8	3.5	138.5	5.6	4.3	131.4	7.9	5.6	142.1
Petroleum	0.0	0.0	0.0	0.5	0.3	172.2	0.7	0.3	229.6	2.1	0.4	492.2
Metals and metal products	8.0	9.6	83.6	14.1	14.0	101.2	15.7	17.1	91.7	14.6	15.5	93.8
Non-electrical machinery	1.5	1.7	92.6	17.1	16.3	105.2	13.1	14.4	91.0	13.0	13.8	94.5
Mechanical engineering	16.4	15.5	106.1	6.7	6.2	107.9	8.5	8.8	96.4	8.7	9.4	93.0
Transport equipment	2.6	2.8	91.4	9.1	9.1	100.4	14.0	14.6	95.8	14.5	16.5	88.1
Miscellaneous							0.5	0.7	73.1	0.4	0.5	67.9
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Sources: See Appendix: Table A.4.

2.2.5. United States

Before the fourth quarter of the nineteenth century, British economy was ahead of other countries despite the industrialization taking place in European nations and the United States. Prior to 1870, Britain had recorded a supremacy over the US in terms of GDP per capita, labour productivity, capital-labour ratio and capital stock[31] (Abramovitz and David 1996). However, this situation changed during the Second Industrial Revolution, in which the American economy played a major role. The favourable conditions have been documented which existed in the United Stated and allowed it to achieve faster technological advances. This has positioned this country as a world leader since the 1870s, overtaking the world's first industrial nation (Abramovitz 1993).

A growing population (in part due to transatlantic immigration) and urbanization contributed to a more unified domestic market and, at the same time, large-scale and capital-intensive production, including the development of infrastructure capable of allowing these changes (steam-powered railways). In this context, manufacturing industries became prominent, as they satisfied most of the demand for durable and non-durable goods. Between 1820 and 1895 the share of primary products in total American exports declined steadily from 80% to 25%. In 1895, the strong majority of exports (75%) was manufactured goods (Allen 2014).

In 1870, American advantages were based on natural resources intensive production, use of scale-dependent physical capital, mass production and new ways of business organization. The United States was very well endowed in raw materials, such as wood, coal and metals. In addition to this, government played a key role through tariff protections and subsidies to expand infrastructure[32] as well as scientific research (Abramovitz and David 1996). Specifically, in-house industrial research was developed after 1870, influenced by advances in physics and chemistry, and revolved around the development of new technology and acquisition of technologies developed external to firms (Mowery and Rosenberg 2000).

The American lead starting in this period can also be explained by other factors. Allen (2014) mentioned the banking system capable of stabilizing the currency and promoting investment, as well as a public education system aimed at preparing an adult labour force for industrial employment.

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[31] In 1870, the capital stock in the US was barely 25% of that in the UK (Abramovitz and David 1996).
[32] An example was the extension of the railroad network into the American west, which impacted manufacturing, construction and transportation activities.

The industrial sector in the nineteenth century was protected from international competition for reasons similar to arguments in favour of infant industry. The effectiveness of this protection system was reflected in a higher rate of capital accumulation and, relatedly, a greater demand for capital goods. This new stage of industrialization generated the knowledge that would later make new capacity more productive (Allen 2014). Also, cheap sources of energy and high wages encouraged capital-intensive and labour-saving technology. Allen (2014) found that the incentive to use power more intensively, per worker, was greater in the United States than in Britain. The United States was more expensive than Britain in terms of wages[33], prices of capital services and prices of industrial raw materials.

During the Second Industrial Revolution, major inventions radically changed lifestyles and working conditions (Gordon 1999, Gordon 2012). Some of them, such as electricity (electric lights and motors), internal combustion engine (which enabled motor and air transport), petrochemicals, plastics and pharmaceuticals, and communications and entertainment (radio, telephone, television). This list of inventions seems to fit well with Wright's definition of general-purpose technology (GPT), as "deep new ideas or techniques that have the potential for important impacts on many sectors of the economy" (Wright 2000:161). In particular, electricity and electric motors were undoubtedly the most important changes introduced in manufacturing.

Nelson and Wright (1992) hold that certain significant innovations led to greater recognition of several American categories in domestic and foreign markets. For example, the massive production of cigarettes due to an increase in the scale operated by the American firms. Also, new inventions associated with beer production, as well as light machinery, crossed the Atlantic in what was known as the "American invasion".

On the eve of WWI, the US economy was 28 percent more productive as a whole than Britain, and manufacturing labour productivity was more than twice as high. Moreover, the British and German capital-to-labour ratios were 60 percent of their American counterpart (Abramovitz and David 1996). This leadership remained up to WWII.

The manufacturing revolution of the 1920s was based on new factory designs involving the distribution of electric power, which was more efficient than steam power. According to Field (2011), by 1929 almost 80% of the American installed manufacturing capacity was powered by electricity. In the years 1919-29, the annual average total factor productivity

[33] In the US, the use of child labour force was limited, contrary to what happened in Britain.

(TFP) growth in American manufacturing reached the highest level of 5.12%, attributed to floor space savings, improved material flow and the new distribution of internal power[34]. New consumer products appeared thanks to the introduction of small electric motors (refrigerators, washing machines, etc.). In the following period, 1929-41, TFP growth in manufacturing fell. However, it remained substantial (2.6%). The share of manufacturing in the economy increased in these years, and varied but positive TFP growth can be observed in several industries: beverages, tobacco, textiles, paper, rubber, leather, machinery, chemicals and petroleum.

As was described by Field (2006), "conveyer belts and other initiatives associated with the reconfiguration of factory layout saved labour, and saved capital, enabling economies in floor space, inventories in storage rooms, in machinery and auxiliary equipment and in cost of maintenance and repairs and through the elimination of waste, reduction of spoilage and shortening of the time in process". The textiles industry significantly benefited from these technological advances, as reflected in its total factor productivity.

From the US's entry into WWII until 1948, the economy changed its priorities, which explained the negative TFP growth rate of -0.52% in manufacturing. After that, during the golden years (1949-1973), manufacturing recorded average TFP growth of 1.52%. While the peak of product innovation was in the 1930s, process innovation had its major development in the 1950s.

There were important advances in the chemicals, mining and electric power generating industries which, in turn, impacted other sectors. For example, chemical breakthroughs led to a longer durability of equipment and structures, and also laid the foundations for the petrochemicals industry. Privately funded research and development is key to explain the TFP results. In the twentieth century, technological progress was to be based on intangible capital, such as investment in research and development and education (Abramovitz 1993). One of the most important issues, related to human capital, was the creation of institutions that aimed at training engineers and other technicians and scientists.

However, intangible capital also became important in other countries and regions. After WWII, other technologically advanced countries caught up with the American labour productivity levels, and the US lost its lead (Abramovitz 1993). Moreover, the internationalization of trade, business and technology helped the convergence toward the US

[34] David and Wright (1999) hold that in the 1920s the pattern of growth in manufacturing was "yeasty" due to distributing power by wires and electric motors.

levels. In Nelson and Wright's words (1992) "the advanced nations of the world have come to share a common technology".

The Third Industrial Revolution dates from the 1960s to the present with the appearance of computers, internet and cellular technologies (Gordon 1999). In the American industrial structure, it implied a relative decline in certain industries such as primary metals, textiles, leather and apparel, and a rise in engineering and chemicals industries (Field 2011). Despite the use of computers already being well established, IT capital was limited and concentrated in only a few industries.

Between 1948 and 2000, the share of manufacturing in the American economy dropped from 27.8 to 15.5%, and most of the drop occurred in the 1970s, alongside a slowdown in economywide productivity growth. The United States suffered a structural crisis during the 1970s. In 1971, the international system agreed upon at Bretton Woods, was bankrupted during the Vietnam War when the United States started to excessively print dollars to finance the war. The US abandoned the gold exchange standard and the value of the dollar was left to float. In addition, both the first oil shock in 1973 and the second oil shock in 1979 negatively impacted consumers and manufacturers in the American economy. In the 1980s, during the presidency of Reagan, the economic policy was based mainly on liberalizing and deregulating market forces.

According to Table 2.5 the main changes in the American industrial structure between 1939 and 1987 involved a higher share of production of engineering industries, together with a less important role of labour-intensive industries and a stable production share of natural resources industries. The shares of value added and employment of industries related to natural resources remained around 30% and 22% of the manufacturing total over the period. The value added of this group was at all times above the manufacturing average. In 1939, food, beverages and tobacco were among the largest industries. However, their share of total value added declined moderately over this period, from 15% in 1939 to 12% in 1987 while retaining a stable share of labour at around 10%. In addition, their labour productivity increased during the period and remained above average. In the case of rubber and plastics, the contribution of industry to value added and employment rose, from 2% to 4%, with a stable value added per labour close to the average over the period. Paper accounted for about 4% of total value added and employment, and had slightly above average labour productivity. In the case of chemicals and petroleum, their shares of value added and employment remained stable and significant (around 10% and 2.5% of total value added and

5% and 1% of total employment). Both industries performed much better than the average during the period[35].

In the group of industries classified as labour intensive, the shares of value added and employment were 34% and 46% at the beginning of the period and they both dropped steadily toward the 1980s. In 1987, the shares were 28% and 36%, respectively. Labour productivity remained below the manufacturing average throughout the period under study: 80% in 1939, 75% in 1967 and 71% in 1987. The textiles, apparel, footwear and leather industries saw their shares decline strongly in value added and employment (from 15% and 26% in 1939 to 5% and 11% in 1987), and their output per worker was only half the average, which partly explains the low level in the group.

Wood, furniture and non-metallic minerals each contributed around 2-4% of total manufacturing value added and employment, whereas in printing these figures were around 5 and 8%. Regarding labour productivity, wood and furniture were at about 60-70% of the sector average, one of the worst performances in the sector, while in non-metallic minerals it was similar to the manufacturing average over the period. Moreover, printing's labour productivity was 40% above the average at the beginning of the period, but decreased from 1939 onwards, and reached 92% of the manufacturing average in 1987.

Finally, concerning engineering intensive industries, their share of value added and employment increased from 35% and 33% in 1939 to 41% and 42% in 1987. Their labour productivity was close to the manufacturing average. The share of metals, in terms of value added and employment, fell from 15% in 1939 to 10% in 1987, and its labour productivity remained close to the manufacturing average. On the other hand, non-electrical machinery had a stable 10% of total value added and employment, whereas electrical machinery and transport equipment started with shares of around 4-7%, and by the end of the period both had climbed to 10%. Over the period, labour productivity in metals, electrical and non-electrical machinery and transport equipment remained very close to the manufacturing average. However, the relative labour productivity of metals worsened toward the end of the period (85% in 1987) and transport equipment improved to 115% in 1977 and remained fairly stable thereafter.

[35] Between 1977 and 1987, the petroleum industry's share of value added declined, as did its labour productivity compared to the average.

Table 2.5. Distribution of value added and employment by industries for selected years, United States.

	1939			1947			1957			1967			1977			1987		
	VA	L	LP	VA	L	LP	VA	L	LP	VA	L	LP	VA	L	LP	VA	L	LP
Food & beverages	14	10	138	12	10	120	11	10	109	10	9	114	10	8	117	10	8	128
Tobacco	1	1	136	1	1	110	1	1	159	1	0	191	1	0	225	1	0	482
Textiles	7	13	57	7	9	83	4	6	59	3	5	62	3	5	58	2	4	58
Apparel	6	9	62	6	8	79	4	8	54	4	8	52	3	7	47	3	6	46
Footwear Leather	2	4	60	2	3	77	1	2	59	1	2	56	1	1	48	0	1	52
Rubber & plastic	2	2	105	2	2	97	2	2	106	3	3	93	3	4	87	4	5	81
Wood	3	4	58	3	4	76	2	4	57	2	3	63	3	4	74	2	4	62
Furniture	3	4	70	2	2	82	2	2	75	2	2	69	2	3	61	2	3	60
Paper	4	3	106	4	3	123	4	3	114	4	4	108	4	3	112	4	3	126
Printing	7	5	140	6	5	114	5	5	103	6	6	98	5	6	93	8	8	92
Non metallic minerals	4	4	103	3	3	96	3	3	106	3	3	100	3	3	99	3	3	97
Chemicals	8	4	196	7	4	163	8	5	184	9	5	198	10	5	204	10	5	226
Petroleum	3	1	195	3	1	184	2	1	196	2	1	270	3	1	353	2	1	243
Metals & metal products	15	15	101	14	15	96	16	15	108	15	14	102	14	14	98	10	12	85
Non-electrical machinery	8	7	113	11	11	97	11	10	105	11	10	105	11	11	102	10	10	97
Mechanical engineering	4	4	114	5	6	93	7	7	100	10	10	92	9	9	92	8	9	93
Transport equipment	7	7	102	8	8	96	13	12	109	11	10	108	11	10	115	12	10	115
Miscellaneous	3	3	92	4	5	87	4	5	87	4	5	95	5	5	92	8	8	99
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Sources: See Appendix A: Table A.5.

2.3. Cross-country comparison of structure of manufacturing

The purpose of this section is to characterize the structure of the manufacturing sector and its relationship with heterogeneity in Brazil, Chile and Uruguay compared to other countries during their state-led industrialization since they began in the 1930s. Recall that chapter 4 contains in-depth study of structural change via shift-share analysis and structural convergence using labour productivity time series at the industry level.

From a structuralist perspective, heterogeneity has characterised the Latin American economies and has been determinant in explaining their peripheral condition (Prebisch 1948, Pinto 1970). As opposed to neoclassical theory which predicts convergence, the evidence suggests that if economies are left to their own devices, the peripheral condition will prevail and the trend will be divergence. Numerous empirical works from heterodox theories study heterogeneity and structural change for Latin America since the 1970s (Cimoli et al. 2005). Following previous works, I focus on the manufacturing sector and employ the coefficient of variation[36] (CV) of labour productivity in order to measure heterogeneity in the Latin American countries compared to the US and Sweden over 1930-1980.

Although no single pattern of industrial transformation should be taken as a universal point of reference, there are general trends in the evolution of certain sectors in the production structure that give hints on to how to achieve sustained development. Different theoretical perspectives may help to understand this change. The Schumpeterian view recognizes that technical progress is the main driver of growth, which is in turn inherent to structural change. Technical progress implies the creation of new sectors and processes that redesign the production structure, making it more diversified, dense and complex. Two indicators allow us to measure structural change associated with technical progress: the Relative Participation Index (RP) and the Krugman Index (KI). While the RP focuses on the share of the engineering sectors in manufacturing as a whole, the KI measures if the production structure is more diversified or concentrated over time. The two indices are complementary (Cimoli et al. 2005, ECLAC 2007)[37].

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[36] It is calculated by dividing the standard deviation of labour productivity by the average of labour productivity.

[37] RP and KI are calculated using data aggregated at the groupings: natural resources intensive, labour intensive and engineering intensive industries.

Table 2.6 shows that, over the period, Brazil had lower heterogeneity than Chile and Uruguay and remained close to the reference country (the US), although always with a higher coefficient of variation. The heterogeneity was lower in Chile and Uruguay at the beginning of the period (circa 1940) and then increased sharply to more than double that of the US. As opposed to the Latin American results, in Sweden heterogeneity remained very low and circa 1980 it was much lower than the US. These results are consistent with the historical observations: Brazil managed to introduce changes in its production structure which helped to reduce productivity differentials, while Chile and Uruguay were unable to discourage structural heterogeneity over the period[38].

Table 2.6. Coefficient of variation (CV) of labour productivity in the manufacturing sector, 1930s-1980s

CV	circa 1940	circa 1950	circa 1960	circa 1970	circa 1980
Brazil	0.39	0.33	0.43	0.54	0.70
Chile	0.84	1.09	1.39	1.14	1.56
Uruguay	0.39			1.57	1.81
US	0.38	0.28	0.39	0.51	0.65
Sweden			0.31		0.41
Relative CV	**circa 1940**	**circa 1950**	**circa 1960**	**circa 1970**	**circa 1980**
Brazil/US	1.0	1.2	1.1	1.0	1.1
Chile/US	2.2	3.9	3.6	2.2	2.4
Uruguay/US	1.0		3.0	3.1	2.8
Sweden/US			0.8		0.6

Source: Industrial censuses for Brazil, Uruguay, United States and Sweden. Industrial census, yearbooks and industrial surveys for Chile.
Note: Data from the closest corresponding year is used, and in many cases does not precisely correspond with the stated year. For Uruguay: circa 1940 corresponds to 1939, circa 1970 corresponds to 1968 and circa 1980 corresponds to 1978.

In order to explore more about heterogeneity, Table 2.7 shows the labour productivity of each industry compared to the manufacturing average separately for each country and for three selected benchmark years. For each country, tobacco, chemicals and petroleum are the industries with higher labour productivity over the period. Food and beverages placed very well in every country in different periods, especially around the 1940s. Other industries such as rubber and plastics in Brazil and Uruguay, paper in Brazil, Chile, the US and Sweden, and transport equipment in Brazil and the US performed very well in certain subperiods.

[38] ECLAC (2010) uses estimates of the coefficient of variation as a proxy of heterogeneity for the whole economy. They found that the CV in Latin American countries rose from 0.94 in 1990 to 1.24 in 1998.

Table 2.7. Relative labour productivity compared to the average of total manufacturing sector, Brazil, Chile, Uruguay, the United States and Sweden. Selected years.

	Brazil			Chile			Uruguay			United States			Sweden		
	circa 1940	circa 1960	circa 1980	circa 1940	circa 1960	circa 1980	circa 1940	circa 1960	circa 1980	circa 1940	circa 1960	circa 1980	circa 1940	circa 1960	circa 1980
Food & beverages	119	109	81	111	114	90	114	117	84	138	109	117	137	109	126
Tobacco	135	173	185	438	934	1,182	226	1,031	1,061	136	159	225	407	163	189
Textiles	76	64	83	99	75	47	74	110	79	57	59	58	76	68	76
Apparel				49	58	45	109	46	46	62	54	47	85	65	56
Footwear	83	66	52	55	56	56	80	72	52	60	59	48	84	70	66
Leather															
Rubber & plastic	115	218	104	116	99	79	61	127	114	105	106	87	106	107	83
Wood	69	64	50	75	58	48	108	50	49	58	57	74	65	81	90
Furniture	60	61	50		69	39	63	37	41	70	75	61	74	70	79
Paper	96	127	139	93	117	205	97	102	84	106	114	112	138	152	152
Printing	91	87	90		97	104	90	73	85	140	103	93	152	103	106
Non metallic minerals	75	70	65	60	88	90	91	109	83	103	106	99	63	93	97
Chemicals	207	185	380	198	138	178	143	163	153	196	184	204	143	138	131
Petroleum					590	536		111	1,459	195	196	353	-	172	230
Metals & metal products	100	118	106		131	165	86	83	76	101	108	98	84	101	92
Non-electrical machinery		97	93	70	71	68	133	83	97	113	105	102	93	105	91
Mechanical engineering	174	121	128		110	94	98	90	99	114	100	92	106	108	96
Transport equipment		163	132		71	100	80	72	133	102	109	115	91	100	96
Miscellaneou	82	81	88	193	72	56	70	95	58	92	87	92			73
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Sources: See Appendix A: Table A.1, Table A.2, Table A.3, Table A.4 and Table A.5.
Note: Data from the closest corresponding year is used, and in many cases does not precisely correspond with the stated year. For Uruguay: circa 1940 corresponds to 1939, circa 1960 corresponds to 1968 and circa 1980 corresponds to 1978.

The lowest relative labour productivity over the period, for almost every country, was in textiles, apparel, footwear, leather, wood and furniture. Therefore, at first glance, the ranking of the productivities by industry does not show great differences between the Latin American countries and the rich ones. However, in Table 2.8 we can observe the calculated labour productivity ratio between the three most productive and the three least productive industries of each country. Comparing these averages, the highest productivity sectors in the US had three times the average in 1960 and five times the average in 1980, a much lower difference than registered in Chile and Uruguay. As was mentioned, tobacco and petroleum are two industries with above average productivity, and particularly in Chile and Uruguay, they are responsible for much of the large gap compared to the less productive industries. Both industries are very capital intensive and do not require a large number of workers.

Meanwhile, the ratio between the three most productive and the three least productive industries in Brazil is very similar to the American ratio, and both are higher than the ratio in Sweden from 1960 onwards. It is confirmed again that the Swedish transformation starting in the 1960s led to successful results in terms of reducing productivity differentials.

Table 2.8.
Ratio between three most productive industries and three least productive industries, by country

	c.1940	c.1960	c. 1980
Brazil	3.1	4.6	5.1
Chile	5.1	9.7	14.7
Uruguay	2.6	9.9	19.6
United States	3.0	3.2	5.1
Sweden	3.5	2.4	2.9

Source: Economic censuses for Brazil, Uruguay, United States and Sweden. Census, yearbooks and industrial surveys for Chile.

As was mentioned above, two indices help us to measure structural change associated with technical progress. The Relative Participation Index (RPI) is the relationship between the share of the engineering sectors (as a proxy of the share of technology-intensive industries) in the total manufacturing value added of a certain country (S_i) in comparison with the analogous share in the United States (S_R). It is assumed to be a proxy of the technological intensity of the industrial sector.

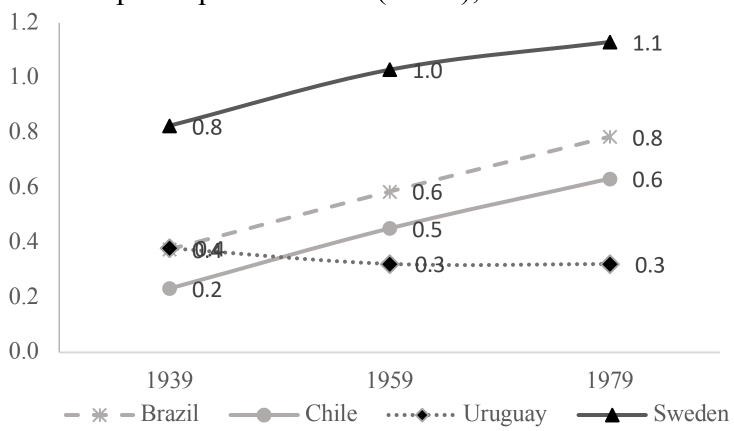
$$(2.1)\ RPI = \frac{S_i}{S_R}$$

The minimum value of RPI is zero and it has no upper limit, but it hardly reaches the unitary.

Figure 2.2 shows how the engineering sectors' shares of manufacturing value added evolved relative to the United States in three different years. Brazil, Chile and Sweden narrowed the gap with the US, whereas Uruguay lagged gradually further over the period.

By 1979, Brazil had achieved a ratio of 0.8, a result of changes in the composition of the production structure mentioned in the historical context section, but according to ECLAC (2007) it started to lose ground compared to the US starting in the 1980s. Concerning Chile, although it also introduced changes, these were less significant than in Brazil and the technological intensity relative to the US declined starting in the 1970s (ECLAC 2007). Meanwhile, the Swedish index showed an increasing trend and by the end of the period had surpassed the American level.

Figure 2.2
Relative participation Index. (US=1), c. 1940 1960 and 1980



Source: Economic censuses for Brazil, Uruguay, United States and Sweden. Census, yearbooks and industrial surveys for Chile.

Finally, I present the Krugman index results. The KI is calculated as the sum of the differences (in absolute terms) between each industry's share of manufacturing value added and the same in comparison with the reference country (the US in this case). If it is equal to zero, then countries have the same structure, and when the KI is increasing over time it implies structural divergence (the maximum level is 2).

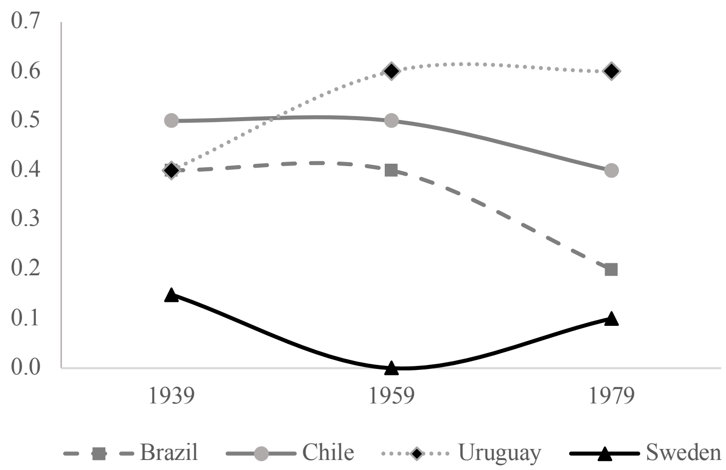
The Krugman Index can be defined as:

$$(2.2)\ KI_j = \sum_{i=1}^{n} \left| S_{ji} - S_{Ri} \right|$$

where S_i represents the share of industry i in manufacturing value added, j is the country, n the number of industries included in the index, and R the reference country (US).

Figure 2.3 depicts the increasing Uruguayan disparity relative to the American industrial structure over the whole period. However, as it happened with the previous indicators, by 1939 Uruguay showed a better performance, which was lost around 1968. Conversely, in Brazil, and much more moderately in Chile, there was a convergence of industrial structures between the 1930s and 1980s (Figure 2.3). However, this trend for Brazil and Chile has strongly reversed since the 1980s (ECLAC 2007). In both countries, the structural divergence coincides with the deindustrialization stage. Meanwhile, in Sweden, the shares of the different sectors in total manufacturing value added tended to change less than in the US between 1939 and 1959. Circa 1979, the Swedish share of engineering industries exceeds the American level, and on the contrary occurs with labour intensive industries. Despite this favourable result for Sweden, it is reflected in a higher KI. This is a reason that the two indices (KI and RP) are best considered together.

Figure 2.3
Krugman Index, circa 1940, 1960 and 1980.



Source: Economic censuses for Brazil, Uruguay, United States and Sweden. Census, yearbooks and industrial surveys for Chile.

2.4. Conclusions

In this chapter I presented estimates for the entire period of state-led industrialization, including the interwar period, in order to understand structural change and heterogeneity in Latin American countries from a cross-country perspective.

The expansion of manufacturing industries from the nineteenth century forward, and especially from the 1930s until the late 1970s, was an exceptional stage in the Latin American countries, which was not repeated again in their economic history. However, the rate of industrialization was different in Brazil and Chile compared to Uruguay. While in Brazil and Chile the manufacturing share of GDP grew steadily until the 1970s and 1980s reaching 30%; in Uruguay, it remained stable at around 25% from the 1950s on.

It may seem that a more premature deindustrialization in Uruguay goes hand in hand with its inability to achieve a significant change in the production structure. The historical context and the evidence showed in this chapter support the idea that this country could not substantially change the composition of value added and employment in the manufacturing sector over the period. Natural resources intensive industries and labour intensive industries were always larger, which was reinforced by state protectionism. This was reflected in the failure to reduce structural heterogeneity.

Aside from that, most especially Brazil, and to a lesser degree Chile, introduced changes. Despite distortions and inefficiencies, both countries achieved a more diversified and technologically complex industrial structure. Toward the late 1960s, in Brazil and Chile the value added and employment shares in engineering intensive industries were respectively around 35 and 25% of the manufacturing total. However, in terms of structural heterogeneity measured by the coefficient of variation, the Brazilian industrial sector showed a better result than the Chilean one.

Considering a cross-country comparison, during the state-led industrialization, different indicators confirm a better performance of the industrial sector in Uruguay by 1939, and an increasing disparity onwards. Conversely, in Brazil, and much more modestly in Chile, there was a convergence of industrial structures toward that in the US over the period. However, this trend for Brazil and Chile strongly reversed from the 1980s forward. In both countries, the structural divergence coincides with the deindustrialization stage. Liberalization policies implemented since the 1980s, but at different paces in Brazil and Chile, contribute to understanding the relationship between these two phenomena.

Chapter 3. Cross-country labour productivity benchmarks

3.1. Introduction

The main purpose of this chapter is to present estimates of labour productivity by industry for Brazil, Chile and Uruguay in two-way comparisons with developed countries based on a benchmark year and disaggregated by industry. Comparison between two countries requires finding a suitable conversion factor to express value of production and value added of both countries in a common monetary unit. Although the most direct way is using the exchange rate, I selected a more accurate conversion factor calculated using the industry-of-origin approach.

This is one of the first works which presents estimates of labour productivity between Latin American countries and developed countries based on the industry-of-origin approach covering a time period starting from the beginning of the twentieth century. Part of the estimates for Brazil versus the United States for 1949 and Brazil versus Sweden for 1975 are taken from previous own works (Lara and Prado 2018a, Lara and Prado 2018b). The new Chilean estimates were built for 1939 and are presented for the first time in this thesis. Finally, the Uruguayan benchmark in 1988 is taken from my previous own work (Lara 2012). All of these benchmarks will be relevant in Chapter 4, where they are used to construct time series of labour productivity by industry and analyse convergence trajectories.

Despite the structural economic differences between the Latin American countries and the developed countries, it is appropriate to perform comparisons between them in order to obtain benchmarks. In the case of the United States, it was the leading economy during much of the twentieth century. Previous works offer empirical evidence to support this fact: average labour productivity was higher in the American economy than other advanced economies, such as the United Kingdom and Germany (Broadberry 1997, de Jong and Woltjer 2011, Veenstra 2014). Moreover, few countries offer a detailed industrial census comparable to the American one, which has made the US the subject of several studies on cross-country productivity comparisons. The comparison with Sweden turns out to be complementary, in the sense that this country showed convergence with the US during the twentieth century, despite having also been a peripheral country prior to its industrial revolution (Bolt et al. 2018).

This chapter is structured as follows. The next section, 3.2, presents a literature review. Section 3.3 summarizes the data and methodology. Then, I show the main results (section 3.4) and conclude (section 3.5).

3.2. Literature review

Comparison between two countries requires finding a suitable conversion factor to express values of production and value added of both countries in a common monetary unit. The most direct way is using the exchange rate. Exchange rates are affected by capital movements, monetary policies and other fluctuations. Therefore, they represent a suitable conversion rate for tradable goods and services, but not for non-tradable sectors (van Ark and Maddison 1988, van Ark 1993).

The second alternative consists of using purchasing power parities (henceforth PPPs) to establish a conversion rate. PPPs can be estimated in two ways. The first method, known as expenditure PPPs, estimates price relatives in the same product groups of final expenditure (goods and services) in national currencies in different countries. Researchers applied this methodology in the United Nations International Comparison Project (ICP), and it has also been adopted by EUROSTAT and the OECD. Expenditure PPPs are based on retail consumption prices of goods produced by the country and imported goods, but exclude goods produced for export and price ratios of intermediate sectors (Mulder et al. 2002), and are affected by trade and transport margins. Such points make this method less accurate for comparing value added at the industry level. Conversely, the so-called industry-of-origin method provides a more sophisticated conversion rate to compare specific economic sectors. One major advantage of this method is that the data required is obtained from a single primary source. In the case of manufacturing the main sources are censuses of production or industrial surveys.

The pioneering works of this industry-of-origin method were by Rostas (1948) and Paige and Bombach (1959). Rostas (1948) compared productivity between the United Kingdom and the United States for 31 industries using physical gross output per worker based on the UK Census of Production of 1935 and the US Census of Manufactures of 1937. Their estimates reveal that productivity in the USA was about 2.2 times higher than in Britain, and this advantage was particularly higher in paper and printing, engineering, iron and steel, and clay and stone.

Paige and Bombach (1959) also compared the two countries using 1950 net output data. By dividing the value of sales by the quantities of each product in both countries, Paige and Bombach obtained sector-specific purchasing power parities to convert value added into the same 'currency' by industry (Broadberry 1997).

From the 1970s onwards, under the leadership of Professor Angus Maddison at Groningen University in the Netherlands, the Programme for International Comparison of Output and Productivity (ICOP) has developed bilateral comparisons for manufacturing using the industry-of-origin approach with benchmarks for the second half of the twentieth century. Van Ark (1993) compiled productivity comparisons for eleven countries for the period after World War II: France, Germany, Japan, Netherlands, Japan, the United Kingdom, the United States, India, South Korea, Brazil and Mexico. Moreover, several studies provide binary comparisons in terms of labour productivity gaps mainly between developed countries from the 1970s onwards.

More recent studies estimate purchasing power parities to compare different countries with at least one benchmark in the first half of the twentieth century: Broadberry (1997), de Jong and Soete (1997), Fremdling et al (2007), Prado (2008), Yuan et al. (2010), de Jong and Woltjer (2011), Broadberry and Klein (2011), Frankema et al. (2013), Woltjer (2013), Veenstra (2014) and Bos (2015). In the following paragraphs I summarize the main points of these works.

Broadberry (1997) estimates British manufacturing performance between 1850 and 1990 compared to other countries. His estimates before 1945 are based on physical output per worker, whereas for after 1945 Broadberry compares productivity levels following Paige and Bombach. The estimates for after 1945 covered 77 industries in the comparison between the United States and the United Kingdom, and 32 industries between Germany and the United Kingdom. One of his results shows that between 1909/07 and 1967/68 British manufacturing performed better than Germany and the United States in lighter industries. In heavy industry, however, Germany and the United States were more productive than the United Kingdom in heavy industry. Since the 1970s, British heavy industry has closed the gap relative to these two counterparts.

On the other hand, de Jong and Soete (1997) calculate productivity levels in manufacturing of the Netherlands and Belgium for the years 1937, 1960 and 1987. For the benchmark year of 1937, the paper estimates labour productivity levels using physical quantities of output for 25 products and industries. Labour productivity in Belgium is higher than the Netherlands in chemicals, primary metals, brewing and cotton yarn. Conversely, in food, tobacco, paper and shipbuilding, the Netherlands remains more productive than its neighbour.

Fremdling et al (2007) compare manufacturing productivity of the United Kingdom and Germany for the 1935/1936 benchmark by applying the *double deflation procedure*[39]. The United Kingdom had an advantage over Germany in light industries and wood products. Industries where labour productivity in the UK is lower than Germany include iron and steel, engineering, shipbuilding, chemicals, paper, and also manufacturing as a whole.

For Sweden, Prado (2008) estimates physical comparisons between this country and the United Kingdom and the United States, in three benchmark years (circa 1907/09, 1924/25 and 1937/35). His results show that Sweden was able to catch up with both countries during the period, although the gaps were considerably different. While in 1935 the British lead was estimated at 17 percent, the American level was 85 percent higher than Sweden. Additionally, the Nordic economy presented poorer results in stone, clay, glass, chemicals and engineering.

Yuan et al. (2010) provide estimates of labour productivity in China, Japan and Korea relative to the United States for circa 1935, measured using working hours. Whereas the Chinese labour productivity was barely 7% of the US level, in Korea and Japan it was 23 and 24%, respectively. Disaggregated by industry, in China, building materials was recorded as having the highest productivity level in this comparison with the US (19%) and in Korea and Japan the highest productivity ratio relative to the US was found in chemicals (42% and 49% respectively).

A comparison between Czechoslovakia and the United Kingdom (Broadberry and Klein 2011) used the industrial censuses of 1935 and wholesale prices from both countries. Based on data for 12 matched items for the benchmark year, they find that labour productivity in the eastern country was 63.1% of that of the United Kingdom in manufacturing as a whole. Labour productivity in Czechoslovak had grown substantially by the end of the seventies, reaching up to 75% of the UK level. However, after that the country lost ground and diverged

[39] According to the OECD Glossary of Statistical Terms: Double deflation is a method whereby gross value added is measured at constant prices by subtracting intermediate consumption at constant prices from output at constant prices; this method is feasible only for constant price estimates which are additive, such as those calculated using a Laspeyres' formula (either fixed-base or for estimates expressed in the previous year's prices).

steadily from the British level during the eighties and nineties. According to the authors, *"the central planning system, which had worked tolerably well during the era of mass production, seemed unable to adjust to the era of flexible production"* (Broadberry and Klein 2011:45).

For a British/American comparison, de Jong and Woltjer (2011) calculate the manufacturing productivity gap based on the benchmark year 1935 using single and double deflation, and also adjusting for hours worked. They conclude that the relative manufacturing productivity level of the US versus UK in terms of hours worked and double deflated PPPs increased from around 200 to 300 between 1900 and 1957. Chemicals, paper and engineering industries in particular drove this strong American performance. Later, Woltjer (2013) provides estimates for the United States and the United Kingdom around 1910 at sectoral levels (agriculture, mining and 11 manufacturing industries). His results using double deflated PPPs show that the United States was more productive in durable goods industries, such as metals industries, engineering and wood. Conversely, the United Kingdom had advantage in light industries, and chemicals, petroleum and rubber.

A broader study on the Netherlands, France, the United Kingdom and the United States (Frankema et al 2013) estimates labour productivity for agriculture, mining and five manufacturing industries circa 1910. One of the main findings is that in manufacturing as a whole, labour productivity in the United Kingdom remained 55 percent below the American level, in France about 60 percent and in the Netherlands about 70 percent.

In 2014, Veenstra compared manufacturing productivity in Germany with the United States and the United Kingdom for the benchmark years 1909 and for 1935-36. The matching procedure between Germany and the US covers 74 items in 1909 and 125 in 1935. German and American productivity levels did not converge in the interwar period, explained by the success of the US performance. His work also applies industry-of-origin benchmarks for five European countries (the United Kingdom, Germany, France, the Netherlands and Sweden) relative to the United States around 1910. The results show that German labour productivity was 50 percent of that in the United States, compared to 41 percent in the UK, 38 percent in France, 32 percent in the Netherlands and 36 percent in Sweden.

Finally, Bos (2015) employs a unit value comparison between West Germany and the United Kingdom for three benchmark years (1935, 1951 and 1968). For 1935, the matching procedure covers 229 items, while in 1951 it covers 186 items representing 26 percent of

British industry and 33 percent of German industry. West Germany's labour productivity is higher than the British level for the three benchmark years, especially in 1951 (Germany was 83 percent ahead of the UK). The German lead is more evident in heavy industry and chemicals.

This literature review reveals that, to date, few studies have focused on cross-country comparisons involving developing countries during the interwar period. Furthermore, due to data requirements, it is unusual to find purchasing power parities for the manufacturing sector including at a disaggregated level.

3.3. The industry-of-origin approach

In order to estimate sector-specific purchasing power parities, so-called unit value ratios (uvrs) of comparable products are identified in the two countries. There can be numerous problems in establishing the correspondence between products. It is impossible to perfectly match every item produced in Brazil, Chile and Uruguay with one in the United States and Sweden. There are product quality differences and different baskets of production goods.

As expected, the United States manufactures a great variety of goods that are not produced in Latin America. Also, there are difficulties in reconciling some product valuations. Adding to the complication is that there is no harmonized product coding system, so some items need to be aggregated in order to obtain a correct match between the two countries. For example, poultry in Uruguay includes three products while in the United States it includes six.

Moreover, special attention must be paid to units of measurement. Brazil, Chile and Uruguay use the conventional metric system while the United States employs the imperial (British) system of units. This makes it necessary to carry out a conversion for the matching procedure, e.g. from gallons to litres, pounds to kilograms, square feet to square meters, etc.

The matching procedure starts at the most detailed level possible, and only then is aggregated to a higher level[40].

In general terms, I followed the same methodology for the comparisons of Brazil, Chile and Uruguay with the United States, and Brazil with Sweden. In showing the steps of the method, Chile and the United States are named in the explanation.

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[40] The assumptions behind the products matched are quite strong: products with comparable qualities, similar market structures, and prices which only reflect different currency values.

The first step consists of calculating for the two countries (Chile and United States), for each product matched, the unit value (p_i), obtained by dividing the output value (v_i) by the respective quantity of this product (q_i) (see Equation 3.1). Therefore, the unit value represents the average producer price of each product i in the countries. The unit value ratios (uvr_{io}) reflect the product-specific relative prices expressed in terms of country *n*'s currency (Chilean pesos) per unit of base country *o*'s currency (US dollars) (see equation 3.2).

(3.1) $p_i = \frac{v_i}{q_i}$, calculated separately for Chile and United States

(3.2) $uvr_{io} = \frac{p_{in}}{p_{io}}$

The aggregation procedure to obtain the aggregated uvrs at the industry level is calculated by weighting the uvr_i of the matched products in the same industry according to their share in the total matched output ($^{v_i}/_{\sum v_i}$). This is done, first using American output weights (the base country o) (see equation 3.3), and then Chilean output weights (the numerator country n) (see equation 3.4): Laspeyres (L^{agg}) and Paasche (P^{agg}), respectively (Woltjer, 2013, Veenstra, 2014).

(3.3) $L^{agg} = \frac{\sum v_{io} * uvr_{io}}{\sum v_{io}}$

(3.4) $P^{agg} = \frac{\sum v_{in}}{\sum v_{in}/uvr_{io}}$

The shares of value added at the industry level mirror the output structure given in each country's industrial census, and for the modest sample of commodities compared do not sum to the total output value.

The final uvr used is a Fisher index, which is a geometric average of the Paasche and Laspeyres indices. The Fisher uvr satisfies the country reversal test (i.e. changing the denominator and numerator does not alter the results) and the factor reversal test (i.e. a Fisher price index times a Fisher quantity index gives a Fisher value index) (van Ark 1993). The Fisher uvr is used to calculate productivity comparisons on a disaggregated basis.

$$(3.5)\ F = \sqrt{L^{agg} * P^{agg}}$$

Finally, I use the single indicator method. Although double deflation is better than single deflation since it considers relative prices for intermediate inputs, it is not possible to find physical quantities and prices for inputs in order to construct input PPPs. Single deflation is based on the following assumptions: 1) at the product level, the value share of intermediate inputs in each unit of output is the same for all products within that industry and across countries, 2) UVRs for inputs equal the corresponding UVR for gross output (van Ark 1993).

Due to data constraints for an earlier period, the benchmark in Uruguay could only be built with more recent statistics (manufacturing census of 1988). It is for this reason that the disaggregation level was higher than for Brazil in 1949 and Chile in 1939. Specifically, in comparing Uruguay versus the United States for the benchmark 1988 and Brazil versus Sweden for the benchmark 1975, the unit value ratios were estimated for industries, branches and major branches. Branches' UVRs are weighted at branch value added to obtain a unit value ratio for manufacturing as a whole. The UVRs are re-weighted in accordance with their relative importance in the aggregate. Following previous works (Freudenberg and Ünal-Kesenci 1994), where matched products cover a low percentage of total output and cannot be considered representative for their industry, I assumed for the Uruguay-US and Brazil-Sweden benchmarks that:

1. For industries with no product matches or a matching percentage of less than 22%, the average UVR of all the matched products is applied to the branch in question.
2. For a branch disaggregated at the four-digit level and without matched products, the average UVR of all matched products in the major branch in question is applied.

3. For a major branch without matched products, the UVR of all matched products for manufacturing as a whole is applied.

Moreover, in the case of Uruguay I used a sensitivity test to verify the robustness of the average UVR to the inclusion of UVRs for small products or for outlier UVRs (van Ark 1993). Outlier UVRs are those which are more than 0.5 times the standard deviation below the mean of the full sample, or more than one standard deviation above the mean, and are excluded from the sample. In this case, five products (cigarettes, nonfilter tips, lubricating oils, hydrated lime and lenses) were dropped from the sample (Lara 2012).

3.4. Data

Following the industry-of-origin method, average values of produced items are calculated to establish a relative price of a product in the two countries being compared. These are obtained by dividing output values by quantities as reported in national statistics.

Moreover, in order to calculate the final unit value ratio, it is necessary to have value added data. The sources of data are heterogeneous across countries and over time. The next subsections describe the data employed for each country: Brazil, Chile, Uruguay, the United States and Sweden.

3.4.1. Brazil

All the Brazilian industrial censuses are surveyed by the national statistical agency of Brazil, *Instituto Brasileiro de Geografia e Estatística*, which started providing physical output information only in 1975. The omission of physical output indicators up to 1975 is the rationale for choosing that year as a benchmark in the only previous attempt to provide an international reference point for Brazilian productivity compared to other countries in manufacturing (van Ark and Maddison 1994).[41]

Departing from the pioneering effort of van Ark and Maddison, Lara and Prado (2018a, 2018b) propose two new benchmarks. The first one focuses on the interwar period and compares Brazil and the United States in 1949. The Brazilian government published four industrial censuses in the first half of the nineteenth century. The first appeared in 1907 and

[41] The Brazil/US estimate was first published as Maddison and van Ark (1989). This was a pilot exercise within the International Comparisons of Output and Productivity project (ICOP). However, I will refer to the study of van Ark and Maddison (1994), which offers updated estimates of Brazil/US productivity in 1975.

is incomplete. In fact, it was not a governmental report: the national manufacturers' association did the survey. The association feared that company owners would ignore a survey conducted by the federal government. A large number of industries were excluded because of the deficient coverage of São Paulo. The data presented by the census may therefore not be indicative of manufacturing as a whole. The procedure used in the censuses that appeared in 1919, 1939 and 1949 improved the coverage, which made these later publications reliable summaries of key aspects of Brazilian manufacturing.[42] The motive for choosing 1949 as the benchmark year, in short, is that the estimated value of this benchmark year can be crosschecked by an independent time series of labour productivity.

Unlike van Ark and Maddison (1994), Lara and Prado (2018a) cannot compute unit value ratios because the pre-1975 versions of *Censos Industrial do Brasil* omit information on physical output. For this reason, we selected wholesale prices instead of unit values from industrial censuses, which is a way to circumvent the data deficiency, comply with the industry-of-origin approach and avoid using the market exchange rate (Broadberry and Klein 2011, Bos 2015).

There is, however, no abundance of Brazilian wholesale prices either. *Fundação Getulio Vargas* (FGV) constructed a wholesale price index beginning in 1944 but never published the particulars of the products underlying the index. Nor did the IBGE, despite a deliberate effort to collect wholesale prices.[43] The only price information available is found in de Bulhões' paper "*Índices de preços*", published in *Revista Brasileira de Economia* (1948), which contains annual price quotations for a wide range of products from 1938 to 1947.[44] De Bulhões (1948) lists 99 products, and if sub-categories are included, the list grows to 133 products. The price quotations were collected by IBGE and pertain to Rio de Janeiro, the *Distrito Federal* at that time, and the wholesale prices were reported by qualified respondents[45].

Moreover, Lara and Prado (2018b) employ the Brazilian census of 1975 in order to compare labour productivity of this country with Sweden. This census is founded on a wealth of information on physical quantities covering the entire manufacturing sector. The products are listed with a sequence of numbers from 1 to 13,678. The census information is presented

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[42] See Haber (1992) and Dean (1969) for a discussion on the *Censos Industrial do Brasil* in 1907.
[43] See chapter 5, *Índices de preços*, in *Estatísticas Históricas do Brasil* (1990).
[44] Octavio Gouveia de Bulhões was one of the top Brazilian economists at the time, affiliated with FGV and the Ministry of Economics between 1964 and 1967.
[45] See *Anuário Estatístico do Brasil,* 1941-1945, pp. 312-24.

using a national classification scheme based on manufacturing branches named *generos*, which has no correspondence with the usual international classifications, thus necessitating additional efforts to match products. The information on product attributes is often scant. Its nationwide coverage covered 183,824 establishments and 3,816,545 employees. The unit of investigation is establishments (not firms), i.e. units (factory, mill, etc.) at which one or a group of products are manufactured. Apart from information on output by products, the census also offers information on output by industry, including number of establishments, employment, wages, hours worked and value added.

3.4.2. Chile

The source of information for Chile has certain shortcomings that must be considered. Although in Chile we can find industrial censuses for the years 1928, 1937, 1947, 1957 and 1967, none of them provide information about output value and quantities at the product level. Thus, the required data (quantities, output value and prices) by products could be collected only from statistical yearbooks, published by *Dirección General de Estadística.* Moreover, the information provided by the yearbooks changes each year, therefore the year selected was determined by the available data.

For this benchmark, I use the yearbook of 1939. The rationale for this choice is that I focus on the interwar period, and the publication in 1939 offers the requisite data[46]. Firms with less than 5 employees are not considered in the statistics. Moreover, the description provided in the yearbook is not comprehensive enough to measure the bias introduced by this collection procedure. However, one can infer from references in the subsequent (and more rigorous) censuses[47] that small and informal enterprises were not included. Assuming that small units are less productive than medium or large ones, the bias would be toward overestimating productivity levels for manufacturing as a whole. In the absence of a more complete coverage, these results cannot be easily generalized. As we do not have output values in the industrial census of 1937, in order to illustrate differences between the census (with a greater coverage) and the yearbook, we can compare the total labour force (employees and workers) in both sources. Whereas the census of 1937 recorded 177,811 labourers, in 1939 the level estimated in the yearbook was 102,414. Therefore, it looks like a reasonable comparison.

[46] The yearbooks of 1936, 1937, 1938 and 1940 do not provide the data needed.
[47] See 1967 Census of Manufacturing.

The yearbook of 1939 provides the following data disaggregated by industry and region[48]: wages and salaries, employees and workers, horse-power (electrical and non-electrical), output, value added, number of establishments and capital investment.

Data about physical quantities and output value could be obtained for some selected industries: textiles, footwear, leather and chemicals. Because of limited data on output values, wholesale prices were also employed in other industries in order to fill this gap (tobacco, paper and printing industry, food and beverages, and non-metallic minerals)[49].

3.4.3. Uruguay

In the case of Uruguay, industrial statistics are heterogeneous. Although there were industrial censuses in 1936, 1968 and 1978, as well as industrial surveys since 1957[50] together with other secondary sources[51], physical output information is only available in the census of 1988[52]. The absence of industrial prices or wholesale prices for the second half of the twentieth century led me to select 1988 as the benchmark year.

The Uruguayan Census of Manufactures for 1988 is conducted by the *Instituto Nacional de Estadísticas.* The census information classification is based on the International Standard Industrial Classification (ISIC) revision 2, using an 11-digit product classification.

The units of observation are economic units operating in different establishments (units of observation). These economic units are legal entities or parts of them. This census has nationwide coverage, and around 25,042 units (with a total of 220,992 manufacturing sector employees) were surveyed.

In this case, I obtained microdata from a manufacturing census at the economic unit level provided by the Department of Economics of the Faculty of Social Sciences at Universidad de la República (UdelaR) in Uruguay. This database provides information on a range of aspects including number of people employed, wages, hours worked, sales revenues, number

[48] The Province of Ñuble was excluded because of the devastating earthquake on 24 January, 1939. However, its contribution to national value added was insignificant in previous years (see Appendix B).
[49] Information about physical quantities and wholesale prices are obtained from the Yearbook of 1939.
[50] The *Banco República* was in charge of this survey and thus it is possible to find some data for the years 1957-1960.
[51] The *Comisión de Investigaciones y Desarrollo Económico* (CIDE) collected data from the manufacturing sector in 1963 in order to prepare an Annual Development Plan for the country over 1965-1974.
[52] There was also industrial data for 1948 and 1952 from the Ministry of Industry and Labour.

of goods produced and their production values, overheads, taxes, inventories and whether supplies are of domestic origin or imported.

From this database, it is possible to aggregate the quantities of each item produced (in different economic units) described in the same unit of measurement and with their corresponding output value, and thus obtain the so-called unit value ratio (UVR), which is the key indicator in this study. After processing the statistical records, I excluded unsuitable information such as municipal government economic units or units lacking the relevant data to obtain a UVR.

3.4.4. United States

In the case of the United States I employ different sources of data. For the benchmark comparison with Brazil in 1947/49, I use American wholesale prices, and for the comparison with Chile in 1939 and Uruguay in 1988 I use industrial statistics (censuses and surveys).

The supply of American prices is sufficiently detailed for product matching, thanks to the wholesale prices underlying the various indices issued by the Bureau of Labour Statistics, made available annually since at least the beginning of the twentieth century. Many of the goods covered appear in the National Bureau of Economic Research's (NBER) macro history database. A sample of about 180 products and prices appears in the various issues of the Statistical Abstract of the United States.

Moreover, the United States has regular manufacturing censuses over the twentieth century conducted by the Census Bureau of the US Department of Commerce. The Census of Manufactures for 1939 collected data only from establishments reporting total value of production valued at 5,000 dollars or more. It includes, at industry level: number of establishments, employees and workers, wages and salaries, hours worked, value added and output. Physical quantities and output for each product category are detailed in the Census of Manufactures for 1939, and the product supplement of the Census of Manufactures for 1947.

The United States census of manufactures in 1987 is classified according to Standard Industrial Classification (SIC), into 20 major groups for manufacturing, which allocates approximately 11,000 items to about 1,500 commodity groups, in accordance with a 7-digit classification. In this census, approximately 220,000 establishments reported by mail using an industry-specific questionnaire tailored to the industry. Data for an additional 150,000 small and single-establishment firms were obtained from federal administrative records. Only establishments with a payroll were considered.

Not all the information that the census obtained is published because when the number of reporting establishments is limited, some data is withheld to avoid violating the privacy of each company by providing confidential information to its competitors. The census includes all establishments employing one or more people at any time in the census year, but in a limited number of cases single establishment companies with less than 5 employees are not required to respond to the census.

Finally, for the benchmark comparison with Brazil and with Uruguay, I had to adjust the American results. In the first case, I adjusted the 1947 American labour productivity levels to 1949 using value added series at current prices and employment prepared by the Bureau of Economic Analysis (BEA). In the second case, I moved the American results of 1987 to a 1988 level by use of the American Annual Survey of Manufactures, which is available in the 1992 US industry report.

3.4.5. Sweden

The Swedish Industrial Statistics of 1975 is published in two volumes[53]. The first provides information by industry: number of establishments, value of output and value added, cost data, employment data, capacity of power equipment, capital and capital formation, etc. including quantity and cost of individually important raw materials consumed during the period. The second offers production data by commodity: output in physical quantities and corresponding product value, and imports and exports.

The industry-level information allows to aggregate unit value ratios from the product level to industry, from industry to branch, and finally from branch to manufacturing as a whole, and it also allows to establish value added per worker in current prices for similar manufacturing industries as in Brazil. The industry classification is according to the Swedish Standard of Industrial Classification (SNI), which is reminiscent of the International Standard Industrial Classification of All Economic Activities (ISIC). Production is given in either gross output (sales values) and net output (value added). The industries are given by

[53]https://www.scb.se/sv_/hitta-statistik/historisk-statistik/sok-publikationer-efter-amne/?Statistikserie=Industri+1911-1996

several subdivisions, sometimes down to the 5-digit level. The classification of industries is nearly as disaggregated as in many countries' industrial censuses.[54]

The information on output by commodity is used to match products and establish unit value ratios by commodity. The commodities are presented according to two classification schemes: the Standard International Trade Classification (SITC) and the Brussels nomenclature with numerous subdivisions[55]. The number of individual items totals almost 5,000. Despite this seemingly large number of items, the Swedish Industrial Statistics do not come close to the number of items that are recorded in the censuses of, for example, the US, the UK and Brazil. The Swedish one offers only about one-third the number of products in the Brazilian census. This limitation is a drawback for international productivity comparisons. In general, the more recent the benchmark year, the more the product variety. The combination of a recent benchmark and the limitation of the Swedish Industrial Census could result in a low level of matched products.

3.5. Benchmark results

Unit value ratios

In this section I present the benchmarks results for Brazil versus the United States in 1947-49 and Brazil compared to Sweden in 1975, Chile compared to the United States in 1939, and Uruguay compared to the United States in 1988.

At each level of aggregation, one has to assume that the sample of commodities gives a representative picture of relative prices. The coverage ratio depends on the sample of commodities. In the case of Brazil 1949 and Chile, the small sample of matched products (55 and 54 products, respectively) stems from insufficient Latin American data and the differences in the economic structures of these countries relative to the American economy[56]. To some extent, low coverage ratios also plague two-way comparison between European countries (France, Netherlands and Sweden) and the US during the first half of the twentieth century (Frankema et al. 2013, Veenstra 2014). Therefore, the margin of error is relatively

[54] Statistics Sweden only carried out three actual Industrial Censuses in the twentieth century: 1931, 1951 and 1972.
[55] Lara and Prado (2018b) used the classification scheme of the Brussels nomenclature because it offers more details on product attributes.
[56] Appendix B describes the products matched in Brazil versus the US in 1949, Chile and the US in 1939, Brazil and Sweden in 1975, and Uruguay and the US in 1988.

high. Broadberry (1997) suggests that international productivity benchmarks have a 10 to 15 percent margin of error.

When we move to the second half of the twentieth century, despite remaining structural differences between these Latin American countries and the developed countries, the number of matched products increases. Van Ark and Maddison (1994) matched 221 products between Brazil and the US in 1975, and the comparison covered 27 industries, accounting for 61 percent of the Brazilian gross output and 89 percent of the American output (van Ark and Maddison 1994:48). In the Brazil versus Sweden comparison for the same year, the number of matched products was 164 and the coverage ratio 21% (Lara and Prado 2018b). Finally, the matching procedure for Uruguay versus the US in 1988 involved 113 products and the coverage ratio measured as matched output in terms of census output was 22% for the manufacturing sector[57].

The unit value ratios obtained with this method assume that each industry and manufacturing as a whole are well represented by the total number of products matched. Furthermore, if we interpret the overall UVR as a converter for average manufacturing production costs in the other country's prices, the relative price level (comparing the geometric UVR with the exchange rate) indicates the price competitiveness of the manufacturing products relative to the reference country (in this case US and Sweden). This advantage pertains to when relative price levels are below 100.

Table 3.1 shows that the relative prices for Brazil, Chile and Uruguay turn out to be higher with American or Swedish output shares (Laspeyres) than with the Brazilian, Chilean or Uruguayan shares (Paasche). Such discrepancies between Laspeyres and Paasche indices should come as no surprise because lower relative prices indicate higher relative productivity, and higher relative productivity often leads to higher growth of output.

In the Brazil versus US benchmark in 1947, the unit value ratio for manufacturing as a whole and the exchange rate diverge to a large degree; the first is 31.1, exceeding the exchange rate (18.4[58]) by 69.2 percent. Using the exchange rate would have led us to

[57] Lara (2012) presents (in Spanish) a detailed list of the product matched between Uruguay and the US in 1988. In the Appendix B the list is presented in English. This coverage ratio for Uruguay is similar to other cases in which a developing country is compared to the United States for a similar period (Pilat 1991, van Ark 1991, van Ark and Maddison 1988).

[58] The exchange rate is calculated using IPEA from https://seculoxx.ibge.gov.br/economicas/setor-externo/tabelas.

dramatically overestimate the Brazilian labour productivity relative to that of the US. Additionally, the large discrepancy between the two figures informs us about a particular feature of Brazilian economic development. The overvalued exchange rate stemmed from the rapid inflation that Brazil experienced in the immediate post-WWII era; the exchange rate, however, remained fixed. The result was a dramatic overvaluation of the cruzeiro, which brought a large increase in imports while exports of manufactures were curtailed (Abreu et al. 2000).

However, in the remaining benchmarks with the United States and Sweden each as a reference country, the Fisher UVR for aggregate manufacturing was lower than the exchange rate. The largest differences were recorded in Chile (with a geometric average of 22.9 Chilean pesos per dollar, and an exchange rate[59] of 32.0 pesos to the dollar) and in Brazil compared to Sweden (a Fisher index of 1.2 and an exchange rate of 2 cruzeiros per krona[60]). The relative price levels of below 100 means that in these comparisons, Latin American manufacturing products were more price-competitive than the American and Swedish products.

Table 3.1. Unit value ratios for different benchmark years. Brazil, Chile and Uruguay

	Brazil 1949, cruzeiros per dollar a/	Brazil 1975, cruzeiros per dollar b/	Chile 1939, pesos per dollar c/	Uruguay 1988, peso per dollar d/	Brazil 1975, cruzeiros per Swedish krona e/
Number of matched items	55	221	54	113	164
Laspeyres UVR	41.8	8.8	28.1	388.9	2.2
Paasche UVR	23.2	6.9	18.7	279.8	0.6
Fisher UVR	31.1	7.8	22.9	329.9	1.16
Exchange rate	18.4	8.1	32.0	358.0	2.0
Relative price level	169.0	95.8	71.6	92.2	59.1

a/ Own estimates based on Lara and Prado (2018a).
b/ Van Ark and Maddison (1994).
c/ Own estimates.
d/ Own estimates based on Lara (2012).
e/ Own estimates based on Lara and Prado (2018b).

[59] The exchange rate is obtained from Braun et al.'s (2000) "Economía Chilena 1810-1995: Estadísticas históricas", Documento de Trabajo No. 187, Instituto de Economía – Pontificia Universidad Católica, Santiago de Chile.

[60] This exchange rate is calculated using the cruzeiros per dollar rate (8.13) and the Swedish kronas per dollar rate (4.17) (van Ark and Timmer 2001).

Table 3.2 shows in detail in which industries it was possible to estimate unit value ratios. The type of available data has limited the coverage at industry level, for example in the earliest comparisons between Brazil and Chile with the US it was not possible to match products in heavy industries such as machinery and transport equipment, and electric engineering. In both comparisons, it was possible to cover significant sectors such as: food and beverages; tobacco; textiles and apparel; leather; chemical products; paper and printing; and non-metallic minerals. In the case of Uruguay-US and Brazil-Sweden, disaggregated data allowed us to impute a unit value ratio when matched products cover a low percentage of total output and cannot be considered representative for their industry (see section 3.3). This is the case for chemicals, non-metallic minerals and machinery and transport equipment in the comparison of Brazil versus Sweden. In the comparison of Uruguay versus the US this criteria was used in several industries: rubber, chemicals, paper, printing, non-metallic minerals, metals, electric engineering, and wood and furniture.

Table 3.2. Unit value ratios by industry for different benchmark years. Brazil, Chile and Uruguay versus the US, and Brazil versus Sweden

<table>
<tr><th></th><th>Brazil 1949, cruzeiros per dollar a/</th><th>Brazil 1975, cruzeiros per dollar b/</th><th>Chile 1939, pesos per dollar c/</th><th>Uruguay 1988, peso per dollar d/</th><th>Brazil 1975, cruzeiros per Swedish krona e/</th></tr>
<tr><td>Food</td><td rowspan="3">22.4</td><td>5.5</td><td rowspan="2">14.8</td><td>303.7</td><td>0.8</td></tr>
<tr><td>Beverages</td><td>6</td><td>238.9</td><td>0.9</td></tr>
<tr><td>Tobacco</td><td>4.7</td><td>19.6</td><td>252.8</td><td>1.0</td></tr>
<tr><td>Textiles</td><td rowspan="2">21</td><td>8.9</td><td rowspan="2">37.5</td><td>310.8</td><td rowspan="5">0.5</td></tr>
<tr><td>Apparel</td><td>8.2</td><td>314.5</td></tr>
<tr><td>Footwear</td><td rowspan="3">16.2</td><td rowspan="3">8.1</td><td rowspan="3">25.9</td><td>281.7</td></tr>
<tr><td>Leather</td><td>284.5</td></tr>
<tr><td>Rubber</td><td>420.6</td></tr>
<tr><td>Chemicals</td><td>42</td><td>11.1</td><td>33.6</td><td>420.6</td><td>1.2</td></tr>
<tr><td>Paper
Printing</td><td>53.2</td><td>9.6</td><td>17.8</td><td>336.2</td><td>1.5</td></tr>
<tr><td>Non metallic minerals</td><td>44.8</td><td>6.3</td><td>19.1</td><td>336.2</td><td>1.2</td></tr>
<tr><td>Metals and metal products</td><td>46.4</td><td>7.5</td><td>n/a</td><td>336.2</td><td>3.4</td></tr>
<tr><td>Machinery and transport equipment</td><td>n/a</td><td>6.6</td><td>n/a</td><td>376.4</td><td rowspan="2">1.2</td></tr>
<tr><td>Electric engineering</td><td>n/a</td><td>9.8</td><td>n/a</td><td>336.2</td></tr>
<tr><td>Wood and furniture</td><td>n/a</td><td>12.3</td><td>n/a</td><td>336.2</td><td>2.1</td></tr>
<tr><td>Total</td><td>31.1</td><td>7.8</td><td>22.9</td><td>329.9</td><td>1.16</td></tr>
</table>

a/ Own estimates based on Lara and Prado (2018a).
b/ Van Ark and Maddison (1994).
c/ Own estimates.
d/ Own estimates based on Lara (2012).
e/ Own estimates based on Lara and Prado (2018b).

Relative levels of labour productivity

Once the unit value ratios are estimated, they are employed to calculate comparisons of levels of labour productivity in the benchmark year. The most straightforward way to compare labour productivity is using value added per employee or per working hour. Value added figures are at factor cost, and for example relative levels of value added per employee are calculated at a given level of aggregation as the value added per employee in one country (expressed in factor costs) divided by value added per employee in the other country (expressed in its own currency). Each country's industrial census or survey provides value added by industry.

The following four tables show, for the mentioned benchmarks, the value added, number of employees and value added per employee using UVR. Because of working hour data constraints in Chile and Brazil, I only present value added per employee for both countries. Implicitly, it assumes the same average length of the working week and number of holidays. For the Uruguay-US, in my previous work (Lara 2012) I was also able to calculate labour productivity ratios using working hours.

Table 3.3 shows that the Chilean labour productivity in 1939 was 23 percent of the American level, and despite variations across sectors, the productivity ratio in all cases was favourable to the United States. As expected, these results are rather poor compared to the productivity ratio estimated between Western European countries and the United States for a similar period. As opposed to those cases, this ratio is similar to other estimates comparing Asian countries with the US for a similar period (Yuan et al 2010).

In food, beverages and tobacco, the labour productivity ratios are above the manufacturing average: 31.2 and 94% respectively. The tobacco industry is a very special case. In the United States in 1939 this industry included a larger share of production of cigars which required more workers and less capital. Conversely, in Chile the tobacco industry was mainly devoted to cigarettes, which requires a more modern production. This was also found by Bos (2015), who compared Britain and West Germany before and after WWII. In West Germany, cigar production was relatively much larger than in Britain in 1935, which explains a massive labour productivity gap favourable to the British firms.

The Chilean firms in chemicals and non-metallic minerals recorded the lowest relative levels of labour productivity between the two countries.

Table 3.3. Value added, persons employed and productivity ratios (US=100) by industry, Chile and the United States, 1939

	Unit value ratios	Value added in current currency: Chile (millions of pesos)	Value added in current currency: USA (millions of dollars)	Value added Chile using UVR: Chile (millions of dollars)	All employees: Chile	All employees: USA	Value added per employee (US$) using UVRs: Chile	Value added per employee (US$) using UVRs: USA	Labour productivity (US=100) using UVR
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)
Food and beverages	14.8	451	3,556	30.6	25,272	916,221	1,210	3,881	31.2
Tobacco	19.6	115	350	5.8	1,628	91,870	3,584	3,811	94.0
Textiles and apparel	37.5	300	3,203	8.0	20,919	1,925,692	382	1,663	23.0
Leather and rubber and footwear	25.9	138	990	5.4	11,396	486,029	470	2,036	23.1
Chemicals	33.6	184	1,822	5.5	5,789	330,228	943	5,518	17.1
Paper and printing	17.8	132	2,636	7.4	8,830	740,151	839	3,562	23.5
Non-metallic minerals	19.1	81	911	4.2	8,485	314,977	501	2,893	17.3
Total	22.9	1,644	24,604	71.8	102,414	8,763,307	701	2,808	25.0

Source: author's estimates based on *Dirección General de Estadística*, Chile; Census Bureau, US.

A greater data availability for Chile and the United States in 1939 led us to carry out additional analysis. Following Broadberry (1997) and de Jong (2003), a selected group of factors might contribute to explaining relative labour productivity levels between countries across sectors: capital intensity, market size and plant size. All of them are expressed in Chilean terms as a proportion of their US counterpart.

Capital intensity is calculated as the ratio of installed horsepower per worker in each country due to the lack of comparable data on industrial capital[61]. As expected, Table 3.4 shows that the American industries had higher capital intensity than their Chilean counterparts, and particularly so in: chemicals; non-metallic minerals; and leather, rubber and footwear. The gap between Chilean and American firms in terms of capital intensity narrowed in: food and beverages; tobacco; and paper and printing[62].

[61] Veenstra (2014) and Frankema and Visker (2011) also employ installed horsepower per hour worked and per employees in their analysis of the productivity gap.
[62] It is not possible to replicate Table 3.4 for Brazil and Uruguay due to data constraints. In the case of Brazil-US, data on output values and capital is not available for both countries. In the case of Uruguay-US, data on establishments and capital is not available.

In addition, market size is estimated as the total gross output of the industries divided by total population, and then compared between the two countries[63] (US=100). As de Jong (2003: 93) pointed out: "*A large market size may influence the level of productivity of industries because it enables them to benefit from economies of scale and allows companies or plants within a particular industry to specialize*". Concerning this variable, the figures report that the market available to Chilean companies is insignificant compared to the American market. However, the American advantage is smaller in: food and beverages; tobacco; and leather, rubber and footwear.

The last variable is average plant size. This is calculated as the number of employees per establishment. According to Chandler (cited by de Jong 2003: 97), larger plant size positively impacts labour productivity. Table 3.4 illustrates that plant size in Chile was smaller than in the United States. The gap between Chile and the US was smaller in: non-metallic minerals; paper and printing; and food and beverages - whereas apparel and chemicals record the highest gaps.

Finally, correlation coefficients are calculated between capital intensity, market size and plant size compared with labour productivity. They indicate a moderate positive relationship.

Table 3.4. Comparison between Chile and the US: labour productivity, capital intensity, market size and plant size (US=100). Year 1939

	Labour productivity	Capital intensity	Market size	Plant size
Food and beverages	31.2	52.1	14.6	63.9
Tobacco	94.0	66.1	16.3	n.a.
Textiles	26.3	34.0	10.2	53.5
Apparel	11.9	n.a.	2.4	19.8
Leather and rubber and footwear	23.1	26.0	17.8	n.a.
Chemicals	17.1	18.0	8.3	19.2
Paper and printing	23.5	92.9	9.4	76.7
Non-metallic minerals	17.3	24.9	9.6	96.0
Total	25.0	42.1	6.4	79.6
Correlation coefficient		0.41	0.56	0.41

Source: author's estimates based on *Dirección General de Estadística*, Chile; Census Bureau, US.

[63] A more sophisticated estimate should include industrial imports and exports; however, this data is not available.

Table 3.5 presents the Brazilian labour productivity in 1949 compared to the American level for manufacturing as a whole and disaggregated by industry. The result for aggregate manufacturing differs slightly from Lara and Prado (2018a) because in these new estimates I calculate labour productivity ratios using total labourers and not only workers. Also, I had to adjust the 1947 American labour productivity to the year 1949. I present the adjustment factors in Appendix B.

Brazilian labour productivity was 19.6 percent of the American level, and as was the case in the Chile-US comparison, the productivity ratio at all times remains favourable to the United States. Comparing this result with other benchmarks allows us conclude that Brazil narrowed the gap with the American level during the period of industrialization. In 1975, the labour productivity of Brazil was 48.5 percent of that of the US (van Ark and Maddison 1994) and 42.5 percent in 1985 (Mulder et al. 2001).

The labour productivity ratios are higher (US=100) than for total manufacturing in 1949 (Table 3.5) in: food, beverages and tobacco; textiles and apparel; and leather, rubber and footwear. The lowest productivity gaps between the two countries in 1949 are recorded in chemicals, paper and printing, and in non-metallic minerals. By 1975, chemicals had improved its previous position (van Ark and Maddison 1994), and metals, machinery and transport equipment showed a better relative performance in 1985.

Table 3.5. Value added, persons employed and productivity ratios (US=100) by industry, Brazil and the United States, 1947-49

	Unit value ratios	Value added in current currency		Value added Brazil using UVR	All employees		Value added per employee (US$) using UVR		Labour productivity (US=100) using UVR
		Brazil (thousands cruzeiros)	USA (thousands dollars)	Brazil (thousands dollars)	Brazil	USA	Brazil	USA	
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VIII)	(IX)	(X)
Food, beverages and tobacco	22.4	12,564,173	9,666,268	561,857	286,572	1,553,629	1,961	6,933	28.3
Textiles and apparel	21.0	11,392,984	9,788,249	542,708	368,123	2,315,269	1,474	4,123	35.8
Leather and rubber and footwear	16.2	1,528,971	2,835,666	94,323	78,433	642,227	1,203	4,342	27.7
Chemicals	41.9	4,450,644	7,380,508	106,166	73,472	844,322	1,445	10,522	13.7
Paper and printing	53.2	2,971,532	7,144,374	55,853	74,326	1,165,283	751	6,200	12.1
Non metallic minerals	44.7	3,427,564	2,306,480	76,641	128,928	462,072	594	5,935	10.0
Metals and metal products	46.4	4,468,989	10,686,910	96,280	102,826	2,128,585	936	5,944	15.8
Total	31.1	47,614,903	74,142,218	1,529,268	1,309,614	14,294,258	1,168	5,954	19.6

Source: author's estimates based on *IBGE*, Brazil; Census Bureau, US.

In the Brazil-Sweden comparison in 1975, the Brazilian labour productivity was 74 percent of that of the Nordic country. The productivity was higher in Brazil than Sweden in: textiles, apparel, leather and rubber; and chemicals, petroleum and plastics (156 and 147 percent, respectively). In addition, there was a slight labour productivity gap favourable to Sweden in: food, beverages and tobacco; and mechanical engineering (76 and 81 percent, respectively). However, in wood and furniture, metals, paper and printing, and non-metallic minerals, the Brazilian performance is rather poor compared to the Swedish firms.

Table 3.6. Value added, persons employed and productivity ratios (US=100) by industry, Brazil and Sweden, 1975

	Unit value ratios	Value added in current currency		Value added Brazil using UVR	All employees		Value added per employee (krones) using UVRs		Labour productivity (Sweden =100) using UVR
		Brazil (thousand cruzeiros)	Sweden (thousand krones)	Brazil (thousand krones)	Brazil	Sweden	Brazil	Sweden	
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)
Food, beverage and tobacco	0.83	43,386,493	8,654,854	52,275,948	575,406	72,076	90.9	120.1	75.7
Textile, apparel, leather and rubber	0.51	37,162,256	4,636,634	73,143,293	718,242	70,954	101.8	65.3	155.8
Wood and furniture	2.13	15,052,410	6,386,089	7,065,597	342,400	76,758	20.6	83.2	24.8
Pulp, paper, and printing	1.48	19,033,727	13,069,780	12,884,313	213,150	104,145	60.4	125.5	48.2
Chemical, petroleum and plastic	1.21	55,462,919	6,501,669	45,703,968	260,908	54,484	175.2	119.3	146.8
Non metallic minerals	1.21	19,161,229	3,041,613	15,789,724	320,304	33,127	49.3	91.8	53.7
Metals	3.42	38,781,494	6,037,837	11,335,608	442,379	70,702	25.6	85.4	30.0
Mechanical engineering	1.21	68,847,373	38,784,083	56,733,366	789,849	436,587	71.8	88.8	80.9
Total	1.16	302,803,305	87,559,654	261,233,546	3,747,162	925,299	69.7	94.6	73.7

Source: author's estimates based on *IBGE*, Brazil; Statistics Sweden.

Contrary to the Brazilian and Chilean benchmarks, the Uruguay-US benchmark is calculated using 1988 data. Relative decline in manufacturing in Uruguay began earlier than in other Latin American countries, and by 1988 manufacturing played a secondary role in economic growth. Due to data constraints, it was not possible to construct a benchmark during the industrialization period.

Table 3.7 illustrates the Uruguay-United States benchmark. Uruguayan productivity remained only 15% of the American level in the late 1980s. This result is similar to the productivity ratio of Hungary, Poland and Egypt compared with the US, whose levels are 19.4, 20.8 and 17.2, respectively, following the industry-of-origin method for similar years. Conversely, Asian economies such as South Korea and Taiwan had reached a labour productivity gap with the US similar to that of Uruguay in the 1970s, but ten years later that region had caught up with American levels while Uruguay and other Latin American countries (Brazil and Mexico) saw the gap increase (Lara 2012). By industry, in textiles, apparel, footwear and leather the gap between Uruguay and the US narrowed compared to total manufacturing (28.7, 21.9 and 33.1%, respectively), whereas increased gaps are recorded in tobacco and chemicals.

Table 3.7. Value added, persons employed and productivity ratios (US=100) by industry, Uruguay and the United States, 1988.

	Unit value ratios	Value added in current currency		Value added Uruguay using UVR	All employees		Value added per employee (US$) using UVRs		Labour productivity (US=100) using UVR
		Uruguay (millions of pesos)	USA (millions of dollars)	Uruguay (millions of dollars)	Uruguay	USA	Uruguay	USA	
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)
Food	303.7	146,352	104,423	482	47,087	1,307,600	10,235	79,858	12.8
Beverages	238.9	29,110	24,009	122	6,276	159,000	19,415	151,003	12.9
Tobacco	252.8	6,197	17,155	25	615	44,700	39,849	383,785	10.4
Textiles	310.8	71,127	33,172	229	20,820	865,900	10,993	38,309	28.7
Apparel	314.5	31,935	25,564	102	15,730	868,500	6,455	29,435	21.9
Footwear and leather	284.5	34,076	4,528	120	10,246	128,200	11,690	35,321	33.1
Rubber and plastics	420.6	29,018	46,595	69	7,530	860,000	9,163	54,180	16.9
Chemicals	420.6	63,920	137,879	152	9,565	829,900	15,890	166,139	9.6
Paper and printing	336.2	35,715	151,464	106	11,203	2,116,800	9,482	71,553	13.3
Non-metallic minerals	336.2	22,164	34,235	66	7,818	522,800	8,432	65,484	12.9
Metals and metal products	336.2	25,821	136,378	77	8,985	2,213,400	8,547	61,615	13.9
Machinery and transport equipment	376.4	38,524	272,643	102	8,114	3,714,500	12,615	73,400	17.2
Electric engineering	336.2	18,511	103,475	55	5,352	1,580,600	10,287	65,466	15.7
Total	329.9	589,308	1,261,815	1,787	171,394	17,918,900	10,424	70,418	14.8

Source: author's estimates based on *Instituto Nacional de Estadísticas*, Uruguay; Census Bureau, US.

Unit labour cost

Another comparison is the ratio of relative productivity and relative remuneration, expressed by the concept of unit labour cost. The relative productivity is measured as the labour productivity in Brazil, Chile and Uruguay compared to the United States, and the relative remuneration is measured as wages per labourer in Brazil, Chile and Uruguay, relative to the United States[64]. Therefore, unit labour cost (ULC) measures the average cost of labour per unit of output and is calculated as relative remuneration divided by relative productivity.

Considering the ULC as reflecting cost competitiveness, Chile is more cost-competitive than the United States for manufacturing as a whole and also in all individual industries. While the average wage per worker was seven times higher in the US than in Chile, labour productivity was four times higher in the US than in Chile (see Table 3.8). On the Chilean side, this result is consistent with Reyes (2017), who studied wages and productivity during industrialization. She found that although industrial wages grew moderately between 1939 and 1952, productivity growth more than doubled industrial wage growth. This could mean that the development strategy adopted during the industrialization era was not based on improving distribution by benefiting workers' incomes. Furthermore, the rate of industrial unionization was relatively low in a context of a strong state repression toward union movements.

Notably, in the tobacco industry, which is a highly concentrated sector (Lagos, 1966), relative wages per employee reach the highest rate compared with the US (23.4 percent), but due to a high productivity rate, its unit labour cost was the lowest (24.9 percent) among all manufacturing industries. Other cost competitive industries in Chile compared to the US are: food and beverages; and leather, rubber and footwear.

[64] Wages per labourer are divided by the exchange rate of the local currencies compared to US dollars.

Table 3.8. Relative unit labour cost in Chile (USA=100), 1939

	Unit labour costs	Wages per employee	Labour productivity
Food and beverages	46.2	14.4	31.2
Tobacco	24.9	23.4	94.0
Textiles and apparel	68.1	15.7	23.0
Leather and rubber and footwear	55.4	12.8	23.1
Chemicals	82.5	14.1	17.1
Paper and printing	74.0	17.4	23.5
Non metallic minerals	77.5	13.4	17.3
Total	54.4	13.6	25.0

Source: author's estimates based on *Dirección General de Estadística*, Chile; Census Bureau, US.

From a neostructuralist approach, being competitive through low costs should not be considered favourably. Fajnzylber (1990) proposed the concept of authentic competitiveness, as opposed to the idea of spurious competitiveness. When countries are able to introduce innovation in a more educated and equal society, their products may achieve a genuine international position without the need to pay low wages. According to Fajnzylber (1990), major technical progress leads to greater competitiveness and in many cases brings prospects for more equity, which ultimately guarantees sustained economic growth. To what extent Latin American countries could be genuinely competitive cannot be addressed with the available data of this thesis.

In the Brazil-US comparison, the unit labour costs for aggregate manufacturing are equal in both countries: wages per employee were equivalent to around 50 percent of labour productivity in 1949. This result is consistent with the time series analysis provided by Colistete (2007). He estimated series of unit labour costs covering the 1945-1962 period, showing that wages rose more slowly than productivity with the exceptions of 1945-1946, 1949-1951 and 1954-1955. From these estimates, one might suppose that the benchmark year (1949) should not be considered to be representative of the entire period. Similar to Chile, after WWII, in Brazil the labour markets were plagued by recurring conflicts and mounting inequalities as wages increased more slowly than labour productivity (Colistete 2007). These problems stand in contrast to such expressions as "the golden age of labour", "compact for growth" and "wage moderation" coined to capture the prosperity and upheaval associated with the post-WWII decades in the US, Japan and Western European countries (Eichengreen 1996).

Cost competitiveness in favour of Brazil is recorded in: food, beverages and tobacco; textiles and apparel; and leather, rubber and footwear. In the remaining industries, the United States is shown as having been more cost competitive than Brazil in 1949.

Table 3.9 Relative unit labour costs in Brazil (USA=100), 1949

	Unit labour costs	Wages per employee	Labour productivity
Food, beverages and tobacco	59.3	16.8	28.3
Textiles and apparel	70.8	25.3	35.8
Leather and rubber and footwear	38.5	10.7	27.7
Chemicals	154.6	21.2	13.7
Paper and printing	199.2	24.1	12.1
Non metallic minerals	171.5	17.2	10.0
Metals and metal products	163.3	25.7	15.8
Total	101.9	20.0	19.6

Source: author's estimates based on *IBGE*, Brazil; Census Bureau, US.

Finally, in the Uruguayan case, although wages per employee in the United States in aggregated manufacturing is around four times that of Uruguay, this ratio is higher than that of value added per employee (see Table 3.10). The comparatively low labour productivity is not in similar proportion with low unit labour costs in other Latin American countries for similar benchmark years (Mulder et al. 2002). In contrast, Uruguay's price competitiveness should not be attributed to labour as a factor. It is probable that cheap factor inputs in production intensive in natural resources influenced the results for price competitiveness.

Table 3.10. Relative unit labour cost in Uruguay (USA=100), 1988

	Unit labour costs	Wages per employee	Labour productivity
Food	197.7	25.3	12.8
Beverages	358.8	46.3	12.9
Tobacco	410.4	42.7	10.4
Textiles	102.4	29.4	28.7
Apparel	136.6	29.9	21.9
Leather and footwear	103.3	34.2	33.1
Rubber and plastics	185.3	31.3	16.9
Chemicals	474.5	45.6	9.6
Paper and printing	244.2	32.5	13.3
Non-metallic minerals	175.9	22.7	12.9
Metals and metal products	154.1	21.4	13.9
Machinery and transport equipment	145.8	25.1	17.2
Electric engineering	202.4	31.8	15.7
Total	179.9	26.6	14.8

Source: author's estimates based on *Instituto Nacional de Estadísticas*, Uruguay; Census Bureau, US.

3.6. Conclusions

In this chapter I used the industry-of-origin approach to obtain currency conversion factors called "unit value ratios" in order to compare the manufacturing performance of Brazil, Chile and Uruguay with that of the United States and Sweden.

In terms of its empirical contribution, this is one of the first works which presents estimates of labour productivity between Latin American countries and both the United States and Sweden based on the industry-of-origin approach. Moreover, for the case of Brazil and Chile versus the United States, the benchmarks are in the first half of the twentieth century. With these estimates, I aimed to provide new insights about the labour productivity gap in manufacturing between Latin American economies and developed countries, and whether variations remain across industries.

The matching procedure was limited mainly due to insufficient data among the Latin American countries. However, after having comprehensively explored official statistics in both countries, it appears highly unlikely to improve the coverage ratio using industrial data. Furthermore, the inability to match products linked to heavy industries may introduce a bias which underestimates the advantages of the United States and Sweden over Brazil, Chile and Uruguay.

Assuming that the matching is representative of the whole sector, the Chilean, Brazilian and Uruguayan labour productivity levels were respectively 25, 20 and 15 percent of the American level in the benchmark years, and for Brazil it was 74 percent of the Swedish level in 1975. Despite variations across sectors, the productivity ratio was at all times favourable to the United States. As expected, these ratios are lower than the productivity levels estimated between European countries and the United States for similar periods. In the Chilean and Brazilian cases, in food, beverages, and tobacco, relative labour productivity ratios (US=100) were higher compared to aggregate manufacturing. In addition, higher relative productivity ratios in Brazil and Uruguay were found in textiles, leather and footwear compared to aggregate manufacturing for the benchmark years. In other words, in the benchmarks presented here, the best results in the region were in industries intensive in natural resources. However, in chemicals and non-metallic minerals, in every benchmark comparison with the United States, all three countries showed a larger productivity gap.

In the Brazil-Sweden comparison in 1975, the picture was more encouraging. Brazilian firms performed better than their Swedish counterparts in: chemicals, petroleum and plastics; and textiles, leather, apparel and rubber.

For Chile I also explored about possible explanatory factors. Market size, mass-production and relatively cheaper energy were the most important elements which contributed to explaining the better performance of the United States in the benchmark year of 1939.

In terms of unit labour costs, Chile is more cost-competitive than the United States in manufacturing as a whole and also at a disaggregated level. In tobacco, which is a highly concentrated sector, wages per employee has the highest ratio relative to the US, but due to a high output per worker its unit labour cost is the lowest in the manufacturing group. Food and beverages; textiles; and leather, rubber and footwear, are also more cost competitive in Chile than the US. In the Brazilian case, a cost competitiveness advantage in favour of Brazil is recorded in: food, beverages and tobacco; textiles and apparel; and leather and rubber and footwear. In Uruguay, the relatively low labour productivity levels do not correspond with low unit labour cost levels.

Finally, these benchmarks will be employed in Chapter 4 in order to present long-run series of labour productivity ratios of the Latin American countries as compared with the US and Sweden, at the industry level.

Chapter 4. Structural change and dynamics of convergence

4.1. Introduction

Since the second half of the twentieth century structuralism and other theoretical perspectives have emphasized the decisive role of structural change in order to explain the relative performance of Latin American economies. Economies that were unable to reallocate the labour force from traditional to dynamic sectors were deemed to remain underdeveloped and stuck to structural heterogeneity. Recent works have also contributed to the debate over why some regions were able to develop and others lagged behind, through explaining structural changes for the whole economy or within the manufacturing sector.

The approach had important policy implications. Between 1930 and 1980 industrial policies played a key role in shaping manufacturing performance and the dynamics of convergence. In the current context, the industrial policy debate gained ground in order to analyse the link between policies and performance more deeply, as well as to learn lessons from the past. However, studies of productivity levels and growth rates disaggregated by industries in Latin American countries are scarce, especially in the interwar period. Most of the evidence for Latin America begins after the 1960s. Therefore, in this chapter I intend to provide more insight into the debate on structural change and convergence, focusing on the manufacturing sector during the industrialization period 1930-1980.

The aim of this chapter is threefold. The first aim consists of exploring the patterns of productivity growth in the manufacturing sector in three Latin American countries and in the United States and Sweden during the years 1930-1980. Second, it investigates whether structural transformation in manufacturing occurred using a shift-share analysis. Finally, this chapter searches for the existence of convergence in productivity levels between industries in Brazil, Chile and Uruguay, compared to the United States and Sweden using unit root tests.

In order to carry out the first two purposes it is necessary to construct time series of labour productivity, hence time series of output in constant prices and time series of labour input; and value added at current prices for several benchmark years. For Brazil, the data was kindly provided by Renato Colistete (FEA-USP), and for Sweden this data come from Schön (1988). For Uruguay the series of labour is taken from a work with Melissa Hernández (not published yet) and the series of value added at constant prices is constructed in this thesis.

For Chile and the United States, the long series of value added at constant prices and labour are developed for the first time in this thesis.

Additionally, the third exercise requires one or several benchmarks of comparative levels of labour productivity for manufacturing as a whole and for separate industries in relation to a reference country. The comparative levels at benchmark years are extrapolated backwards and forwards using the time series of labour productivity. I presented the available benchmarks as well as the new estimates carried out in this thesis in Chapter 3.

The chapter is divided into three sections after this introduction. Section 4.2 presents the distribution of productivity growth across industries in order to analyze whether productivity increases are concentrated in a few industries or are widespread covering the whole manufacturing industry using Harberger diagrams. Section 4.3. focuses on the impact of specialization and structural changes on productivity growth in manufacturing using a shift share analysis. In section 4.4. an econometric exercise based on unit root tests helps us to analyze the existence of convergence at the aggregate and disaggregate level. Industrial trajectories are measured using the labour productivity of Brazil, Chile and Uruguay compared to the labour productivity of the reference countries (the United States and Sweden) for the whole manufacturing, as well as other industries. Section 4.5 concludes.

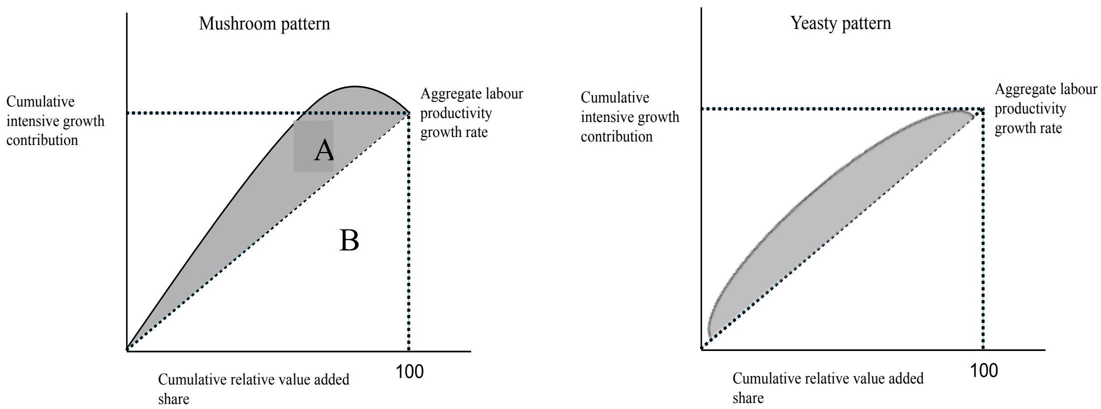
4.2. Patterns of productivity growth

This subsection aims to analyze the concentration of productivity gains across industries in Brazil, Chile, Uruguay, United States and Sweden between 1930 and 1980. The distribution of productivity growth rates across industries is classified as "mushrooms and yeast", an approach proposed by Harberger (1998) designed to explore whether productivity increases are concentrated to a few industries or are spread evenly across industries. This approach was followed by several works for different periods and countries (Inklaar and Timmer 2007, Prado 2014, Bakker et al. 2015, Lavopa 2015). Although this analysis could be applied to a broad range of industries, including services and primary activities, this chapter focuses exclusively on manufacturing industries.

The expression "mushroom and yeast" refers to the patterns of industry contribution to aggregate productivity growth: a mushroom distribution implies that few industries contribute more to the aggregate productivity growth, while a yeast distribution means that industries contribute evenly to total productivity growth. Harberger used the expression real cost reductions, which he translated into the growth of total factor productivity. In this chapter, it has not been possible to calculate total factor productivity due to capital data constraints. Therefore, aggregate productivity growth refers to labour productivity growth, as a proxy to Harberger´s notion[65]. We may look at total factor productivity as the weighted sum of growth rates of labour productivity and growth rates of capital productivity. Using labour productivity instead of capital productivity implies that I implicitly assume that growth rates of capital productivity are zero.

The Harberger curves are Lorenz-type diagrams which show the cumulative contribution of industries to total labour productivity growth against the cumulative share of these industries in total value added. The area between the line of "perfect equality" (the straight line) and the curves measures the degree of concentration of productivity gains within each economy. This area is the result of variations in the size of the industry and the productivity growth rate. The larger this area, the more mushroom-like the pattern of productivity growth. Moreover, at a more aggregated industry level, the group of industries comes closer to the performance of the manufacturing industry at large, thus it will be more likely to show yeast-like growth patterns.

Figures 4.1. Examples of Harberger diagrams



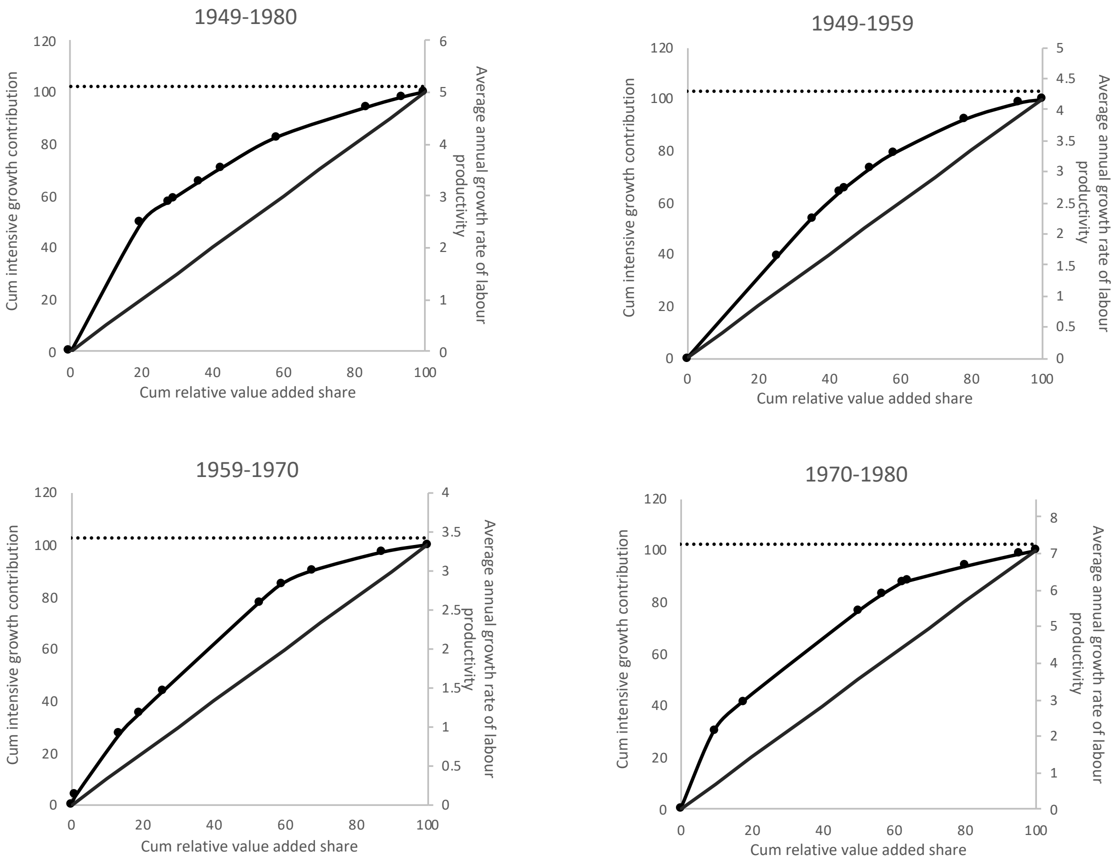
65 Lavopa (2015) and Prado (2014) also employ labour productivity growth as a proxy of TFP. Furthermore, Stiroh supports the idea that labour productivity, instead of total factor productivity, is the more adequate measure of efficiency gains. Technological progress would be contained in the stock of capital (Stiroh 2002).

The calculations presented in Tables C.15 to C.19 in the Appendix C are the base for the Harberger's diagram. They show the concentration of labour productivity growth among industries by country, for the total period 1930–1980 and different sub-periods. Value added disaggregated by industries at current prices is employed to calculate cumulative share of industries in total value added. This data defines the sub-periods by countries over time; and they originate from manufacturing censuses in Brazil and the United States, censuses and industrial surveys in Chile and censuses and other official statistics in Uruguay. In the case of Sweden, this data was taken from historical national accounts (Schön 1988).

The first column presents the labour productivity growth rate in descending order, column 2 shows the initial value added at the initial year of the sub-period and column 3 the cumulative relative share of initial value added. Column 4 presents the real cost reductions; following Harberger, which means the increase in output would have been between the initial and ending year if the industry had operated with the same quantity of inputs as in the initial year. Column 5 presents the figures of cumulative intensive growth contribution, which means the percentage shares of the cumulative sums of real cost reductions. Finally, column 6 contains total productivity growth measured as the cumulative weighted productivity growth rate (initial value added as weights).

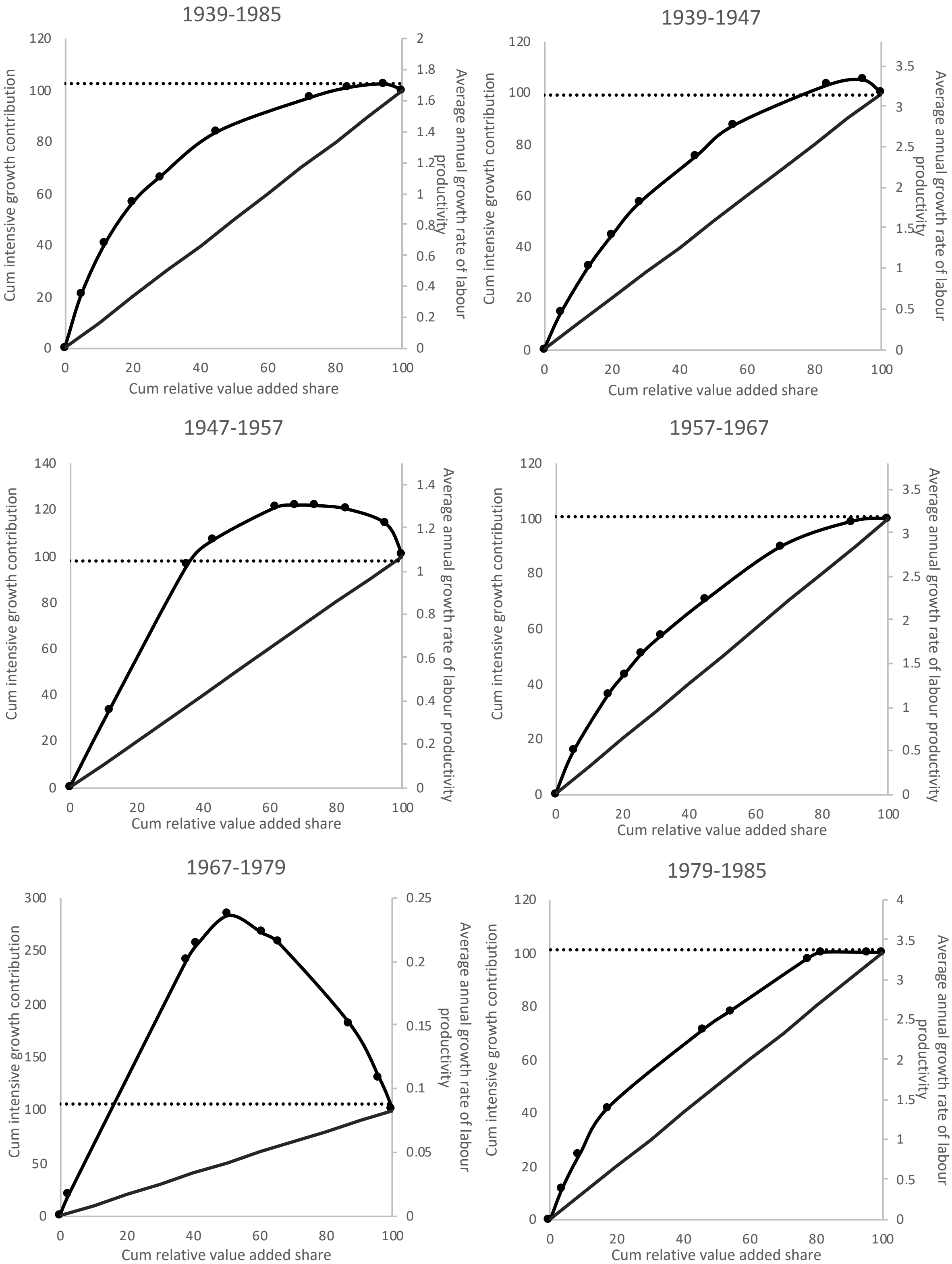
Figures 4.2 to 4.6 plot the cumulative contribution of industries to total labour productivity growth against the cumulative share of these industries in total value added, and also includes the average growth rate of labour productivity in a secondary vertical axis. Figure 4.2 shows the results for Brazil in the total period and for each of the sub-periods, figure 4.3 illustrate the same for Chile, figure 4.4 for Uruguay, figures 4.5 for Sweden and figure 4.6 for the United States.

Figures 4.2. Cumulative distribution of intensive growth contribution by industry. Brazil.



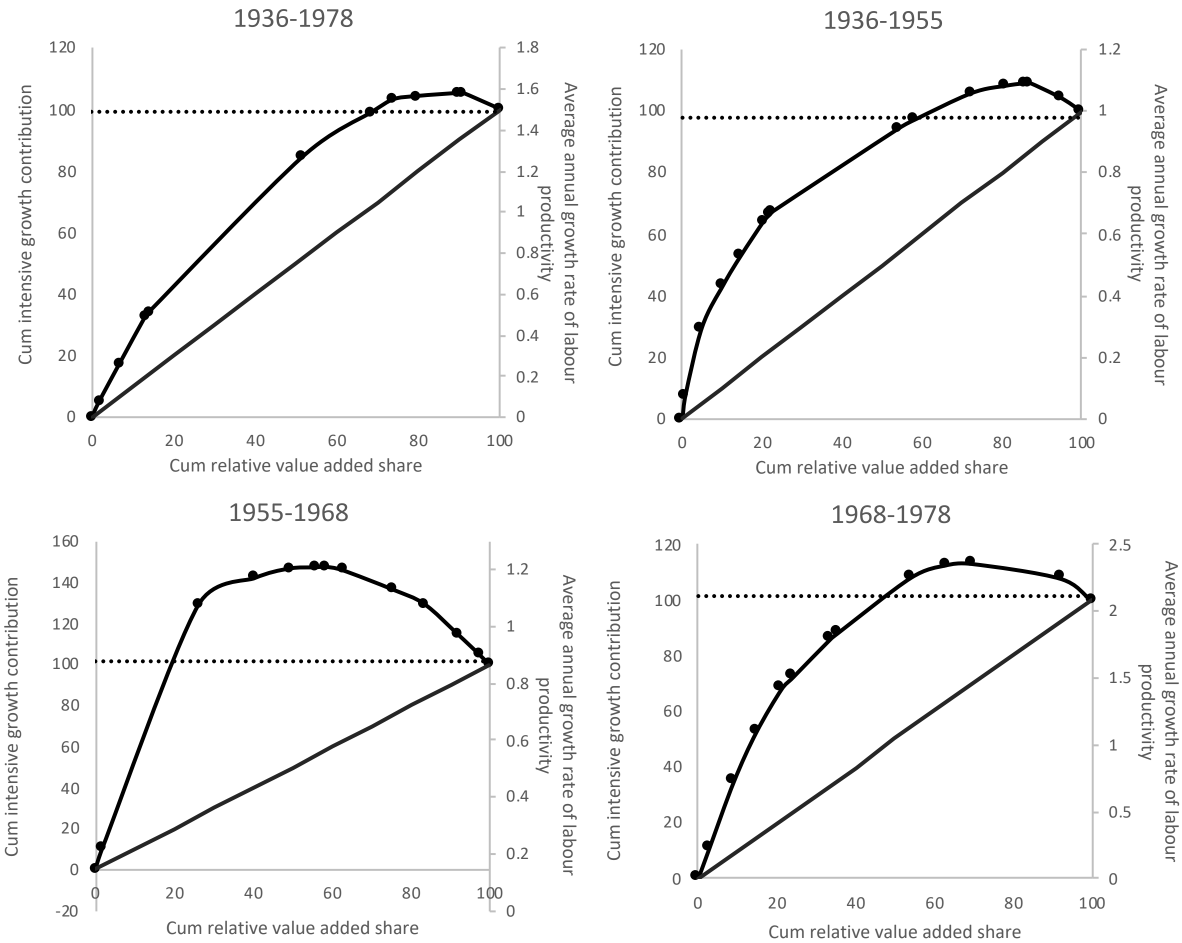
Sources: See Appendix C: Table C.15.

Figures 4.3. Cumulative distribution of intensive growth contribution by industry. Chile.



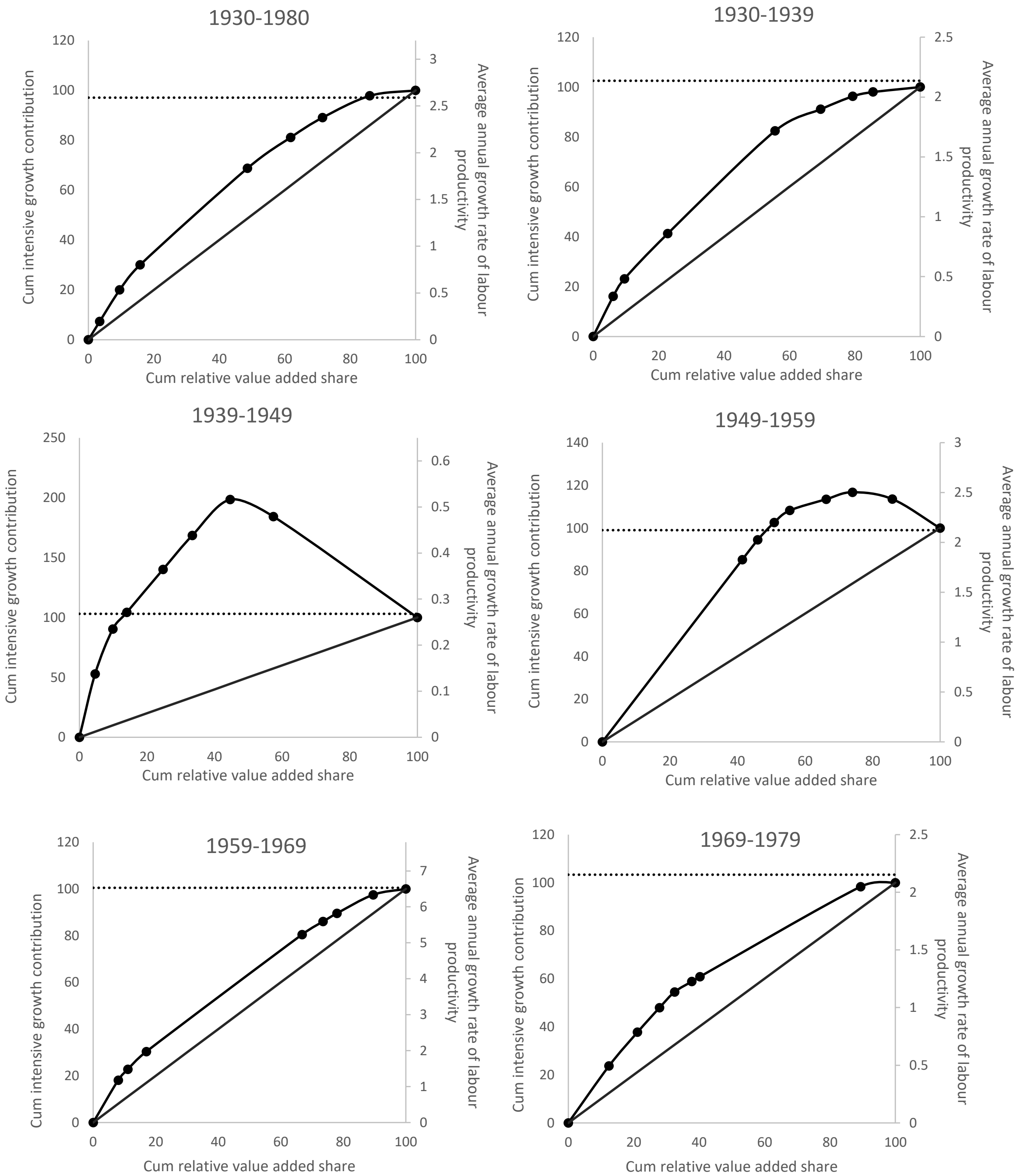
Sources: See Appendix C: Table C.16.

Figures 4.4. Cumulative distribution of intensive growth contribution by industry. Uruguay.



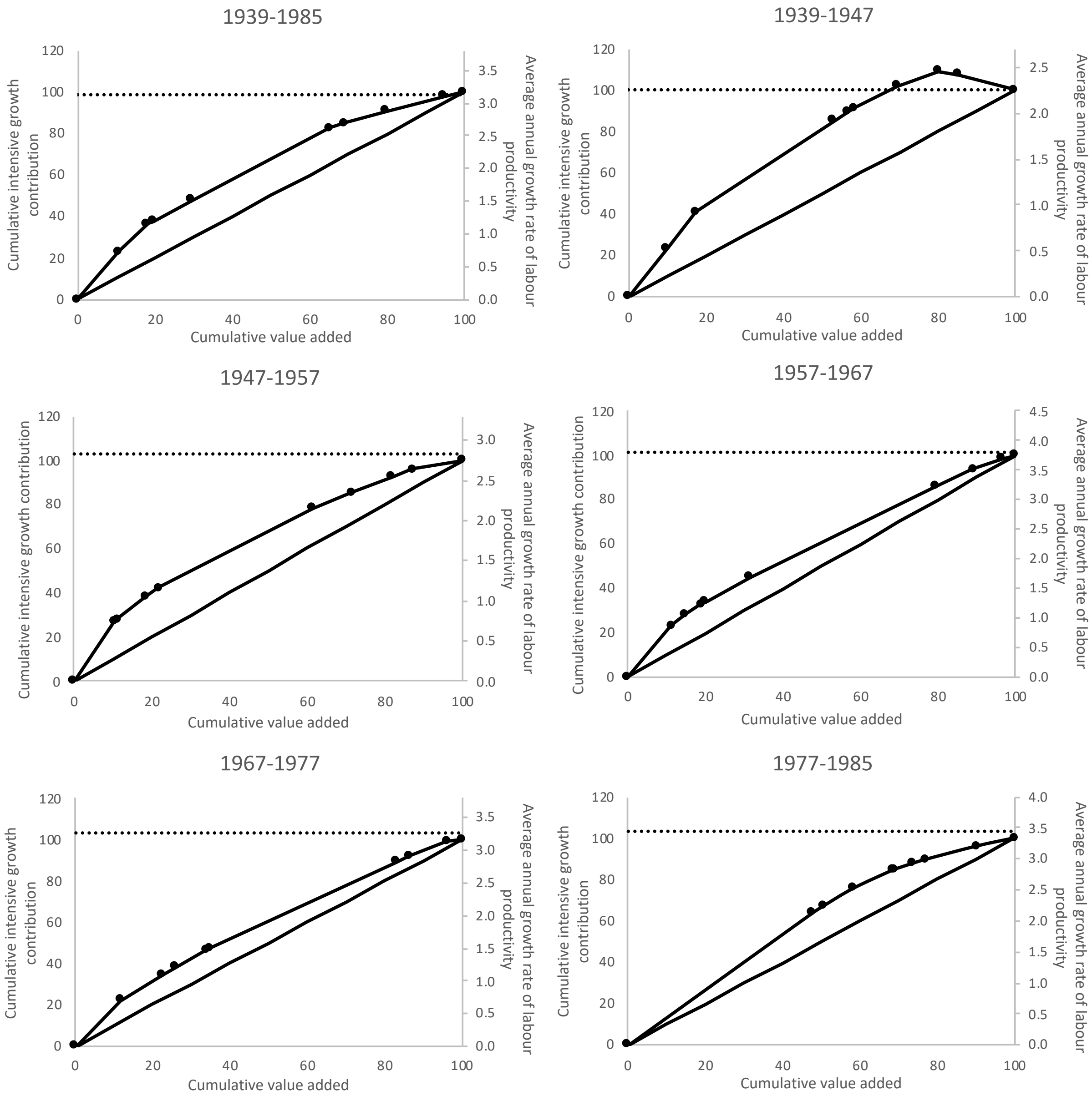
Sources: See Appendix C: Table C.17.

Figures 4.5. Cumulative distribution of intensive growth contribution by industry. Sweden.



Sources: See Appendix C: Table C.18.

Figures 4.6. Cumulative distribution of intensive growth contribution by industry. United States.



Sources: See Appendix C: Table C.19.

The choice of sub-periods as well as the starting and ending points are relevant in two ways. First, the longer the time period the less chance to capture a mushroom pattern. In this case, the range of sub-periods goes from 5 to 10 years (with some exceptions), as is usual in the literature. Second, the business cycle may have a short-term impact on productivity levels because of capacity utilisation (labour hoarding). Preferably, the estimate of productivity growth rate estimate should therefore be made from trough to trough or from peak to peak. Although this point is not especially dealt with in these estimates, it was considered for some sub-periods.

Following previous works, the Harberger coefficient (HC) is the area between the curve and the diagonal divided by the total area under the curve. Therefore, it measures the degree of concentration of industry contributions to total labour productivity growth. It ranges from 0 to 1, with a lower value indicating higher equality among industrial contributions to labour productivity growth.

$$(4.1)\ HC = \frac{A}{A+B} = \frac{\int_0^1 f(x)dx - 0.5dA/A}{\int_0^1 f(x)dx}$$

where *dA/A* is the labour productivity growth for the whole economy, *x* is the cumulative share of value added when the intensive growth contributions are ranked from largest to smallest labour productivity growth rate, and *f(x)* is the cumulative labour productivity growth contribution.

First, table 4.1. shows a stable trend in labour productivity growth in the United States over the period. Conversely, a strong acceleration occurred in the 1950s and 1970s in Brazil, and in the 1960s in Sweden. Both countries, Brazil and Sweden, recorded the highest productivity rates in the period. On the other hand, labour productivity growth in Uruguay was low between 1936 and 1968, but increased at the end of the period (1968-78). In Chile, the productivity rate oscillated during the period but never surpassed a moderate growth of 3 per cent per annum.

Following the Harberger coefficient, the industry pattern in Brazil was always yeast-like and particularly so in the 1950s and 1970s. A similar pattern can be observed in the United States, with decreasing and low coefficients from the 1930s-70s. At the other end of the scale, Uruguay recorded the highest level of concentration in the 1960s, while Chile had high concentrations in the 1970s. The result for Chile, though, shows two opposite tendencies during the 1970s: in 1970 to 1973, the pattern was yeast-like, and from 1974 to 1979, the pattern was mushroom-like. In Sweden, the higher concentration in the 1940s was explained by the sub-period 1939–1945, coinciding with the turmoil of WWII. In the post-WWII era, the pattern that asserted itself was yeast-like until the 1970s[66].

In few words, Brazil and United States showed a yeast-like industry pattern for the entire period, and Sweden after the 1950s. Uruguay presented a dominant mushroom-like growth process, and Chile alternated periods of yeast and mushroom-like patterns. In general, when labour productivity growth rates increase, the productivity growth rates tend to form a yeasty pattern; in contrast, when labour productivity growth rates decrease, mushroom-like patterns dominate (with the exception of US in the last sub-period). Thus, deceleration in productivity growth rates goes hand in hand with a heavier concentration in real cost reductions; progress becomes dependent on a few key industries.

These results may be related to the role of the technology adopted during the period and the impact on the pattern of growth. A yeasty pattern may be more linked to a technology with large spill-over effects. Those types of technologies are known as general purpose technologies (GPTs). Following Wright´s definition GPTs are "deep new ideas or techniques that have the potential for important impacts on many sectors of the economy" (Wright 2000: 161)[67]. Moreover, the introduction of technology in the production process depends on the establishment size, the cost of technology, abundance of natural resources (as sources of energy), technological maturity, among others. Despite exceptions for sub-periods and countries, the economic history literature on Latin America has argued that external dependence on imported technology and a national bourgeoisie uninterested in promoting innovation thwarted industrialization (Fajnzylber 1983).

The use of modern energy related to modern capital may contribute to explaining a more balanced growth pattern. Travieso (2015) demonstrated that during the proper industrialization period 1943–1954 in Uruguay there was a greater participation in total manufacturing of industries intensive in modern energy (petroleum and electricity) such as non-metallic minerals, transport equipment, metals, chemicals, rubber and paper. However, residential consumption and the transport sector consumed more modern energy than

[66] The estimates 1970-1973 and 1974-1979 for Chile, and the estimates 1939-1945 for Sweden are not presented in this chapter.

[67] As was described in Chapter 2, electricity and electric motors were undoubtedly the most important GPTs introduced in manufacturing.

manufacturing. After the 1950s, this dependence on increased. The inability to introduce more modern capital was compatible with a limited interest to an energy transition by the 1950s, which was also encouraged by an absent energy policy. This is reflected in a more balanced growth process during 1939-1955 and its reversal towards a higher concentration for the years 1955-1968 (Table 4.1.).

Table 4.1. Labour productivity growth rate and Harberger coefficient, by country, for different sub-periods

Labour productivity growth rate	ca 1940s	ca 1950s	ca 1960s	ca 1970s	ca 1980s
Brazil		4.30	3.43	7.25	1.64
Chile	3.14	1.04	3.18	0.09	3.37
Uruguay	0.98		0.88	2.12	
Sweden	0.27	2.12	6.53	2.15	
United States	2.25	2.84	3.81	3.28	3.44
Harberger coefficient	**ca 1940s**	**ca 1950s**	**ca 1960s**	**ca 1970s**	**ca 1980s**
Brazil		0.18	0.23	0.15	0.19
Chile	0.25	0.36	0.20	0.69	0.22
Uruguay	0.35		0.53	0.38	
Sweden	0.48	0.33	0.11	0.15	
United States	0.24	0.12	0.07	0.08	0.29

Source: author´s estimates based on Table C.15, Table C.16, Table C.17, Table C.18 and Table C.19.

Lavopa (2015) calculated Harberger diagrams for a more recent period (1973-2007), covering countries such as Brazil, Chile and Sweden among others. He concluded that the more successful countries were able to adopt new technologies and spread out their productivity increases across industries. In other words, a yeasty pattern of growth goes in line with a process of structural modernization. In Lavopa´s thesis, in Brazil the low coefficients resembled a yeasty pattern between 1972 and 2007 (0.33 in 1972-1982 and 0.35 in 1982-2007); in my results the Harberger coefficient remained even lower in the earlier period 1945-1970s. In Chile, the coefficients were much higher during Lavopa´s more recent period (0.44 in 1972–1982 and 0.95 in 1982–2007) reflecting a process increasingly mushroom-like process after 1982. In Sweden, the pattern went from being even (0.29 in 1972-82) to being uneven (0.51 in 1982-2007). This result of uneven growth in Sweden in 1982–2007 may be heavily influenced by the crisis in the early 1990s.

Concerning Sweden, the evidence suggests a pattern that was quite mushroom-like in the last quarter of the nineteenth century (Prado 2014). This result was also found for other developed countries. Prado (2014) concluded that the relatively scant use of steam engines in Sweden explains the mushroom-like pattern during 1869-1901; steam in Sweden never reached the dominant position that it did in Britain. After the turn of the century, steam was rapidly replaced by electricity and this transition yielded a balanced growth pattern in the sub-period 1901–9. The argument is that the use of electric motors was widespread, which caused positive externalities and fostered skill-intensive industries.

Finally, my new American results cannot be directly compared with the previous ones because of sectoral composition and different ways to proxy real cost reductions. Harberger (1998), Inklaar and Timmer (2007) and Bakker et al (2015) presented estimates of total factor productivity growth for the US, covering different time periods and based on groups of industries (not only manufacturing). Harberger´s results for 1958-1967 and 1970-1990 (five-year averages), and Inklaar and Timmer for the years 1987-1995 and 1995-2003, concluded that the American TFP growth was characterized by a mushroom pattern. Conversely, Bakker et al (2015) studied the period 1899-1941 using new evidence for human capital, and found that TFP growth in manufacturing followed a yeast-like pattern, except for 1909-19.

4.3. Structural change

The aim of this subsection is to discuss structural change in manufacturing with disaggregated data for Brazil, Chile and Uruguay, compared to developed countries (United States and Sweden).

First, the works of Hirshman (1958) and Rosenstein-Rodan (1943) were based on forward and backward linkages and increasing returns to scale in manufacturing, respectively. Later, in 1960 the famous Kaldor´s law that manufacturing sector is the "engine of growth" strengthened the arguments in favour of manufacturing to achieve a successful economic performance. Furthermore, as already mentioned, since the 1950s structuralist thought emphasized the idea that structural transformations should be concentrated on the manufacturing industry.

More recent literature has followed this belief: manufacturing plays a crucial role in economic development and its performance may help us to understand why some countries were able to catch up while others lagged behind the leaders (Szirmai 2012, McMillan and Rodrik 2011, Rodrik 2015).

Kuznets (1955) defines structural change as the reallocation of labour from traditional to modern sectors. Applying this concept to the manufacturing sector would mean that structural change is found when there is a labour shift from industries with lower than average output to worker ratios to industries with higher than average output to worker ratios. Empirically, structural change can be decomposed into three constituent components following the "shift-share" analysis which was originally developed by Fabricant (1942) and proposed later by Fagerberg and Verspagen (1999) and Fagerberg (2000).

For Chile, United States and Sweden the periods chosen are: 1939-1950, 1950-1960, 1960-1970 and 1970-1980. For Brazil the first period is 1945-1960, and for Uruguay the periods differ due to data constraints: 1939-1947, 1947-1955, 1955-1968, 1968-1978. See Appendix C for more details.

The shift-share analysis, in one form or another, has previously been applied to Latin American countries by Timmer and Szirmai (2000), Holland and Porcile (2005)[68], Azar and Fleitas (2010)[69], McMillan and Rodrik (2011), Timmer and de Vries (2009), Timmer et al (2012), Aravena et al (2014), Aldrighi and Colistete (2015)[70], López Arnaut (2017). Some of them analyze structural change at a total economy level. Others focus, as this chapter does, on the manufacturing industry. This study has a twofold contribution to the literature: the time period covers the interwar years, and the comparison between Latin American countries with developed countries is based on the same disaggregation.

[68] Holland and Porcile (2005) studied structural change in Brazil, Chile, Colombia, Mexico and Uruguay between 1970 and 2002. In all countries and all periods, the productivity growth was explained primarily for the increases in labour productivity within industries

[69] Azar and Fleitas (2010) descomposed productivity growth in manufacturing sector for Argentina, Brazil, Uruguay and the United States for the period 1930 to 1960. Their results show that for all countries the major source of contribution to aggregate productivity was the within-industry effect. They also identify structural change in the United States and in Brazil during 1939-1959. According to these estimates, in the Southern Cone only Brazil could reduce the heterogeneity among sectors and achieve structural change.

[70] Aldrighi and Colistete (2015) estimated structural change with a shift-share analysis for manufacturing sector in Brazil between 1945 and 2009. One of its most remarkable conclusions is that productivity gains within industries was the major source of aggregate productivity growth since the early industrialization until the 1980s. Moreover, they suggest that the relatively success process of learning and technological advance by manufacturing firms petered out after the lost decade.

Chapter 2 showed indicators of structural heterogeneity for some benchmark years. In the case of Uruguay, the evidence makes clear that taking the whole industrialization period the composition of value added and employment in manufacturing did not change substantially. Industries using either natural resources or labour intensively always kept a privileged place in Uruguay. No determinant structural change was in sight. On the other hand, Brazil mainly and Chile moderately, modified their productive structures. Despite distortions and inefficiencies, these modifications led to a rather diversified and technologically complex industrial sector. Towards the late 1960s, engineering industries, broadly defined, comprised 35 percent of manufacturing's value added and 25 percent of manufacturing's employment in both countries. However, in terms of structural heterogeneity measured by the coefficient of variation, the Brazilian industrial sector showed a better performance than the Chilean one (see Chapter 2).

In this chapter I address the structural heterogeneity through the shift-share analysis. The increase in overall productivity by taking two points in time is the result of three specific components (Fabricant 1942, Fagerberg 2000):

$$(4.2.)\quad \frac{(P_t - P_0)}{P_0} = \sum_{n=1}^{i}\Bigg(\underbrace{\frac{S_{i0}\,(P_{it} - P_{i0})}{P_0}}_{(I)} + \underbrace{\frac{P_{i0}(S_{it} - S_{i0})}{P_0}}_{(II)} + \underbrace{\frac{(P_{it} - P_{i0})(S_{it} - S_{i0})}{P_0}}_{(III)}\Bigg)$$

Where P is the labour productivity, i an individual industry, S_i is the share of industry i in total manufacturing, t is the final time period and 0 is the initial time period.

Component (I) of the equation is the contribution of productivity growth within industries considering the initial weight of these industries in total labour structure (within-industry effect). Component (II) of the equation shows the change in the employment structure considering the initial fixed productivity and, ultimately, the whole effect of the change in productivity due to the reallocation of labour between industries (static effect). Static effect will be positive if the share of high productivity industries in total labour increases at the expense of industries with low productivity. Component (III) is the result of two effects: within-industry and the static effect. This component will be positive if industries which increase their productivity more rapidly than average, also increase their share of total labour. On the contrary, when labour moves to those industries in which labour productivity increases less than average, the contribution of this effect is negative. This component is referred to as the dynamic effect.

For a shift share analysis it is necessary to gather a series of value added at constant prices and of labour at the industry or sector level for each country. For Brazil the value-added data at constant prices was kindly provided by Colistete and it is expressed in cruzeiros of 1970. For Sweden this data comes from Schön (1988) and is expressed in kronor of 1910/12. For Uruguay the series of value added are own estimates expressed in pesos of 1936 (see Appendix C). For the United States and Chile, the long series of value added at constant prices are own estimates expressed in dollars of 1947 and Chilean pesos of 1953, respectively (see Appendix C).

Table 4.2 shows annual labour productivity growth rates for different sub-periods and the shift share results[71]. The three effects (within, static and dynamic) are expressed as a percentage, which means that they measure their contribution to total productivity growth.

For each sub-period in Chile, Brazil, US and Sweden, and after 1955 in Uruguay, the aggregate productivity growth was dominated by the within-effect. This result is in line with previous evidence for the Latin American countries (Aldrighi and Colistete 2015, Holland and Porcile 2005, Azar and Fleitas 2010, López Arnaut 2017). This means that aggregate productivity would have taken place even if the size distribution of industries had remained unchanged.

As Aldrighi and Colistete (2015) have documented, labour productivity in Brazil accelerated in the 1950s and in the 1970s. Annual productivity growth rates were around 7% for both subperiods (table 4.2), much higher than the American and Swedish rates. Deliberate industrial policies contributed to the development of modern sectors (chemicals, metals, electrical and transport equipment) and also to improving productivity in specific traditional sectors, such as textiles. As was explained in Chapter 3, Vargas' governments employed different instruments to promote industrialization, first based on consumer goods industries and then capital-intensive ones. Later, at the end of the 1960s and over the 1970s, policies were more oriented towards the private sector and also foreign firms, performing very well in terms of labour productivity. Contrary to other small Latin American countries, the large domestic market in Brazil allowed firms to reap the benefits of economies of scale,

[71] Labour productivity growth rates are calculated using those industries which are comparable in the different benchmark years. Thus, they do not have to coincide with the calculations shown in Table 4.1.

and made it profitable to produce capital goods, durable consumption goods and transport equipment. Teitel and Thoumi (1986) found that the capital-intensive industries, such as metallurgy and metalworking, increased their volumes of exports and achieved higher efficiency and increased productivity rates.

This change in Brazil is reflected in the result of the three effects. Above all, the within effect represented the highest contribution to total labour productivity growth for each subperiod. In addition to the within growth effect, between 1945 and the 1970s, labour reallocation from low to high productivity industries contributed positively to total productivity growth. Since the 1960s, despite this movement of labour between industries, a decreasing share of fast-growing productive industries contributed negatively to aggregate productivity. As a result of both effects, structural change measured by the net static effect (static and dynamic effect) was slightly positive between 1945 and the 1970s, and negative in the following decade. Aldrighi and Colistete (2015) obtained similar results for Brazil in this period.

The evidence reported in table 4.2 shows that aggregate labour productivity growth in Chile was around 2-3% per annum over 30 years (1939-1969), whereas it remained stagnant in the 1970s. Although manufacturing in the Andean country was more diversified over the state-led industrialization period (see Chapter 3), total productivity growth was mainly accomplished by rapid progress within some specific industries, such as paper, non-metallic minerals, and metals. Efect II based on labour reallocation, was positive in 1960-1970 and in 1970-1980 in Chile. In the first sub-period the result was explained by metals, and in the second it was due mainly to food and beverages. This result is also consistent with Chapter 3. However, the net static effect was always negative due to a greater negative dynamic effect. The message is that the driver of total productivity growth in the Chilean manufacturing sector did not come from total structural change measured by a shift-share analysis.

Table 4.2. Decomposition of labour productivity growth in Chile, US, Uruguay, Brazil and Sweden, 1939-1980

1939-1950	Brazil	Chile	Uruguay b/	United States	Sweden
Annual LP growth rate		1.5%	-0.3%	2.7%	1.4%
Within effect		146.3%	18.3%	95.6%	80.3%
Static effect		-38.9%	95.7%	1.6%	17.3%
Dynamic effect		-7.3%	-14.0%	2.8%	2.5%
1950-1960	Brazil a/	Chile	Uruguay b/	United States	Sweden
Annual LP growth rate	7.2%	2.8%	1.9%	2.7%	2.6%
Within effect	91.8%	117.4%	92.7%	102.2%	96.8%
Static effect	5.7%	-9.0%	56.4%	3.0%	2.5%
Dynamic effect	2.5%	-8.4%	-49.1%	-5.3%	0.8%
1960-1970	Brazil	Chile	Uruguay b/	United States	Sweden
Annual LP growth rate	3.0%	2.1%	0.9%	3.8%	7.1%
Within effect	82.9%	106.6%	212.9%	99.8%	91.7%
Static effect	20.3%	2.8%	-34.0%	0.3%	5.9%
Dynamic effect	-3.2%	-9.4%	-78.9%	-0.1%	2.5%
1970-1980	Brazil	Chile	Uruguay b/	United States	Sweden
Annual LP growth rate	7.7%	0.2%	2.0%	2.9%	2.3%
Within effect	103.1%	587.5%	94.4%	104.4%	77.7%
Static effect	1.2%	115.8%	23.8%	-2.6%	19.7%
Dynamic effect	-4.3%	-603.3%	-18.2%	-1.8%	2.6%
1939-1980	Brazil	Chile	Uruguay b/	United States	Sweden
Annual LP growth rate	6.1%	1.6%	1.1%	3.0%	3.3%
Within effect	105.1%	139.3%	151.3%	102.0%	81.9%
Static effect	3.7%	-5.1%	-11.4%	0.0%	4.2%
Dynamic effect	-8.8%	-34.2%	-39.8%	-2.0%	13.9%

Notes: a/For Brazil the first period of analysis is 1945-1960. b/For Uruguay the periods are: 1939-1947, 1947-1955, 1955-1968, 1968-1978 and 1939-1978.
Sources: own estimates based on industrial surveys and censuses, yearbooks.

In Uruguay, the aggregate labour productivity growth rate is negative for the years 1939-1947, and then it rose to 2 per cent for 1947-1955. After that, productivity dropped to 1 per cent per annum and recovered in the 1970s to 2 per cent. Therefore, the labour productivity performance was very modest during almost the whole period, lower than that of Brazil and Chile. This result is in line with the conclusions of Chapter 3, which pointed to bounded industrialization in Uruguay compared to the industrialization of Brazil and Chile. The within-effect explained most of the total productivity growth rate, barring the first sub-period of 1939–1947. However, it is also important to illustrate the role played by effects II and III. The static effect was positive between 1939 and 1955, negative between 1955 and 1968 and positive again between 1968 and 1978. It means that the sectors which increased their participation in employment were those with higher than average productivity levels. Nevertheless, the dynamic effect of structural change always showed a negative contribution. As a result, the net static effect reveals a positive contribution between 1939 and 1955[72], which disappeared in 1955 to 1968, and was again positive between 1968 and 1978. Therefore, it is important to note that during the proper industrialization period in Uruguay (1939-1955), the results related to structural change were more favourable.

In the United States and Sweden, labour productivity growth rates were always positive and moderate for every subperiod, with higher rates in 1960-1970 (4 per cent annual in the US and 7 per cent in Sweden). In both countries, the within-effect accounted for the majority of aggregate productivity growth in each subperiod and the era as a whole. While in the Swedish manufacturing industry, the static and dynamic effect contributed positively to total productivity, the results of these two effects are less favourable for the American sectors. Positive static gains during 1939-1970s in the United States were cancelled by a negative dynamic effect for the subperiods 1950-1960 and 1970-1980s. A dynamic of positive, though mild, structural change could be identified in the US between 1939-1950 and 1960-1970s.

To conclude, structural change measures whether the dynamics of the manufacturing industry were able to generate increases in productivity that coincided with the reallocation of labour to those industries that were also more productive. When a process of positive structural change is identified, structural heterogeneity is also reversed. Uruguay reported the lowest labour productivity growth rates during the period 1930-1980 (1.1 per cent

[72] This result is consistent with previous works for Uruguay (Bértola 1991, Arnábal, Bertino and Fleitas 2013).

annual), followed by Chile (1.6 per cent annual). On the other hand, Brazilian productivity grew at the highest rates (6.1 per cent annual), doubling the Swedish and American rates (3.3 per cent and 3.0 per cent, respectively). Moreover, for each subperiod in Chile, Brazil, US and Sweden, and after 1958 in Uruguay, the within effect is the driver of labour productivity growth (effect I).

The effect II reflects the impact of the reallocation of employment in those sectors that present the highest productivity. During the entire period 1939-1980 and by subperiods, the static effect of structural change was positive in Brazil, Sweden and the United States (except for the years 1970-1980). Conversely, in Chile and Uruguay labour force movements were more volatile and changed over the years; this is why, for the whole period, this component recorded a low and negative contribution.

The importance of effect III is that it measures the changes in the structure of employment and, at the same time, the changes in labour productivity growth rates by industries. When the effect is positive, it shows that both changes were in the same direction. Sweden for the whole period, and Brazil and the United States for certain sub-periods, were able to achieve a positive dynamic effect of structural change. On the other hand, in Chile and Uruguay for the whole period, this strong effect contributed negatively to aggregate labour productivity growth rate. The positive dynamics observed in Sweden were also identified in Brazil, if only moderately; they were, though, almost absent in Chile and Uruguay for the entire period. We may contrast these new results for manufacturing with the previous results for the economy at large (Mc Millan and Rodrik 2012, Castillo and Martins 2017). In both strands of work, Brazil and Chile recorded positive productivity growth rates from 1950 to 1975 together with a favourable structural change. Their performances in manufacturing as well as in the aggregate worsened once they deindustrialized and liberalized their markets from the eighties (and accelerated in the 1990s). In particular, in more recent decades between 1990 and 2011, structural change was growth-reducing.

4.4. Dynamics of convergence

The unit value ratios (UVR) presented in Chapter 3 are the key components of this subsection. They make it possible to translate different currencies into a single unit of pay in binary comparisons of labour productivity by manufacturing industries. The UVRs correspond to a benchmark year. Labour productivity gaps among countries at the level of separate industries were obtained by extrapolating time series of labour productivity forwards and backwards in time (see Appendix C).

In this subsection I use an econometric method to estimate convergence or divergence of labour productivity levels. The works of Katz (2000), Katz and Stumpo (2001), Muinelo and Pérez (2002), and Lavopa (2011), analyzed convergence between the Latin American countries and the world leaders. All of them employed the PADI-ECLAC[73] database starting in the 1970s and assumed that industrial paths of productivity were a good proxy for technological trajectories.

In this thesis labour productivity by industries in Brazil, Chile, and Uruguay are compared with the levels in the United States and Sweden. The evolution of this ratio measures catching up or convergence. Applying this method will require us to have data for value added per employee at constant prices for each industry in every country. Labour productivity levels are expressed in the same currency in order to make comparisons possible[74]. It is thus possible to identify manufacturing industries that caught up and those that did not.

Following previous works (Matheson and Oxley 2007, Lavopa 2011), the technological gap in each industry is defined as the log ratio between the labour productivity (P) of the country under analysis (c) at the industry (i) and the US/Sweden productivity in the same industry:

$$(4.3)\ g_{i,t}^{c} = \ln \frac{P_{i,t}^{c}}{P_{i,t}^{us}}$$

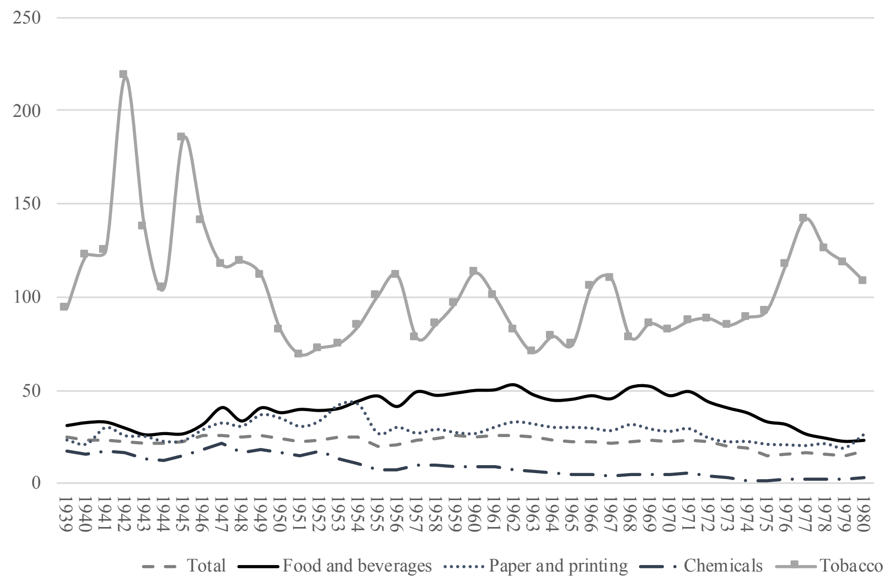
[73]This database is compiled by the Division of Productive Development and Entrepreneurship-ECLAC and is so-called *Programa de Análisis de la Dinámica Industrial (PADI)*. The database provides information about value added and employees for Latin American countries since 1970.

[74] Following Lara and Prado (2018a) I employ van Ark and Maddison´s unit value ratios calculated for 1975 in the binary comparison Brazil vs US.

Before showing the econometric results of this formal test of convergence over the period, Figures 4.7 to 4.10, let us visually recognize if there seem to be a positive or negative trend in the final series of labour productivity gaps for total manufacturing and several industries. I present Brazil, Chile and Uruguay compared to the US, as well as Brazil compared to Sweden (see Tables C.11 to C.14 in Appendix C). Moreover, Figures C.1. to C.10. in the Appendix C present the indexes of labour productivity for different industries in the five countries individually. They illustrate that the American and Swedish references become stricter over the period as their labour productivity trends increased steadily.

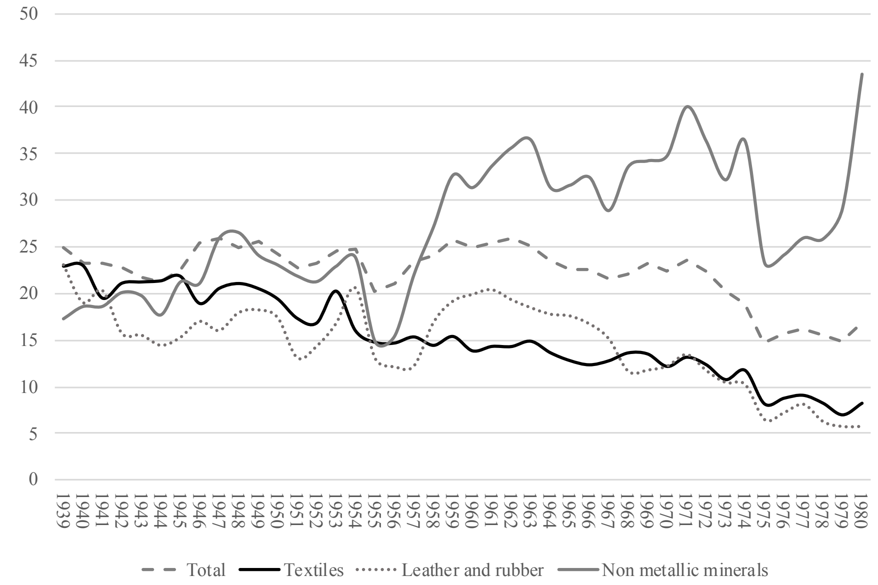
For manufacturing at large, Chilean labour productivity oscillated around 20-25 per cent that of American level until the 1970s, when a sharp decline took place. After this decline, the ratio remained stable and in a lower level. This general trend, however, did not apply to all industries: food and beverages and non-metallic minerals caught up significantly; paper and printing did so during a short period of time and diverged again (as did leather and rubber). On the other side, chemicals, as well as textiles, diverged the entire time (Figure 4.7.a and Figure 4.7.b).

Figure 4.7.a. Chile to US labour productivity ratios



Sources: See Appendix C: Table C. 12.

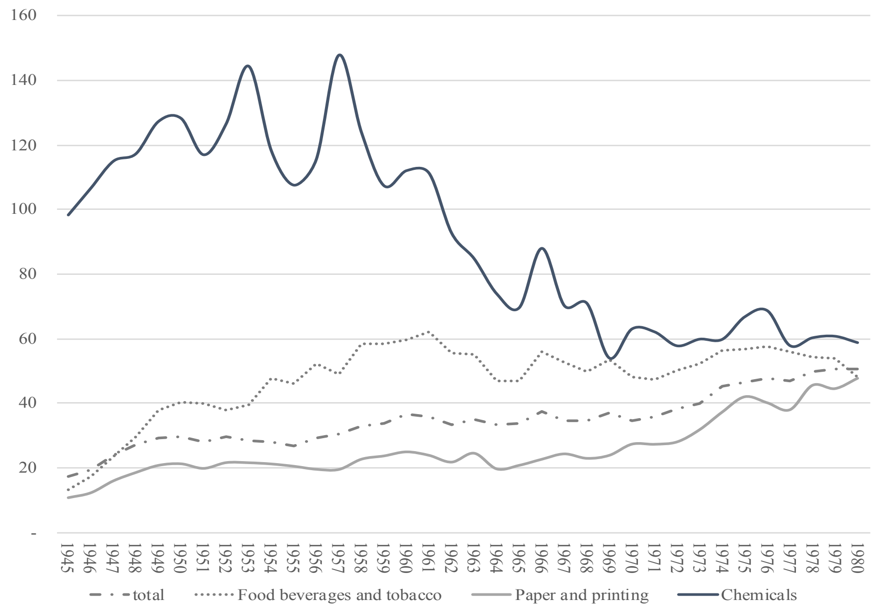
Figure 4.7.b. Chile to US labour productivity ratios



Sources: See Appendix C: Table C. 12.

Brazilian manufacturing sector showed a steady catching up all over the period with the American level. Most of its industries caught up, with the exception of chemicals[75]. (Figure 4.8.a, Figure 4.8.b and Figure 4.8.c).

Figure 4.8.a Brazil to US labour productivity ratios

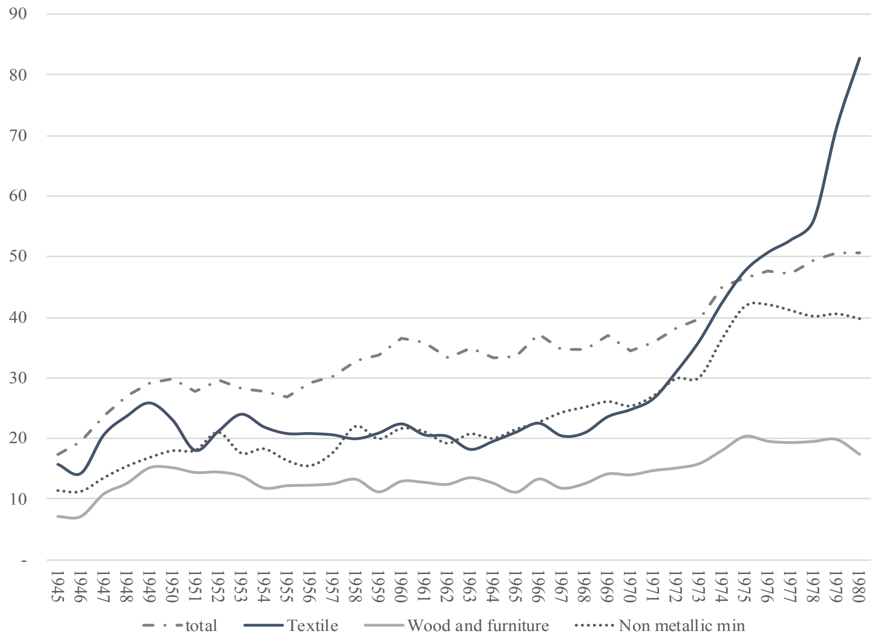


Sources: See Appendix C: Table C. 11.

[75] The high relative labour productivity level in chemicals during 1945 and 1960 should be taken carefully and studied in depth using other sources.

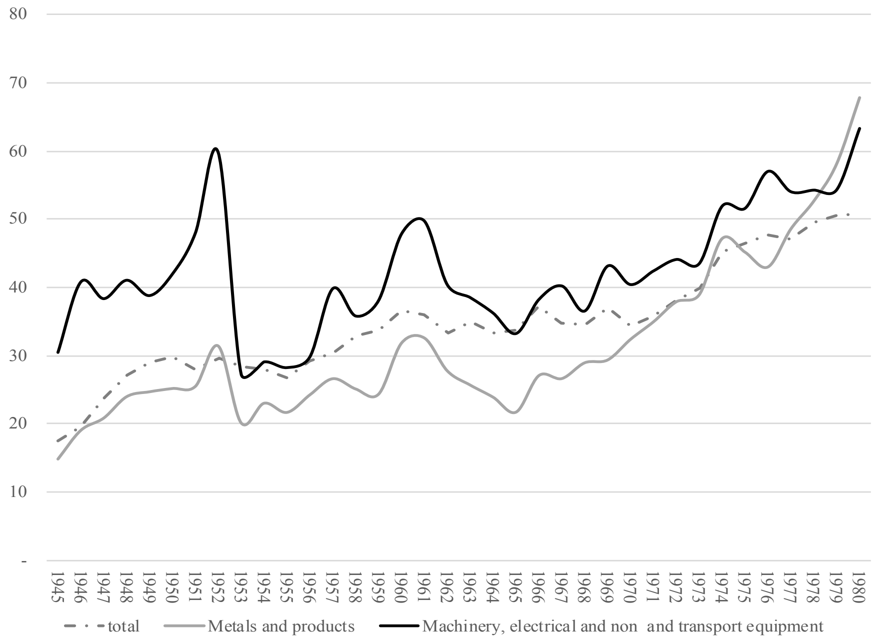
Particularly, between the 1960s and 1970s the Brazilian relative labour productivity levels grew sharply in almost every industry, and even more intensively in textiles, metals and machinery (Figure 4.8.a, Figure 4.8.b and Figure 4.8.c).

Figure 4.8.b. Brazil to US labour productivity ratios



Sources: See Appendix C: Table C. 11.

Figure 4.8.c. Brazil to US labour productivity ratios



Sources: See Appendix C: Table C. 11.

Comparing Brazil with fast-growing Sweden, moderates the previous impression of Brazilian convergence with the US. For some sub-periods, catching up seems to occur in food, beverage and tobacco; textiles, apparel, leather, footwear and rubber; and metals and machinery. Conversely, sharp divergence occurred in the chemical industry. (Figure 4.9.a, Figure 4.9.b and Figure 4.9.c).

Figure 4.9.a. Brazil to Sweden labour productivity ratios

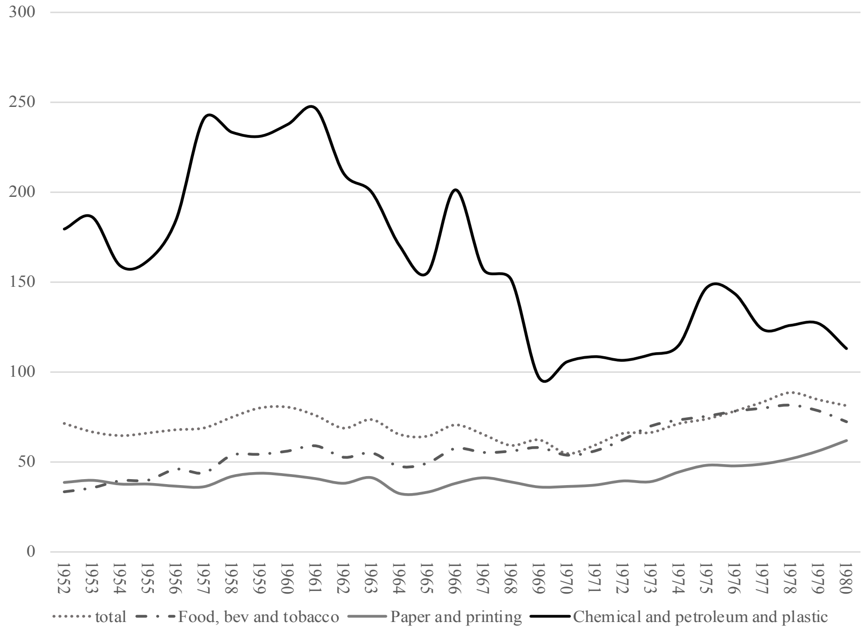


Figure 4.9.b. Brazil to Sweden labour productivity ratios

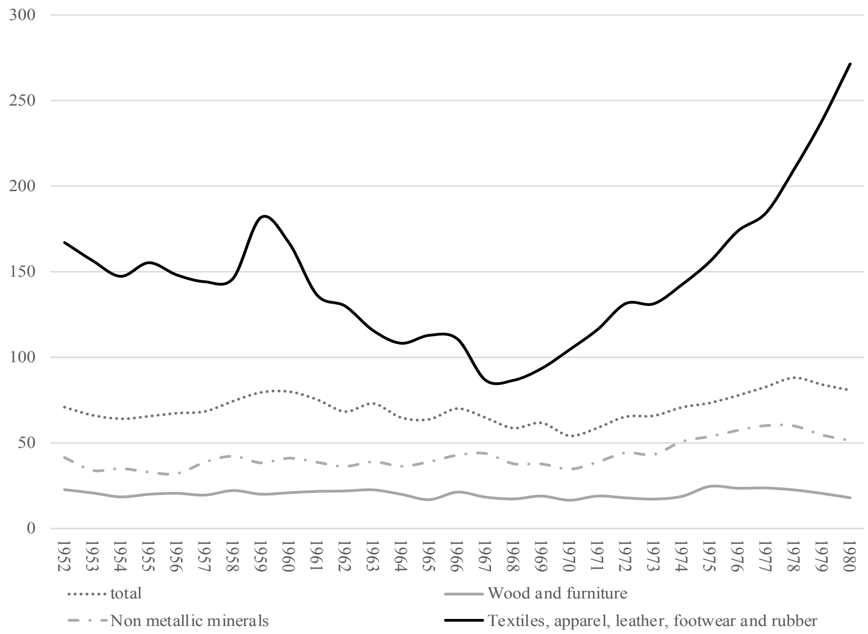
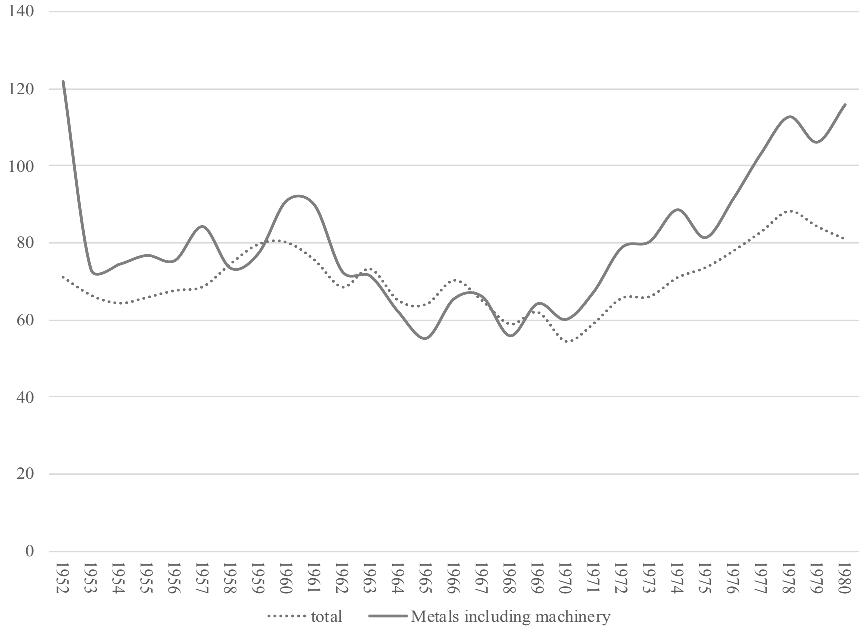


Figure 4.9.c. Brazil to Sweden labour productivity ratios



Sources: See Appendix C: Table C. 14.

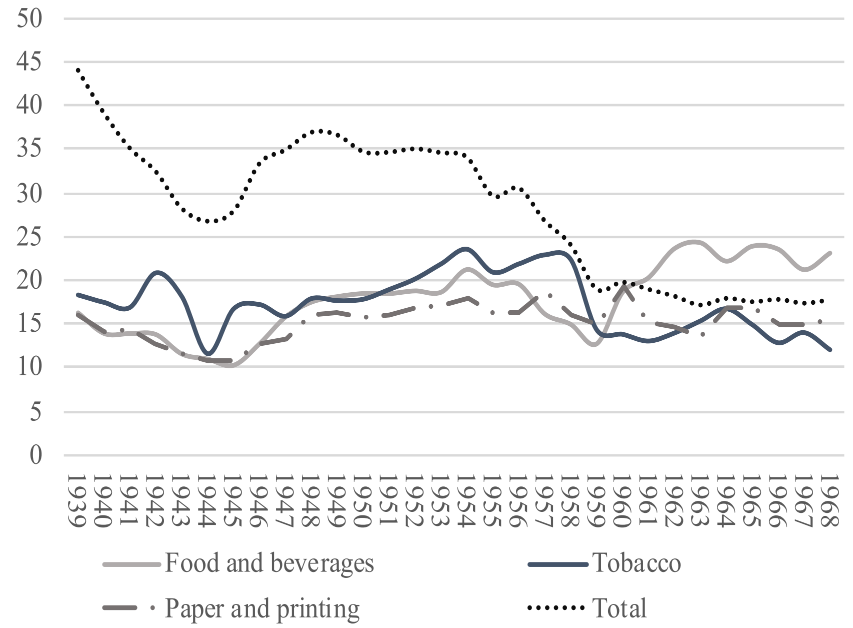
Finally, the Uruguay/US ratio for total manufacturing dropped between 1939 and 1945, and then it recovered until the mid-fifties with a labour productivity around 35% of the American level. From 1955 onwards, this ratio for total manufacturing started to decline. The beginning of this decreasing trend coincides with the moment in which industrialization stagnated in Uruguay.

Although the comparative labour productivity level did not show an outstanding performance during the industrialization period, it remained higher than the result estimated in 1968 (lower than 20%) and in the benchmark year in 1988 (14.8 per cent of American labour productivity, see Lara 2012).

This average trend was the result of quite different industry-specific trends: tobacco and food and beverages, paper and printing, and rubber and plastic performed rather well until the 1950s, while chemicals and textiles diverged sharply. The chemical industry is a particular case, as it lost an original very high advantage[76] and ended at a very low comparative level.

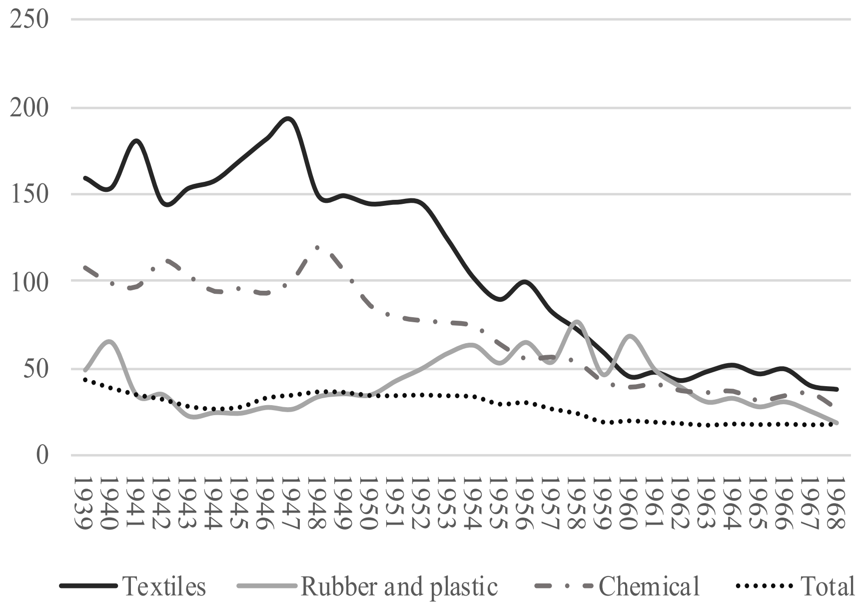
[76] The high relative labour productivity level in chemicals during 1939 and 1950 should be taken carefully and studied in depth using other secondary sources.

Figure 4.10.a. Uruguay to US labour productivity ratios



Sources: See Appendix C: Table C. 13.

Figure 4.10.b. Uruguay to US labour productivity ratios



Sources: See Appendix C: Table C. 13.

Test of convergence

The Augmented Dickey-Fuller test is one of the best-known and most widely used unit root tests (Stock and Watson 2012). In this case, the procedure consists of using a model with a constant and deterministic trend in order to test stationarity around a trend, and then test whether the technological gap tends to narrow (convergence) or widen (divergence) over time.

$$(4.4)\ \Delta g_{i,t}^{c} = \beta_i + \gamma_i t + \alpha_i g_{i,t-1}^{c} + \sum_{j=1}^{p} \varphi_{ij} \Delta g_{i,t-j}^{c} + u_{i,t}$$

where, t is a linear time trend, φ is the lag structure of the ADF test and u is the error term.

If, with the ADF test, there is no unit root evidence (the null hypothesis is rejected), we can conclude that the series of productivity ratios either increases (convergence) or decreases (divergence). If the existence of a unit root is detected (the null hypothesis is not rejected), the convergence or divergence hypothesis is rejected.

If it is concluded that the series has a trend stationary evolution (not detecting unit root), the conclusion as to whether there is a convergent or divergent relationship will depend on the nature of the deterministic components of the series.

Following Matheson and Oxley (2007), the nature of its components is analyzed from the estimation of the following model:

$$(4.5)\ g_{i,t}^{c} = \beta_i + \gamma_i t + \varepsilon_{i,t}$$

If γ_i turns out to be significant and positive, the conclusion is that there is convergence. On the contrary, if γ_i is significant and negative, the relationship would be divergence.

Perron (1989) shows that the ADF test can lead to erroneous conclusions in cases where the series presents some structural breakdown, given the low power of the test when the alternative hypothesis is specified incorrectly. It incorporates an exogenous structural break to the ADF test and rejects the unit root hypothesis in series in which the traditional ADF test was not rejected. Therefore, in case of structural break, the process could be stationary despite not rejecting the unit root hypothesis with the ADF test.

Unit root test when there is a structural breakdown

Zivot and Andrews (1992) return to Perron's analysis and define an iterative methodology for testing unit root in the event of a structural break. Unlike Perron, they do not define the breaking point, but examine whether the data determines the breaking point endogenously. The breaking point is determined by minimizing the test statistic for testing $\hat{\alpha}^i = 1$ with i=A, B, C. This procedure brings the advantage of not having to decide beforehand when the structural break takes place.

The null hypothesis is the existence of a unit root process without structural change. The alternative hypothesis is a stationary trend process with an unknown structural breaking point. Three models are tested: model (A) proposes the existence of a break in the level of the series, model (B) a break in the growth rate, and model (C) both breakdowns.

$$(4.6)\ A)\quad g_{i,t}^c = \hat{\mu}^A + \hat{\theta}^A DU_{i,t}(\hat{\lambda}) + \hat{\beta}^A t + \hat{\alpha}^A g_{i,t-1}^c + \sum_{j=1}^{k} \hat{c}_j^A \, \Delta g_{i,t-j}^c + \hat{e}_{i,t}$$

$$(4.7)\ B)\quad g_{i,t}^c = \hat{\mu}^B + \hat{\beta}^B t + \hat{\gamma}^B DT_{i,t}(\hat{\lambda}) + \hat{\alpha}^B g_{i,t-1}^c + \sum_{j=1}^{k} \hat{c}_j^B \, \Delta g_{i,t-j}^c + \hat{e}_{i,t}$$

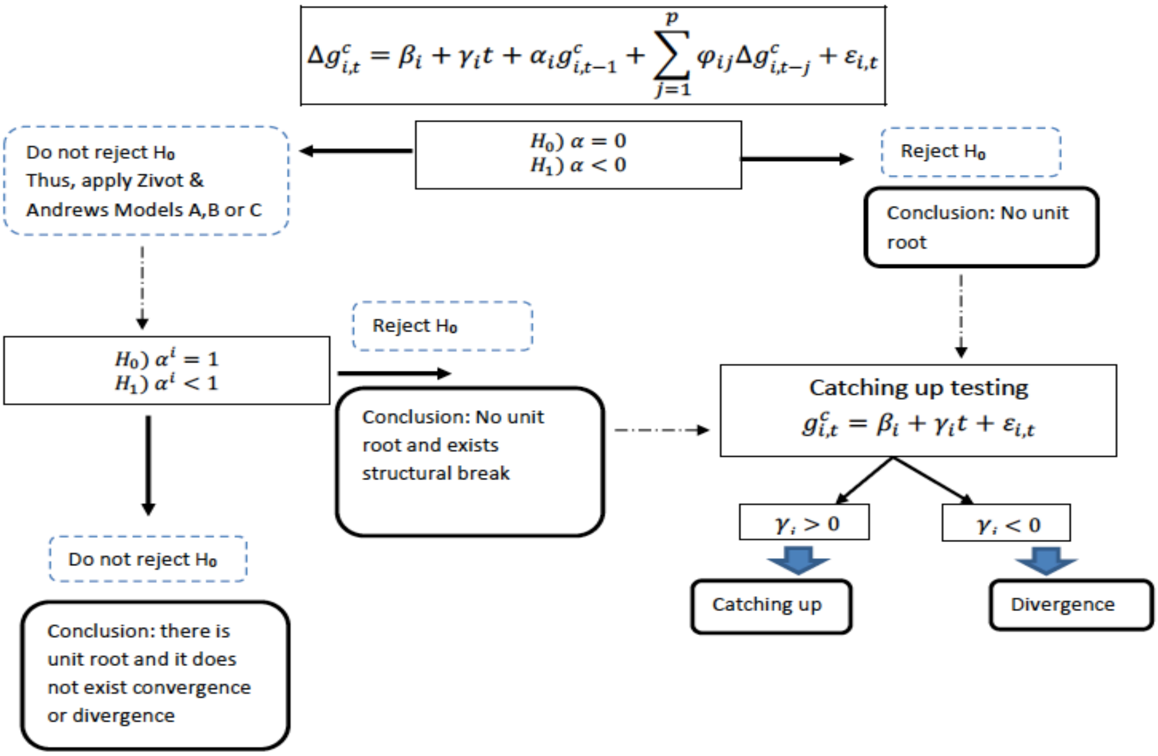
$$(4.8)\ C) g_{i,t}^c = \hat{\mu}^C + \hat{\theta}^C DU_{i,t}(\hat{\lambda}) + \hat{\beta}^C t + \hat{\gamma}^C DT_{i,t}(\hat{\lambda}) + \hat{\alpha}^C g_{i,t-1}^c + \sum_{j=1}^{k} \hat{c}_j^C \, \Delta g_{i,t-j}^c + \hat{e}_{i,t}$$

Where $DU_{i,t}(\hat{\lambda}) = 1$ if $t > T\hat{\lambda}$, 0 otherwise; $DT_{i,t}(\hat{\lambda}) = t - T\hat{\lambda}$ if $t > T\hat{\lambda}$, 0 otherwise; and $\hat{\lambda}$ is the break fraction. T is the sample size.

If the Zivot and Andrews test concludes that the series is stationary around a trend with a structural break (rejects the unit root hypothesis), the existence of convergence or divergence in the model (1) is analyzed separately in the two periods before and after the structural break.

Figure 4.11 summarizes the procedure followed with the time series to test catching up over the period or during sub-periods.

Figure 4.11. Procedure to test catching up



Source: adapted from Matheson and Oxley (2007).

Table 4.3 shows the main results obtained from Augmented Dickey Fuller and Zivot and Andrews tests. When convergence and/or divergence is observed over the entire period or over sub-periods, the result of the deterministic trend is presented in this table as well.

For manufacturing at large, there was no evidence of statistically significant catching up either in the comparison of Chile with the US (1939-1980) or in the comparison of Uruguay with the US (1939-1968)[77]. In contrast, Brazil showed a statistically significant convergence process relative to the US over the 1945-1980 period, and also Brazil caught up with Sweden after 1968.

[77] Although the sample size is short in the comparisons Uruguay vs US and Brazil vs Sweden, ADF test can be applied (Stock and Watson 2012) and Zivot and Andrews presents different tests in order to deal especially with small samples (Zivot and Andrews 1992).

At industry level, in the binary comparison of Chile vs the US, the evidence is conclusive of a divergence process for the whole period in chemicals and textiles. After using the ZA test in tobacco, paper and printing, and leather and rubber, different stationary paths were identified for short sub-periods. The breaking points were 1950 in the first two cases, and 1958 in the last case. Before 1950, there was a convergence trend in paper and printing, and after that it changed towards a divergence process. On the contrary, after 1950 the tobacco industry started to converge. In the case of leather and rubber, the breaking point in 1958 only indicated a profound divergence path.

In the binary comparison Brazil versus the United States, the evidence always presents a conclusive result mainly through a positive significant coefficient for the whole period or a sub-period. Chemicals recorded a breaking point in 1962, whereas in food and beverage the breaking point was in 1975. Before their breaking point years, these industries converged with the US and after that they lost ground. Furthermore, when introducing the structural breaks test, paper and printing, metals and machinery, managed to reduce their gaps before and after the breaking years (1969, 1964 and 1953, respectively) but at different rates. After 1964 textiles, and after 1966 wood and furniture, both joined to the convergence trend. Brazilian manufacturing achieved by far the best performance in comparative terms during the industrialization period. After the 1980s, Lavopa (2015) found that Brazil lost its ground compared with the American level.

However, when comparing Brazil with Sweden the convergence results are more moderate. Disaggregated by industries, the Zivot and Andrews test shows that only the metal industry managed to reduce the gap with Sweden restricted to the 1965-1980 period, and in wood industry and furniture industry the divergence trend is statistically significant before and after 1975. In the remaining industries, it is not possible to conclude on a statistically significant convergent or divergent trend.

Finally, the Uruguay vs the United States comparison shows divergence in paper and printing until 1948, and convergence in tobacco until 1959. The ZA test in rubber and plastic allows us to identify a convergent trend before 1959 and a divergent trend after 1959. Only the food and beverages industry displayed a convergence trend over the whole period. In the remaining industries, it is not possible to conclude on a statistically significant convergent or divergent trend.

Table 4.3. ADF tests, Zivot and Andrews test, and deterministic trend estimates. Chile, Brazil and Uruguay compared to US, and Brazil compared to Sweden.

	ADF		Deterministic trend			
	Trend & constant	Zivot and Andrews	γ_i	Break year	$\gamma_{i(to-t*)}$	$\gamma_{i(t*-T)}$
Chile vs US 1939-1980						
Manufacturing						
Chemicals	-3.48 (**)		-0.05(***)			
Food&beverage						
Textiles	-3.84 (**)		-0.02(***)			
Tobacco		-5.00 (**)		1950	-0.0001	0.01(***)
Paper & printing		-4.28 (**)		1950	0.037(**)	-0.02(***)
Non metalmineral						
Leather& rubber		-5.08 (**)		1958	-0.018(***)	-0.06(***)
Brazil vs US 1945-1980						
Manufacturing	-3.73(**)		0.021 (***)			
Chemicals		-4.71 (**)		1962	0.003	-0.016(**)
Food & beverage		-4.71 (**)		1975	0.027(***)	-0.04(**)
Textiles		-5.36 (**)		1969	0.002	0.11 (***)
Paper & printing		-4.48 (**)		1969	0.019(***)	0.06 (***)
Non metalmineral						
Metals		-5.09 (**)		1964	0.021(**)	0.065(***)
Machinery		-6.31 (***)		1953	0.068(***)	0.021(***)
Wood&furniture		-4.90 (***)		1966	0.010	0.04 (***)
Brazil vs Sweden 1952-1980						
Manufacturing		-5.11 (**)		1968	-0.0002	0.04(***)
Chemicals						
Food&beverage						
Textiles						
Paper & printing						
Non metalmineral						
Metals		-6.27 (**)		1964	-0.013	0.049(***)
Wood&furniture		-4.87 (*)		1975	-0.008(***)	-0.066(**)

Uruguay vs US 1939-1968

Manufacturing					
Chemicals					
Food&beverage	-3.62 (**)	0.020(***)			
Textiles					
Paper&printing	-4.90 (**)		1948	-0.03 (*)	-0.005
Rubber&plastic	-4.58 (**)		1959	0.035 (**)	-0.13(***)
Tobacco	-4.94 (**)		1959	0.017 (***)	-0.008

Significance levels: * p< 0.1, ** p<0.05, *** p<0.01.
Source: own estimates based on Appendix C: Table C.11, Table C.12, Table C.13 and Table C.14.

4.5. Conclusions

In this chapter, I presented new evidence of industrial growth patterns, of structural change and of the dynamics of convergence for Latin American countries in a comparative perspective. Harberger diagrams showed a yeast-like industry pattern in Brazil and United States over the period, and in Sweden after the 1950s. Uruguay showed a dominant mushroom-like growth process, and in Chile both yeast-like and mushroom growth processes occurred over the period. In general, the pattern of growth rates becomes balanced when growth rates are high, and it becomes unbalanced when growth rates are low. In other words, the brakes to productivity increases go hand in hand with a higher degree of concentration in the productivity advances across industries.

Furthermore, the shift-share analysis allows us to conclude that labour productivity took place mainly within the prevailing productive structure. For each subperiod in Chile, Brazil, US and Sweden, and after 1955 in Uruguay, the aggregate productivity growth was dominated by the within-effect. This result is in line with previous evidence for the Latin American countries (Aldrighi and Colistete 2015, Holland and Porcile 2005, Azar and Fleitas 2010, López Arnaut 2017).

For the entire period, in Chile and Uruguay, most gains obtained by the static effect of structural change were more than cancelled out by the dynamic effect, that is, the largest negative contribution to productivity comes from the joint effect of the change in the structure of employment towards sectors that show a lower growth rate of productivity. However, during 1939-1955 Uruguay reached a positive net static effect, and Brazil also managed to partially reduce its structural heterogeneity until the 1970s. Sweden showed the best performance over the whole period.

From the procedure to test convergence I conclude that there is no evidence of catching up statistically significant in the comparison Chile versus the United States (1939-1980), and Uruguay versus the United States (1939-1968) for manufacturing at large. However, Brazil showed a statistically significant convergence process relative to the United States over the period (1945-1980) and relative to Sweden after 1968. Brazil carried out industrial and technological policies, which contributed to transforming the productive structure and reducing the productivity differences from the country leader. Gap reduction and structural change seem to go hand in hand.

Finally, the convergence analysis disaggregated by industries made it possible to recognize successful cases of catching-up. Most of them were concentrated mainly in the comparison of Brazil versus the United States. This is consistent with the results obtained in the previous subsections of this chapter, as well as the main hypothesis presented in this thesis. Furthermore, in Chile, paper, printing, and tobacco were able to achieve a better performance during shorter periods; and in Uruguay, food and beverages overachieved between 1939 and 1968, and tobacco, rubber, and plastic overachieved until 1959.

Chapter 5. Conclusions

The objective of this thesis is to contribute to analyze and characterize, on the basis of new evidence, the performance of the manufacturing industries in Brazil, Chile and Uruguay, during the stet-led industrialization period and in a comparative perspective with two developed countries (United States and Sweden).

A first set of evidence is related to the analysis of production structures, structural change, structural heterogeneity and the pattern of industrial growth. Until now, the literature has presented results for some of the five countries individually, or partially covered the industrialization period. This thesis presents new estimates to complement and broaden the well-known evidence.

Data collection at a highly disaggregated level using various industrial censuses and surveys in the five countries has led to a better understanding of the changes that occurred during the years of industrialization. To this I have added the elaboration of new long run series of value added per worker at constant prices and disaggregated by industries for Chile, Uruguay and the United States. These series are important by-products of this thesis, since through them, and together with existing series for Brazil and Sweden, two methods were applied: i) a shift-share analysis to understand changes in total manufacturing productivity growth rate, and ii) Harberger diagrams and the Harberger coefficient to analyze the pattern of labour productivity growth in the industrial sector. Both methods offer novel results, beyond some previous evidence in relation to the first method in Brazil and Uruguay.

A second set of evidence involves the analysis of manufacturing convergence. So far, what has been studied in greater depth is income convergence, that is, the distance of economies in terms of GDP per capita from a leading country or a group of them. There is almost no analysis of manufacturing convergence measured by labour productivity in Latin American countries for this period. In order to estimate convergence through the selected tests (ADF and Zivot and Andrews test), I needed labour productivity series which were comparable between countries. This was achieved thanks to the currency conversion factors developed and compiled in the thesis. Therefore, other by-products of the thesis are: i) the currency conversion factors produced for Latin American countries in relation to the United States and Sweden in certain benchmark years, and ii) the final series of labour productivity levels of Brazil, Chile and Uruguay in comparative terms to the reference countries, disaggregated by industries and for the total manufacturing industry.

During the 1930s and 1970s, the Latin American manufacturing sector, described in detail through this thesis, acquired an important weight in the economy, measured in terms of gross value added (around 25% on average). Moreover, its growth rate surpassed that of the economy as a whole. The manufacturing sector was also relevant for its effects on employment generation, incorporation of technology and innovation, as well as for its links to other sectors of the economy. This period was, in turn, unusual because the State played a leading role in this industrialization process through policy intervention. These facts are not repeated again in the region, thus constituting a singular stage of the Latin American economic history. As discussed in Chapter 2, the selected countries have nuances with respect to the average: while in Uruguay the industrializing impulse was exhausted by the 1950s, in Chile and Brazil the degree of industrialization grew until the 1970s and 1980s, respectively; the models of state intervention differ in the three countries. These variations allow for a richer analysis of convergence trajectories, given that the institutional, political, and socio-economic factors were different in each country.

Compared to other late industrializers, Latin America experienced an early de-industrialization, with negative consequences for economic growth and development. Amsden (2001) and Szirmai (2009) present evidence that developing countries that bet on industrialization late but maintained the industrializing model for an extended period of time, successfully managed to converge towards rich countries in terms of per capita GDP. To this end, these industrialization experiences were also supported by protectionist industrial policies (Chang 2009). Protectionism should not be considered intrinsically a 'bad', on the contrary, throughout history there are several examples of it being a powerful tool to carry out productive transformations.

Although the industrialization process is proposed as an engine of growth from both theoretical and empirical contributions, this stage for Latin America has been loaded with negative appraisals. Part of the contribution of this thesis was to offer new evidence to evaluate the success or failure of the period, with a comparative perspective.

A first specific objective of the thesis was to characterize the productive structures of the five selected countries, taking the manufacturing sector as a reference. From the descriptive analysis it can be deduced that there were transformations within the manufacturing industry in all of them, however, the depth and rhythm of these changes were different in each country.

As expected, in the United States and Sweden the changes in the productive structure occurred earlier than in Latin America; therefore, by the 1930s these two countries had a mature and diversified industrial sector. For example, the mechanical and electromechanical industry in Sweden was already developed at the beginning of the twentieth century, and in the case of the United States it also happened in the chemical industry. By 1914 the productivity of the American manufacturing sector was twice that of the United Kingdom; the United States positioned itself as the world's most productive economy and the productivity leader in most industries (Nelson and Wright 1992). From the 1930s onwards, both countries deepened the weight of modern industrial sectors associated with the greater incorporation of technology and knowledge and, therefore, structural heterogeneity was reduced by a strong structural change. In both cases, policies played an important role, as explained in Chapter 2. Therefore, these two reference countries are characterized by having followed a sustained path of transformations in their manufacturing sector. The 1970s marked a turning point in these developed economies.

With respect to the three Latin American countries, a first point to highlight is that in all three there were changes within the industrial sector. However, the degree of transformation was weak and limited in time for the case of Uruguay, followed by the Chilean experience with moderate advances, and finally the Brazilian case which showed profound and sustained changes over the period.

In Uruguay the biggest changes in the industry occurred until the mid-1950s. However, the weight of resource-intensive industries was always high, some of them associated with the production of traditional non-durable consumer goods (food and beverages) and others (paper, chemicals and oil). Food and beverages had high levels of protection, and recorded productivity levels above the average for the manufacturing sector. On the other side, textiles was also a protected industry, and contrary to the rest of the labour-intensive industries, this industry registered high levels of productivity until 1968. Unlike other countries in the region, there was no strong institutional framework with industrial policies that deliberately supported the production of engineering-intensive goods. The latter group of industries grew very slightly in terms of value added and employment, and their level of labour productivity remained low.

The story was different in Chile. Although at the beginning there was high protection for non-durable consumer goods industries (food, beverages, tobacco, textiles), the appearance of CORFO in 1939 gave a boost to the industrializing process in capital-intensive industry and technology. This resulted in a greater weight of engineering-intensive industries by 1957, to the detriment mostly of labour-intensive industries. On the other hand, natural-resource-intensive industries maintained their importance and recorded labour productivity levels above the industry average. In the 1960s the industrialization project gave greater prominence to the private sector, and changes continued to take place within the industry. Labour-intensive industries continued to fall in their share and level of productivity, while engineering-intensive industries increased their weight in the industry as a whole and also their level of productivity; although they remained below the weight of the group of natural resource-intensive industries.

In Brazil, two periods were identified: between 1930-1960 and 1960-1980. The first period was characterized by the industrialization of import substitution itself, with the majority of the production of goods intensive in natural resources and labour. These industries had a significant level of protection, with the former having productivity levels above the average for the industry as a whole. The 1950s marked a turning point: the consumer durables industry (automobiles, household appliances), power generation, iron and steel gained more prominence to the detriment of other light industries. BNDES was a key figure in financing industries with greater requirements of infrastructure, as well as other industrial policies that actively involved the State in production. The 1959 industrial census accounted for these changes, while the gross value added of resource-intensive industries accounted for 41 per cent of total manufacturing, engineering-intensive industries accounted for 39 per cent and had the highest levels of productivity.

Between 1960 and 1980, structural change deepened in Brazil, with greater diversification and increased productivity of the most sophisticated industries (mechanical engineering, transport equipment). Engineering-intensive industries became more important in terms of value added and employment than the rest of the industries. On the contrary, labour-intensive industries lost participation, and at the same time ranked as the least productive industries. This took place in a context of greater prominence of the private sector in production, greater presence of transnational companies, and an increase in industrial exports.

From a comparative perspective, Uruguay was the country with the weakest transformation of its manufacturing sector during the entire period 1930-1980. The four indicators presented in Chapter 2 conclude for Uruguay that: (i) the internal gap between the most productive and least productive industries widened; (ii) the relative technological intensity of the industrial sector remained stable; and (iii) there was no convergence of the industrial structure with that of the United States. However, it is important to note that at the beginning of the period (1939), the four indicators were more favourable for Uruguay, and by 1968 all of them worsened.

The results for Chile also show a widening of the internal productivity gap between industries, however, in relation to technological intensity the indicator reflects a growing and favourable trend - albeit moderate - and the Krugman index indicates a certain convergence with the American industrial structure. Finally, the four indicators in Brazil confirm a significant and favourable structural change. The structural heterogeneity measured by the evolution of the degree of dispersion of relative sectoral productivities was reduced, a technologically complex and more diversified industrial structure was achieved, and the Brazilian industrial structure was more similar to the American structure. Both in Chile and in Brazil since the 1980s, other works show how they moved to a stage of industrial divergence with the structure of the United States and also increased the structural heterogeneity.

In Chapter 4, the thesis returns to the measurement of structural change using the shift-share method. Since I worked with series of value added per labourer at constant prices, I could calculate the variations in different sub-periods. From the shift-share analysis it is concluded that the growth rate of labour productivity in the selected sub-periods is explained to a greater extent by the productivity changes within industries. In the case of Uruguay, the within effect became dominant after 1955. These results were in line with previous evidence for Latin American countries (Aldrighi and Colistete 2015, Holland and Porcile 2005, Azar and Fleitas 2010, Arnaut 2017). An interesting point about this method is being able to disaggregate the so-called "static effect" from the "dynamic effect". The first occurs when workers are transferred from those industries that were less productive at the beginning of the period to industries that were more productive. The dynamic effect incorporates the change in productivity that occurs during the period; therefore, the positive result of this effect is observed if the industries that increase their productivity more between the initial and final year do so accompanied by the incorporation of employment.

In Chile during 1939-1950 tobacco, paper and printing, and food and beverages were the industries with more productivity gains and at the same time those which expelled more workers. Then in the next ten years, tobacco remained in the same position, and leather and non-metallic minerals are included in the group of more productive industries with a smaller labour force. Engineering-intensive industries partially offset this situation, since they combined greater relative dynamism with the incorporation of labourers, and the positive role of these industries is also observed for the 1960s. On the other hand, food and beverages, textiles and non-metallic minerals are the industries that show the highest productivity growth in the sixties but which are accompanied by a loss of labourers. Between 1970 and 1980 the most productive industries were tobacco, non-metallic minerals, and engineering intensive; all of them did so at the cost of expelling workers. Therefore, the message for Chile is that by employing this method of shift-share, no structural change is found, beyond some engineering-intensive industries having grown and absorbed workers over much of the period.

Unlike Chile, in Uruguay particular industries intensive in natural resources (paper and chemicals) have been key to compensating for the negative effect of loss of employment in the most productive industries. Between 1939 and 1947 there was a fall in total labour productivity, explained by the fall in important industries such as food, apparel and footwear. In turn these industries expelled workers, while on the contrary the textile industry gained in terms of productivity and absorbed more employment. In the following years 1947-1955 industrial labour productivity grew, favourably driven by food, metallurgy, and non-metallic minerals. However, those three industries required fewer workers. Between 1955-1968 the manufacturing industry had lost its dynamism, and the more traditional industries (food and beverages) contributed positively to productivity growth at the expense of fewer employed workers. Finally, between 1974-1978 the manufacturing industry was boosted and this was reflected in a greater (though moderate) labour productivity growth rate, explained by petroleum, non-metallic minerals, and beverages; all of them with expulsion of employment. In short, Uruguayan industries did not have the capacity to contribute substantially to productivity growth while expanding employment. Although there are some positive contributions, these were limited in scope and were more concentrated in natural resource-intensive and labour-intensive industries.

In Brazil the results were different from those found in Chile and Uruguay. Between 1945 and 1960, although labour productivity in food, beverages and textiles grew at the cost of expelling workers, this was compensated by the performance of the chemical and engineering intensive industries, in which there was a better relative dynamism of productivity along with employment expansion. Again, in the 1960s, engineering intensive industries, together with paper, leather, and chemicals, offset the negative effect that occurred in other industries that expelled employment and at the same time with high productivity (as in the case of textiles). This was reflected in a net effect of positive structural change in the period 1945-1970. Then, in the seventies there was a greater participation of industries with more productivity that lost labour force, and this could not be compensated by the greater absorption of employment in the more productive industries intensive in engineering. In any case, in the overall performance of the period, Brazil is one of the three Latin American countries studied which managed to reduce its structural heterogeneity measured through shift-share analysis.

These results in terms of structural change and structural heterogeneity can be combined with industrial growth patterns and trajectories of relative labour productivity gaps. Both were presented in Chapter 4.

Harberger diagrams helped reveal characteristics of industrial productivity growth processes, calculated for shorter periods of time. While in Brazil and the United States for the whole period, and in Sweden after the 1950s, the pattern of industrial productivity growth was more even among industries; in Chile periods of balanced and unbalanced growth alternated and in Uruguay it was dominated by a mushroom-like pattern. In general, when the labour productivity growth rate increased, the distribution of this growth was more even among industries, and when the rate of labour productivity growth fell, the prevailing pattern was one of greater concentration of productivity gains (with the exception of the United States in the last sub-period analyzed). Thus, the slowdown in labour productivity growth rates went hand in hand with a greater focus on real cost reductions; progress became dependent on a few key industries. This again raises the importance of diversification within the manufacturing sector to achieve a more equitable distribution of the gains from total productivity growth.

Chapter 4 of the thesis also devoted a section to presenting an analysis of convergence disaggregated by industries through relative labour productivity gaps. Before going into this, a previous step, and which accounts for Chapter 3 of this thesis, has to do with the solution when comparing aggregate values of countries in their different currencies. For the reasons given in Chapter 3, the industry-of-origin methodology was chosen to find the currency conversion factors, known as unit value ratios (UVRs). These conversion factors made it possible to compare the value added of Brazil, Chile and Uruguay with that of the United States and Sweden. The UVRs for the benchmarks were: i) Brazil versus the United States in 1947/49, ii) Chile versus the United States in 1939, iii) Uruguay versus the United States in 1988, and iv) Brazil versus Sweden in 1975. The data source used was mostly industrial censuses, industrial surveys, and statistical yearbooks.

With the existing industrial sources for Latin American countries, although they may introduce bias in the results, it is difficult to improve the estimates presented here. Future research could involve exploring new sources of information to collect unit price data for industrial goods, such as foreign trade, although this would make it more flexible with the chosen methodology. If information could be gathered, the construction of new benchmarks in the first half of the twentieth century for Brazil and Sweden, and Uruguay and the United States, would be a great contribution to the analysis of comparative productivity.

Once the UVRs were found, labour productivity ratios were calculated by industry and for the total manufacturing industry. In all constructed benchmarks disaggregated, the productivity ratio was always favourable to the United States. However, in industries that are intensive in natural resources and at the same time dedicated to the production of consumer goods (food, beverages, tobacco) and in other industries with the weight of the labour factor (textiles, leather), productivity ratios were registered relatively closer to those of the United States. In contrast, in the chemical and non-metallic minerals industries, productivity ratios with respect to the United States turned out to be more unfavourable. In the Brazil-Sweden benchmark for 1975 the results are more favourable for Brazil than for the Scandinavian country in several industries (chemicals, petroleum, plastics, rubber, leather, textiles, and clothing), which is consistent with changes that occurred in the Brazilian industrial structure during the industrialization period.

Competitiveness, approached in the “spurious” sense as Fajnzylber called it, was also calculated in the reference years. The results identified the advantage of the cheaper labour costs in Chile and Brazil over the United States. In the case of Chile, the advantage is absolute, and in the Brazil-United States comparison for a large part of the industries (food and beverages and tobacco, textiles and clothing, leather, rubber and footwear). On the other hand, Uruguay did not find a competitive advantage via costs over the United States. The absence of this advantage does not necessarily imply a favourable situation for Uruguay, since it was also evidenced by an insufficient relative performance of labour productivity.

Taking benchmarks as a starting point, they were extrapolated backwards and forwards with series of value added at constant prices at the industry as a whole and by industries. The final coverage period varied by country. These long-term series allowed me to approach catching up analyses of the three countries of the region with respect to the United States and Sweden.

The hypothesis tested in Chapter 4 was the existence of a virtuous pattern of structural change due to persistent increases in productivity and employment, which in turn made it possible to close gaps in production and technological conditions between lagging economies and those at the international technological frontier. In other words, investigate whether the periods in which structural change was identified also closed productivity gaps with the reference countries.

At the level of the industry as a whole, the results are neither conclusive of statistically significant convergence nor divergence in the comparison Chile versus the United States for the years 1939-1980, and Uruguay versus the United States for the years 1939-1968. However, Brazil's trajectory vis-à-vis the United States did show a statistically significant convergence process throughout the period 1945-1980, and from 1968 onwards the Brazilian manufacturing industry also managed to shorten the productivity gap with Sweden. As discussed in Chapter 2, Brazil pursued industrial policies that helped transform the productive structure and this was also reflected in the reduction of productivity differentials with respect to the United States and Sweden. Structural change and industrial convergence went hand in hand in Brazil. This result is in line with previous works (Bértola 2000, Durán et al 2017).

Using the series by industry, it was possible to explore convergence at that more disaggregated level. Beyond the fact that the labour productivity of US industries grew steadily throughout the period, certain industries of Latin American industries managed to catch up either for the whole period or a subgroup of them. If I focus only on statistically significant convergence, the Chilean paper industry converges with the United States until the 1950s, while the tobacco industry of the same country narrowed the gap with the United States from the 1950s onwards. Both industries recorded trajectories of high productivity in Chile, but at the cost of expelling workers. It should be bear in mind that paper industry had a high share of value added and employment, whereas tobacco industry was less significant.

In the case of Uruguay, food and beverages achieved a convergence path, and tobacco and rubber and plastic did so until 1959. These industries were protected under the state-led industrialization model, and they also contributed to the growth of total labour productivity by reducing employment.

Finally, the Brazilian industries performed very favourably with respect to those of the United States, managing to consolidate a catching up process in most industries, with the exception of the chemical industry (diverged from 1962) and non-metallic minerals (neither converged nor diverged). The greatest relative success was observed in the textile industry, because despite being a very dynamic industry in the United States, Brazil showed a very high performance and its pace of convergence was the strongest within the manufacturing industries.

In this sample of industries from the three Latin American countries, convergence has not been the rule for the entire period. It is a different result to that found by Rodrik (2013) for the period 1965-2005, where the industrial sectors, considered modern, converged unconditionally in labour productivity. On the contrary, in the results of this thesis the convergence has been located in the industries of one country (Brazil), and in some industries intensive in natural resources of Uruguay and Chile (food and beverages, tobacco, paper, rubber and plastic).

In short, the manufacturing industry in Brazil achieved substantial changes, which were reflected in a reduction in structural heterogeneity and structural change. Manufacturing convergence accelerated in Brazil in the 1960s, when the development model based on industrialization was deepened and different characteristics were adopted from those recorded in the first stage of industrialization. Structural transformation was weaker in Uruguay and mild in Chile, and the ability to reduce technological gaps with leaders was limited to some industrial sectors associated with natural resources and with medium and high levels of industrial protection. The latter must also be linked to the different pace of industrialization in these two countries, especially in Uruguay, where the industrializing impulse was exhausted very early on. An underlying reflection, and largely the argument for early deindustrialization, is that if the industry had not been dismantled so quickly, other more successful trajectories of the sector's relative performance could have been achieved.

Although this thesis has not delved into policies, they are part of the period of state-led industrialization and have therefore been necessary to carry out this economic model. The range of policies is wide, from protectionist policies to another set of policies for training workers, promoting innovation and investment, and funding policies, which have been key to the development of the industry. A future agenda topic could be to link the results found in this thesis on the performance of industries and the type of industrial policies they received.

At the level of the manufacturing industry as a whole, this thesis confirmed that the country that made the most progress with industrial policies, Brazil, was the one that managed to catch up with the leader during the industrialization period. In the case of Uruguay, in its stage of proper industrialization the relative level of productivity with respect to the United States remained stable and at moderately high values, but since the mid-fifties when the model stagnated in this country, this relative position was considerably lost and placed at very poor levels (around 20% in 1968 and 15% in 1988). And finally, Chile's relative position was modest and stable until the 1970s, before falling to levels similar to those of Uruguay. The loss of the relative labour productivity position of industry in Uruguay and Chile, which was accompanied by a change in economic policies and development model, did not seem to have generated positive results in the economy as a whole. The results of economic convergence support it: Uruguay and Chile increased the income gap with respect to the United States in 1955 and 1972, respectively. In Brazil, divergence also occurred after the eighties and more significantly since the nineties.

Another agenda item could be to compare Latin America with other developing regions such as Asia as well as extend the period of analysis to cover years before and after the one proposed in this thesis. In order to do this, the construction of more benchmarks would be an essential task. A long run view would contribute to understanding, for example, the transition from the period of state-led industrialization to a new development model under rules of free market, and limited state intervention. Finally, it is proposed for future studies to exploit the link between the results found at the level of industries, and other relevant dimensions such as wages, human capital, and the profile of foreign trade. In addition, working with data at the four-digit level may also be helpful when dealing with industries such as chemicals, and other more sophisticated industries. Studies at the firm level would also help to complement the results obtained here.

This thesis contributes to a fairer balance than was expected of a period in which there were many changes to be made, many of which were not possible, and the dismantling of the model happened prematurely. The three countries analyzed provided evidence, to a greater or lesser extent, of industries that were able to develop successfully, which was reflected in the results obtained. The nuances are part of the evaluation process, but we should adopt a more balanced and less negative judgement of the process than has predominated.

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APPENDICES

APPENDIX A

Table A.1. Value added at current prices (VA), total labour force (L) and labour productivity (LP). In thousand cruzeiros, Brazil.

	1939			1949		
	VA	L	LP	VA	L	LP
Food & beverage	1,789,895	189,852	9	11,920,778	273,564	44
Tobacco	146,065	13,615	11	680,436	13,008	52
Textiles	1,412,628	233,443	6	9,358,541	338,035	28
Apparel, leather & footwear	418,957	63,915	7	2,661,406	97,660	27
Paper	94,036	12,318	8	1,072,449	24,959	43
Printing	229,491	31,617	7	1,899,083	49,367	38
Chemical	749,131	45,596	16	4,626,249	73,472	63
Rubber & plastic	41,267	4,524	9	1,023,592	13,918	74
Wood	205,042	37,303	5	2,008,655	68,486	29
Furniture	137,733	28,785	5	1,029,671	38,802	27
Non meta llic mineral	340,370	57,416	6	3,410,777	128,928	26
Metals and prod	488,562	61,338	8	4,468,989	102,826	43
Non-electrical machinery	-	-		1,018,363	26,600	38
Mechanical engin	352,888	25,624	14	763,128	15,774	48
Transport equipment	-	-		1,061,856	20,182	53
Miscellaneo us	71,727	10,976	7	777,274	24,033	32
Total	6,477,792	816,322	8	47,781,247	1,309,614	36

Source: Industrial censuses, taken from livro Estadisticas historicas do Brasil.
Note: in 1939, 1949 and 1959 the values are expressed in thousand of cruzeiros acorrding to the monetary system of 1942.

Cont. Table A.1. Value added at current prices (VA), total labour force (L) and labour productivity (LP). In thousand cruzeiros, Brazil.

	1959			1970		
	VA	L	LP	VA	L	LP
Food & beverage	104,612,213	309,983	337	8,412,905	431,020	20
Tobacco	7,048,930	13,169	535	699,831	14,509	48
Textiles	64,839,021	328,297	198	4,976,927	342,839	15
Apparel, leather & footwear	25,164,451	122,714	205	2,126,704	190,904	11
Paper	16,037,604	40,925	392	1,364,271	66,994	20
Printing	16,211,677	60,625	267	1,958,090	97,087	20
Chemical	67,622,074	118,298	572	7,957,409	154,328	52
Rubber & plastic	20,592,929	30,561	674	2,038,075	75,429	27
Wood	17,481,258	87,822	199	1,343,221	135,979	10
Furniture	11,877,940	63,471	187	1,116,058	105,322	11
Non meta llic mineral	35,509,439	163,680	217	3,134,408	236,506	13
Metals and prod	63,747,452	174,279	366	6,158,995	266,928	23
Non-electrical machinery	18,658,605	62,148	300	3,756,203	180,431	21
Mechanical engin	21,592,690	57,904	373	2,868,636	115,485	25
Transport equipment	41,106,668	81,876	502	4,242,403	158,336	27
Miscellaneo us	9,506,222	37,910	251	1,123,185	62,533	18
Total	541,609,173	1,753,662	309	53,277,321	2,634,630	20

Source: Industrial censuses, taken from livro Estadisticas historicas do Brasil.
Note: in 1939, 1949 and 1959 the values are expressed in thousand of cruzeiros according to the monetary system of 1942. In 1970, 1975 and 1980 the values are expressed in thousand of cruzeiros acorrding to the monetary system of 1970.

Cont. Table A.1. Value added at current prices (VA), total labour force (L) and labour productivity (LP). In thousand cruzeiros, Brazil.

	1975			1980		
	VA	L	LP	VA	L	LP
Food & beverage	40,174,819	553,695	73	442,288,804	680,574	650
Tobacco	3,211,674	21,711	148	26,920,740	18,183	1,481
Textiles	18,828,819	333,776	56	251,520,048	377,600	666
Apparel, leather & footwear	13,215,668	338,393	39	208,548,481	502,106	415
Paper	7,750,459	85,785	90	118,980,494	107,433	1,107
Printing	11,283,268	127,365	89	102,054,656	142,078	718
Chemical	48,552,389	181,194	268	675,630,929	222,614	3,035
Rubber & plastic	12,028,299	125,787	96	145,533,846	175,328	830
Wood	8,953,735	203,856	44	105,714,885	263,004	402
Furniture	6,098,675	138,544	44	70,199,860	174,685	402
Non meta llic mineral	19,161,229	320,304	60	228,554,620	437,405	523
Metals and prod	38,781,494	442,379	88	452,469,007	531,729	851
Non-electrical machinery	31,691,907	391,472	81	398,677,644	538,146	741
Mechanical engin	17,655,103	176,453	100	249,754,319	243,494	1,026
Transport equipment	19,500,363	221,924	88	297,170,759	281,272	1,057
Miscellaneo us	10,004,921	153,907	65	155,780,213	222,558	700
Total	306,892,822	3,816,545	80	3,929,799,305	4,918,209	799

Source: Industrial censuses, taken from livro Estadisticas historicas do Brasil.
Note: In 1970, 1975 and 1980 the values are expressed in thousand of cruzeiros according to the monetary system of 1970.

Table A.2. Value added at current prices (VA), total labour force (L) and labour productivity (LP), Chile. In Chilean pesos.

	1939			1947		
	VA	L	LP	VA	L	LP
Food and beverages	451,412,026	25,272	17,862	2,495,000,558	32,110	77,702
Tobacco	114,539,013	1,628	70,356	590,973,310	1,422	415,593
Textiles	270,216,879	17,085	15,816	1,995,329,360	29,163	68,420
Apparel	29,959,723	3,834	7,814	313,740,220	6,459	48,574
Footwear	65,816,000	7,476	8,804	380,104,255	9,961	38,159
Wood	93,489,566	7,812	11,967	531,203,935	13,103	40,541
Furniture						
Paper	131,711,878	8,830	14,916	657,033,247	9,989	65,776
Printing						
Leather, rubber and plastic	72,676,682	3,920	18,540	331,059,036	6,979	47,436
Chemicals	183,501,471	5,789	31,698	1,243,004,660	11,651	106,687
Petroleum					-	
Non metallic minerals	81,122,525	8,485	9,561	783,997,354	13,421	58,416
Metal and metal products	132,287,866	11,738	11,270	1,243,004,660	23,627	52,610
Non electrical machinery						
Mechanical engineering						
Transport equipment						
Miscellaneous	16,885,144	545	30,982	42,477,488	321	132,329
Total	1,643,618,773	102,414	16,049	10,606,928,083	158,206	67,045

Source: Industrial censuses, industrial surveys, and yearbooks.
Note:

- 1938-1959: Chilean pesos.
- 1960-1975: Chilean escudos. It replaced the peso at a rate of 1 escudo = 1000 pesos.
- 1976-2015: Chilean pesos. The current peso was introduced on 1975 by decree 1,123, replacing the escudo at a rate of 1 peso for 1,000 escudos.

Cont Table A.2. Value added at current prices (VA), total labour force (L) and labour productivity (LP), Chile. In Chilean pesos.

	1957			1967		
	VA	L	LP	VA	L	LP
Food and beverages	68,648,200,000	43,156	1,590,699	2,084,860,300,000	71,711	29,073,089
Tobacco	16,327,000,000	1,248	13,082,532	257,302,300,000	1,284	200,391,199
Textiles	40,197,900,000	38,312	1,049,225	992,483,000,000	47,205	21,024,955
Apparel	13,193,800,000	16,109	819,033	287,000,800,000	17,537	16,365,444
Footwear	10,448,500,000	13,295	785,897	173,580,400,000	13,483	12,874,019
Wood	9,540,300,000	11,835	806,109	287,378,700,000	32,601	8,815,027
Furniture	4,924,700,000	5,090	967,525	99,730,400,000	7,975	12,505,379
Paper	5,740,000,000	3,517	1,632,073	205,648,000,000	4,919	41,806,871
Printing	11,171,300,000	8,220	1,359,039	266,914,100,000	11,124	23,994,435
Leather, rubber and plastic	7,579,600,000	5,446	1,391,774	393,307,900,000	13,911	28,273,158
Chemicals	23,762,900,000	12,297	1,932,414	725,308,800,000	17,864	40,601,702
Petroleum	9,643,100,000	1,167	8,263,153	179,965,600,000	2,351	76,548,533
Non metallic minerals	15,858,000,000	12,874	1,231,785	314,994,700,000	15,046	20,935,445
Metal and metal products	45,346,800,000	24,724	1,834,121	2,067,066,700,000	41,217	50,150,829
Non electrical machinery	5,156,400,000	5,188	993,909	426,143,900,000	16,634	25,618,847
Mechanical engineering	5,032,800,000	3,253	1,547,126	317,279,900,000	8,257	38,425,566
Transport equipment	7,115,300,000	7,198	988,511	628,578,700,000	23,657	26,570,516
Miscellaneous	3,712,100,000	3,676	1,009,820	60,664,000,000	3,715	16,329,475
Total	303,398,700,000	216,605	1,400,700	9,768,208,200,000	350,491	27,870,069

Source: Industrial censuses, industrial surveys, and yearbooks.
Note:

- 1938-1959: Chilean pesos.
- 1960-1975: Chilean escudos. It replaced the peso at a rate of 1 escudo = 1000 pesos.
- 1976-2015: Chilean pesos. The current peso was introduced on 1975 by decree 1,123, replacing the escudo at a rate of 1 peso for 1,000 escudos.

Cont Table A.2. Value added at current prices (VA), total labour force (L) and labour productivity (LP), Chile. In thousand Chilean pesos.

	1979			1989		
	VA	L	LP	VA	L	LP
Food and beverages	48,604,242	82,456	589	526,048,020	104,870	5,016
Tobacco	7,754,878	1,003	7,732	71,934,396	692	103,951
Textiles	11,259,481	36,577	308	102,898,707	32,136	3,202
Apparel	5,899,765	20,043	294	49,704,874	22,252	2,234
Footwear	3,519,476	9,618	366	34,298,207	13,044	2,629
Wood	7,721,632	24,573	314	81,315,215	25,473	3,192
Furniture	1,742,172	6,855	254	17,070,280	6,801	2,510
Paper	9,307,481	6,940	1,341	156,316,232	9,564	16,344
Printing	8,460,902	12,456	679	61,712,665	11,435	5,397
Leather, rubber and plastic	7,990,494	15,415	518	74,454,369	19,128	3,892
Chemicals	19,953,614	17,098	1,167	221,089,273	22,293	9,917
Petroleum	8,687,050	2,478	3,506	152,535,714	2,906	52,490
Non metallic minerals	7,435,963	12,582	591	74,087,982	13,938	5,316
Metal and metal products	43,622,300	40,372	1,081	733,818,317	42,038	17,456
Non electrical machinery	4,502,868	10,106	446	48,885,908	15,903	3,074
Mechanical engineering	4,668,242	7,608	614	37,710,160	4,644	8,120
Transport equipment	7,178,446	10,994	653	36,820,634	8,938	4,120
Miscellaneous	1,004,212	2,754	365	5,594,774	2,393	2,338
Total	209,313,218	319,928	654	2,486,295,727	358,448	6,936

Source: Industrial censuses, industrial surveys, and yearbooks.
Note:

- 1938-1959: Chilean pesos.
- 1960-1975: Chilean escudos. It replaced the peso at a rate of 1 escudo = 1000 pesos.
- 1976-2015: Chilean pesos. The current peso was introduced on 1975 by decree 1,123, replacing the escudo at a rate of 1 peso for 1,000 escudos.

Table A.3. Value added at current prices (VA), total labour force (L) and labour productivity (LP), Uruguay. In thousand pesos in 1936 and 1968.

	1936			1968		
	VA	L	LP	VA	L	LP
Food & beverages	38,579,724	24,435	1,579	24,703,472	39,375	627
Tobacco	3,488,007	1,116	3,125	4,919,158	891	5,521
Textiles	7,223,327	7,063	1,023	14,356,304	24,321	590
Apparel	6,546,125	4,335	1,510	4,503,904	18,111	249
Paper	1,251,986	936	1,338	1,330,991	2,446	544
Printing	3,667,377	2,929	1,252	2,261,128	5,746	394
Chemicals	4,234,193	2,135	1,983	6,787,502	7,771	873
Petroleum	-	-		2,177,937	3,654	596
Rubber & plastic	685,722	815	841	4,423,562	6,500	681
Leather & footwear	4,894,996	4,419	1,108	3,686,575	9,624	383
Wood	1,588,698	1,066	1,490	1,211,827	4,481	270
Furniture	1,946,173	2,245	867	846,195	4,317	196
Non metallic minerals	4,539,654	3,619	1,254	4,771,514	8,207	581
Metals and metal products	6,031,523	5,075	1,188	4,050,794	9,100	445
Non-electrical machinery	673,192	366	1,839	1,113,428	2,493	447
Mechanical engineering	786,413	581	1,354	3,104,852	6,442	482
Transport equipment	4,512,157	4,097	1,101	5,049,462	13,148	384
Miscellaneous	700,244	727	963	1,018,585	1,997	510
Total	91,349,511	65,959	1,385	90,317,190	168,623	536

Sources: Industrial censuses, Instituto Nacional de Estadísticas, Uruguay.

Cont. Table A.3. Value added at current prices (VA) in thousand nuevos pesos in 1978 and million nuevos pesos in 1988, total labour force (L) and labour productivity (LP) in thousand nuevos pesos in 1978 and million nuevos pesos in 1988, Uruguay.

	1978			1988		
	VA	L	LP	VA	L	LP
Food & beverages	2,178,862	50,548	43	207,847	53,363	4
Tobacco	371,767	686	542	27,487	615	45
Textiles	870,617	21,614	40	73,008	20,820	4
Apparel	416,057	17,652	24	28,932	15,730	2
Paper	150,858	3,508	43	19,606	3,833	5
Printing	242,830	5,565	44	19,396	7,370	3
Chemicals	741,390	9,465	78	69,012	9,565	7
Petroleum	1,449,027	1,944	745	79,767	2,546	31
Rubber & plastic	464,050	7,945	58	33,526	7,530	4
Leather & footwear	468,878	17,537	27	35,404	10,246	3
Wood	114,420	4,573	25	5,019	2,734	2
Furniture	62,354	2,974	21	4,800	3,033	2
Non metallic minerals	362,444	8,568	42	26,553	7,818	3
Metals and metal products	450,232	11,587	39	31,983	9,619	3
Non-electrical machinery	168,112	3,395	50	7,294	2,767	3
Mechanical engineering	309,427	6,120	51	21,609	5,352	4
Transport equipment	431,695	6,362	68	44,495	6,257	7
Miscellaneous	71,998	2,437	30	3,972	2,196	2
Total	9,325,018	182,480	51	739,709	171,394	4

Sources: Industrial censuses, Instituto Nacional de Estadísticas, Uruguay.

Table A.4. Value added at current prices (VA) in million dollars, total labour force (L) in thousand and labour productivity (LP) in thousand dollars, United States.

	1939			1947			1957		
	VA	L	LP	VA	L	LP	VA	L	LP
Food & beverages	3,556	916	4	9,116	1,461	6	16,347	1,688	10
Tobacco	350	92	4	641	112	6	1,246	88	14
Textiles	1,822	1,137	2	5,323	1,232	4	5,197	989	5
Apparel	1,381	789	2	4,440	1,082	4	6,067	1,264	5
Paper	870	292	3	2,913	454	6	5,724	563	10
Printing	1,766	449	4	4,249	715	6	7,913	867	9
Chemicals	1,880	342	5	5,317	626	8	12,373	757	16
Petroleum	675	123	5	1,991	208	10	3,249	186	17
Rubber & plastic	406	138	3	1,300	258	5	2,462	260	9
Leather & footwear	584	348	2	1,533	383	4	1,892	362	5
Wood	618	381	2	2,520	642	4	3,285	646	5
Furniture	627	318	2	1,346	316	4	2,514	375	7
Non metallic minerals	911	315	3	2,299	461	5	4,980	526	9
Metal & metal products	3,780	1,329	3	10,653	2,131	5	22,864	2,386	10
Non-electrical machinery	1,969	618	3	7,834	1,552	5	15,978	1,707	9
Mechanical engineering	1,000	311	3	3,860	796	5	9,620	1,084	9
Transport equipment	1,794	628	3	5,842	1,175	5	18,492	1,901	10
Miscellaneous	694	270	3	3,207	708	5	6,199	802	8
Total	24,683	8,796	3	74,384	14,312	5	146,402	16,451	9

Source: Industrial Censuses, BEA.

Cont. Table A.4. Value added at current prices (VA) in million dollars, total labour force (L) in thousand and labour productivity (LP) in thousand dollars, United States.

	1967			1977			1987		
	VA	L	LP	VA	L	LP	VA	L	LP
Food & beverages	26,621	1,650	16	56,062	1,520	37	121,609	1,449	84
Tobacco	2,032	75	27	4,334	61	71	14,264	45	317
Textiles	8,153	929	9	16,105	875	18	25,660	672	38
Apparel	10,064	1,357	7	19,671	1,334	15	32,516	1,081	30
Paper	9,756	639	15	22,171	629	35	50,489	611	83
Printing	14,355	1,031	14	31,980	1,092	29	90,162	1,494	60
Chemicals	23,550	841	28	56,721	880	64	120,778	814	148
Petroleum	5,426	142	38	16,378	147	111	18,518	116	160
Rubber & plastic	6,800	517	13	19,740	721	27	44,418	831	53
Leather & footwear	2,627	329	8	3,719	243	15	4,378	129	34
Wood	4,973	554	9	16,223	692	23	28,664	698	41
Furniture	4,170	425	10	8,917	464	19	20,310	511	40
Non metallic minerals	8,333	590	14	19,130	614	31	33,375	524	64
Metal & metal products	38,021	2,623	14	83,080	2,670	31	121,147	2,162	56
Non-electrical machinery	27,836	1,865	15	67,223	2,083	32	118,178	1,844	64
Mechanical engineering	24,487	1,875	13	50,366	1,723	29	95,815	1,565	61
Transport equipment	28,174	1,834	15	64,291	1,768	36	137,076	1,817	75
Miscellaneous	11,017	817	13	29,044	999	29	88,384	1,356	65
Total	256,395	18,093	14	585,155	18,515	32	1,165,741	17,719	66

Source: Industrial Censuses, BEA.

Table A.5. Value added at current prices (VA) in krones in 1926 and thousand krones in 1952 and 1975, total labour force (L), and labour productivity (LP) in krones in 1926 and thousand krones in 1952 and 1975, Sweden.

	1926			1952			1975		
	VA	L	LP	VA	L	LP	VA	L	LP
Food & beverages	262,545,098	45,722	5,742	982,220	62,334	16	8,399,716	70,651	119
Tobacco	53,278,867	3,121	17,071	44,013	1,855	24	255,138	1,425	179
Textiles	135,599,874	42,749	3,172	559,685	56,570	10	1,864,898	25,894	72
Apparel	55,135,772	15,405	3,579	436,257	46,334	9	1,297,030	24,443	53
Paper	245,321,806	42,387	5,788	1,179,778	53,597	22	8,667,707	60,279	144
Printing	92,934,364	14,527	6,397	541,878	36,078	15	4,402,073	43,866	100
Chemicals	66,018,684	10,984	6,010	549,752	27,345	20	4,917,364	39,543	124
Petroleum				56,218	2,249	25	590,910	2,720	217
Rubber & plastic	18,848,170	4,232	4,454	180,610	11,597	16	2,050,930	26,109	79
Leather & footwear	58,608,672	16,574	3,536	223,738	22,101	10	417,171	6,729	62
Wood	120,154,296	44,223	2,717	363,465	31,067	12	5,132,858	60,053	85
Furniture	52,953,255	16,976	3,119	348,893	34,483	10	1,253,231	16,705	75
Non metallic minerals	109,729,202	41,691	2,632	545,238	40,501	13	3,041,613	33,127	92
Metals and metal products	142,990,568	40,738	3,510	1,603,247	109,141	15	13,704,135	157,877	87
Non-electrical machinery	27,226,615	7,001	3,889	1,943,618	127,208	15	11,461,426	133,164	86
Mechanical engineering	292,002,932	65,576	4,453	762,612	48,680	16	7,401,359	81,134	91
Transport equipment	46,235,790	12,045	3,839	1,037,227	71,155	15	12,255,000	135,114	91
Miscellaneous							447,095	6,466	69
Total	1,779,583,966	423,951	4,198	11,358,449	782,295	15	87,559,654	925,299	95

Source: Industrial Censuses

APPENDIX B

Table B.1. Product items, unit of measure, quantities produced, output value, unit value in local currency, quantities valued at other currency, and unit value ratios. Chile and US, 1939.

Product item	Unit of measure	Chile			
		Quantity	Value of product shipment	Unit value in local currency	Quantity valued at other currency
Cigars	number	5,595,258	3,362,316	0.60	171,288
Wool yarn	kgs	480,541	17,516,524	36.45	1,184,284
Cotton fabrics	mtrs	24,680,445	116,333,398	4.71	2,315,732
Hosiery (incl socks)	dozen pairs	1,091,890	60,360,167	55.28	2,916,300
Underwear	dozen	362,996	33,676,547	92.77	836,014
Outerwear	dozen	41,343	7,896,026	190.99	528,050
Textile fabrics	kgs	96,830	4,400,658	45.45	150,185
Silk fabric	mtrs	4,767,212	73,611,458	15.44	1,060,907
Jute products	kgs	5,112,403	33,269,295	6.51	1,184,281
Footwear for men	pairs	1,195,380	70,168,806	58.70	2,501,820
Footwear for women	pairs	1,822,046	76,799,239	42.15	3,269,644
Footwear for kids	pairs	1,334,675	29,870,027	22.38	956,358
Writing paper	kgs	13,250,788	36,614,019	2.76	2,063,156
Wrapping paper	kgs	11,762,149	18,231,331	1.55	1,009,943
Cardboard	kgs	3,248,795	4,645,777	1.43	294,433
Hydrochloric acid	kgs	481,455	400,882	0.83	24,755
Nitric acid	kgs	126,984	318,306	2.51	2,411
Sulphuric acid	kgs	3,470,088	3,171,774	0.91	16,978
Tartaric acid	kgs	44,464	838,813	18.86	25,975
Acetic acid	kgs	81	2,252	27.80	8
Boric acid	kgs	25,000	90,000	3.60	2,370
Sodium sulfide	kgs	1,021,978	1,987,706	1.94	53,204
Phosphate	kgs	17,959,632	8,953,952	0.50	1,617,349
Iron sulfate	kgs	50,000	40,000	0.80	628
Zinc sulfate	kgs	2,000	6,000	3.00	108
Aluminium sulfate	kgs	392,525	382,119	0.97	7,976
magnesium sulfate	kgs	684,053	610,320	0.89	20,216
Sodium sulfate	kgs	870,250	294,284	0.34	10,703
Barium sulfate	kgs	767,000	285,811	0.37	44,389
sodium sulfite anhydrous	kgs	17,823	58,889	3.30	1,103
Liquid and powder sodium	kgs	288,536	441,054	1.53	96,535
sodium silicate	kgs	56,791	78,530	1.38	2,222
Potassium iodide	kgs	2,000	140,000	70.00	5,179
Silver nitrate	kgs	520	192,440	370.08	4,866
zinc oxide	kgs	55,248	230,942	4.18	5,823
Ammonia	kgs	139,428	421,421	3.02	11,460
glycerin	kgs	153,215	1,632,747	10.66	26,812
methyl alcohol	litres	44,503	734,299	16.50	3,209
calcium carbonate	tons	18,576	1,056,183	56.86	433,602
Copper carbonate	kgs	35,000	350,000	10.00	12,271
Carbonate of magnesia	kgs	565	5,650	10.00	64
Sal sode	kgs	2,173,000	1,738,400	0.80	54,784
crystallized soda	kgs	115,541	93,469	0.81	1,282
calcium carbide	kgs	2,209,550	5,827,781	2.64	111,994
Industrial gelatin	kgs	9,165	153,255	16.72	7,320
Soap	kgs	11,326,200	52,058,833	4.60	1,874,569

Continue Table B.1. Product items, unit of measure, quantities produced, value of product shipment, unit value in local currency, quantities valued at other currency, and unit value ratios. Chile and the United States, 1939

Product item	Unit of measure	United States				UVR
		Quantity	Value of product shipment	Unit value in local currency	Quantity valued at other currency	
Cigars	number	5,223,368,000	159,903,002	0.03	3,138,838,960	19.63
Wool yarn	kgs	35,014,552	86,292,714	2.46	1,276,339,053	14.79
Cotton fabrics	mtrs	7,699,931,893	722,473,948	0.09	36,294,290,542	50.24
Hosiery (incl socks)	dozen pairs	152,342,091	406,886,510	2.67	8,421,538,849	20.70
Underwear	dozen	10,509,742	24,204,936	2.30	975,029,533	40.28
Outerwear	dozen	7,680,819	98,102,528	12.77	1,466,945,953	14.95
Textile fabrics	kgs	36176547.5	56110516	1.55	1,644,124,891	29.30
Silk fabric	mtrs	1,226,486,468	272,945,238	0.22	18,938,418,755	69.39
Jute products	kgs	69,435,250	16,084,583	0.23	451,854,402	28.09
Footwear for men	pairs	122,078	255,498	2.09	7,165,979	28.05
Footwear for women	pairs	214,778	385,417	1.79	9,052,893	23.49
Footwear for kids	pairs	24,632	17,650	0.72	551,264	31.23
Writing paper	kgs	539,324,957	83,973,218	0.16	1,490,240,012	17.75
Wrapping paper	kgs	2,031,180,283	174,404,823	0.09	3,148,329,438	18.05
Cardboard	kgs	53,409,594	4,840,432	0.09	76,375,720	15.78
Hydrochloric acid	kgs	76,800,000	3,948,831	0.05	63,947,280	16.19
Nitric acid	kgs	167,740,000	3,184,912	0.02	420,467,527	132.02
Sulphuric acid	kgs	7,711,487,000	37,730,541	0.00	7,048,551,497	186.81
Tartaric acid	kgs	4,451,910	2,600,682	0.58	83,985,242	32.29
Acetic acid	kgs	22,084,631	2,298,442	0.10	614,007,271	267.14
Boric acid	kgs	15,737,861	1,491,651	0.09	56,656,298	37.98
Sodium sulfide	kgs	31,481,000	1,638,895	0.05	61,229,276	37.36
Phosphate	kgs	223,253,000	20,104,982	0.09	111,304,989	5.54
Iron sulfate	kgs	35,214,000	442,573	0.01	28,171,200	63.65
Zinc sulfate	kgs	13,189,358	710,952	0.05	39,568,073	55.66
Aluminium sulfate	kgs	416,108,000	8,455,376	0.02	405,076,805	47.91
magnesium sulfate	kgs	47,689,000	1,409,398	0.03	42,548,677	30.19
Sodium sulfate	kgs	337,243,000	4,147,614	0.01	114,042,194	27.50
Barium sulfate	kgs	5,571,344	322,435	0.06	2,076,077	6.44
sodium sulfite anhydrous	kgs	11,213,000	693,773	0.06	37,048,889	53.40
Liquid and powder sodium	kgs	6,682,360	2,235,713	0.33	10,214,607	4.57
sodium silicate	kgs	46,012,000	1,799,982	0.04	63,624,912	35.35
Potassium iodide	kgs	415,003	1,074,653	2.59	29,050,242	27.03
Silver nitrate	kgs	670,560	6,274,506	9.36	248,158,656	39.55
zinc oxide	kgs	136,937,375	14,431,992	0.11	572,411,513	39.66
Ammonia	kgs	103,064,827	8,470,900	0.08	311,513,343	36.77
glycerin	kgs	13,275,046	2,323,087	0.17	141,466,513	60.90
methyl alcohol	litres	129,259,204	9,319,752	0.07	2,132,775,410	228.84
calcium carbonate	tons	70,504	1,645,707	23.34	4,008,674	2.44
Copper carbonate	kgs	274,469	96,229	0.35	2,744,692	28.52
Carbonate of magnesia	kgs	5,679,000	646,981	0.11	56,790,000	87.78
Sal sode	kgs	29,971,000	755,609	0.03	23,976,800	31.73
crystallized soda	kgs	2,960,722,000	32,862,016	0.01	2,395,130,080	72.88
calcium carbide	kgs	167,592,000	8,494,613	0.05	442,030,944	52.04
Industrial gelatin	kgs	13,219,598	10,557,903	0.80	221,055,047	20.94
Soap	kgs	747,776,195	123,762,430	0.17	3,437,018,247	27.77

Source: Statistics Yearbook for Chile (1939), and Statistics Yearbook for the United States (1939).

Table B. 2. Product items, unit of measure, unit value in local currency, and unit value ratios. Chile and the United States, 1939.

United States			Chile			
Product	unit	prices	unit	prices (a)	UVR	conversion
Food						
butter	pounds	0.263	46 kgs	948.22	35.51	pound to kilos
cheese	pounds	0.142	46 kgs	410.24	28.49	pound to kilos
flour	100 lbs	5.245	46 kgs	61.33	11.53	pound to kilos
beef	pound	0.163	1 kg	3.96	11.03	pound to kilos
lamb	pound	0.167	1 kg	4.23	11.49	pound to kilos
pork	pound	0.176	1 kg	5.354	13.80	pound to kilos
salmon	dozen cans	1.174	4 dozens 4 cans	133.85	9.50	
lard	pound	0.069	1 kg	3.43	22.55	pound to kilos
salt (b)	100 lbs	0.94	100 kgs	26.99	13.02	pound to kilos
sugar	pound	0.046	10 kgs	22.62	22.30	pound to kilos
Non metallic minerals						
brick	1000	12.046	thousand	230	19.093	

(a): Average of monthly prices

(b): Corresponds to the year 1946

Source: Statistics Yearbook for Chile (1939), and National Bureau of Economic Research for the United States (1939).

Table B.3 Price ratios underlying the benchmark of 1949, Brazil vs US

	Shares of value added			
	US	Brazil	Laspeyres	Paasche
Textile	0.14	0.26	21.2	20.8
Cotton	0.7	0.88	20.6	20.6
Wool	0.3	0.12	22.4	22.4
Glass, stone and clay	0.03	0.08	45.3	44.1
Metals	0.43	0.17	48.7	44.2
iron and steel	0.75	0.43	51.7	51.7
other metals	0.25	0.57	39.8	39.8
Chemical	0.11	0.1	51.8	34
Chemical products	0.39	0.5	63.4	63.4
Extraction of oil, vegetal essences and raw animal greases	0.09	0.19	26.5	26.5
Person hygien etc	0.12	0.27	19.6	19.6
Fossil fuel	0.39	0.04	55.8	55.8
Food	0.14	0.29	32.2	15.5
Sugar	0.04	0.24	16	16
Coffee	0.03	0.14	11.8	11.8
Miscellaneous	0.02	0.02	23.8	24.4
Grain milling	0.08	0.07	30	30
Meat and poultry	0.24	0.15	13.3	7.4
Dairy	0.11	0.08	19.8	19.5
Beverages	0.35	0.23	60.6	56.9
Tobacco	0.12	0.07	12	12.1
Leather	0.04	0.04	16.2	16.2
Paper	0.1	0.07	53.2	53.2

Sources: see explanatory notes for table B.3, based on Lara and Prado (2018a).

Explanatory notes for table B.3:

Textile: includes cotton cloth, bleaked cotton cloth and cotton.

Wool: includes woolen cloth and wool.

Glass stone and clay: include limestone, Portland cement and window glass.

Metals: include iron, gross steel sheet, lead bar, coppar sheet, tin bar, zink sheets, silver and barbed wire.

Chemical: includes sulphuric acid, bicarbonate of soda, carbonate of soda, carbide of calcium and American Sulphur, cotton seed oil, soap, gasoline, oil, kerosene and coal.

Food: includes sugar, coffee, salt, linseed oil, wheat flour, rice, potatoes, lard, fresh meat, egg, butter, cheese, milk, beer, wine, tobacco leaves and cigars.

Leather: includes sole, shoes, calfskin, leather of swine.

Paper: includes paper tissue.

All Brazilian prices pertain to 1947 and originate from Bulhões (1948), with the following exceptions: barbed wire, prices of 1940; sole, prices of 1946.

All American prices pertain to 1947 and originate from Statistical Abstract of the United States, 1939–1949, with the exception of the following cases: bleaked cotton cloth, prices from 1948; potatoes, prices from NBER macro-economic database; leather of swine, unit values from Census of Manufactures 1947 (p. 481); tobacco leaves, unit values from Census of Manufactures 1947 (p. 151); tissue paper, unit values from Census of Manufactures 1947 (p. 323); sole, prices from 1946; beer, unit values from Census of Manufactures 1947 (p. 133); wine, unit values of Census of Manufactures 1947 (p. 134); barbed wire, prices of 1940 from NBER macro-economic database; Portland Cement, unit value from Census of Manufactures 1947 (p. 504); bicarbonate of soda, carbonate of soda and American Sulphur, prices from Census of Manufactures 1947 (p. 386); potatoes, prices from NBER macro-economic database.

Table B.4. Adjustment factor: ratio Value Added per Labour at current prices of 1949 over Value Added per Labour at current prices of 1947, United States.

	1947	1948	1949	Ratio 1949/1947
Manufacturing	4.44	4.80	5.10	1.15
Lumber and basic timber products	2.68	2.92	2.63	0.98
Furniture and finished lumber products	3.79	4.34	4.49	1.18
Stone, clay, and glass products	4.39	4.80	5.22	1.19
Metals and their products	4.69	5.00	5.55	1.18
Machinery, except electrical	3.25	3.63	4.13	1.27
Electric and electronic equipment	6.00	6.40	7.35	1.23
Transportation equipment	5.37	6.10	7.34	1.37
Miscellaneous manufacturing	2.30	2.39	2.56	1.12
Food and beverages and tobacco	7.05	7.74	7.85	1.11
Textile mill products	3.59	3.79	3.51	0.98
Apparel and leather	2.83	3.07	2.78	0.98
Paper and allied products	5.70	5.77	5.66	0.99
Printing and publishing	1.93	2.02	2.11	1.10
Petroleum and coal products	8.38	9.51	8.86	1.06
Chemicals and allied products	5.95	6.59	7.56	1.27
Plastics and rubber products	6.84	6.60	7.45	1.09
Chemicals and petroleum	6.56	7.32	7.89	1.20
Paper and printing	3.39	3.46	3.43	1.01
Textiles and apparel	3.18	3.40	3.10	0.98

Source: author´s estimates based on BEA data for the United States.

Table B.5. Detailed list of matched items, coverage ratio, initial UVR and intermediate UVR, Uruguay vs US, 1988.

Mayor branches	Number of UVRs (matched items)	Coverage ratio (% of matched sales)			Initial UVR		Intermediate UVR	
Branches Industries		UY (1988)	USA (1987)	Average	UY (1988)	USA (1987 adj to 1988)	UY (1988)	USA (1988)
Food and beverages and tobacco	28	45%	28%	35%	232	275	232	275
Food products	19	44%	22%	31%	230	322	230	322
Meat	10	66%	53%	59%	180	222	180	222
Dairy products	5	46%	36%	41%	261	541	261	541
Grain mill products	4	81%	11%	31%	431	434	431	434
Beverage products	8	60%	72%	66%	243	202	243	202
Malt beverage	1	66%	96%	80%	309	223	309	223
Wines	4	46%	64%	55%	272	229	272	229
Distilled and Blended Liquors	1	5%	67%	18%	37	25	243	202
Soft Drinks and Carbonated Water	2	85%	76%	80%	247	207	247	207
Tobacco	1	3%	10%	6%	121	121	232	275
Tobacco products	1	3%	10%	6%	121	121	232	275
Textiles, wearing apparel and leather products	26	19%	26%	22%	278	356	278	356
Textiles	15	31%	38%	34%	281	361	281	361
Broadwoven fabrics and yarns	7	33%	81%	52%	273	339	273	339
Others	8	18%	10%	13%	414	483	281	361
Wearing apparel	2	0%	1%	0%	473	487	278	356
Footwear and leather products	9	10%	56%	24%	260	312	260	312
Footwear	3	43%	93%	64%	260	305	260	305
Other leather products	6	2%	25%	7%	258	331	260	312

Source: based on Lara (2012).

Cont Table B.5. Detailed list of matched items, coverage ratio, initial UVR and intermediate UVR, Uruguay vs US, 1988.

Mayor branches	Number of UVRs (matched items)	Coverage ratio (% of matched sales)			Initial UVR		Intermediate UVR	
Branches Industries		UY (1988)	USA (1987)	Average	UY (1988)	USA (1987 adj to 1988)	UY (1988)	USA (1988)
Chemicals, petroleum, rubber plastic	15	41%	22%	30%	415	426	415	426
Chemical products	8	16%	3%	7%	204	299	415	426
Soap and detergent	4	26%	44%	34%	100	224	100	224
Fertilizers and pesticides	4	78%	26%	45%	337	436	337	436
Petroleum and products	4	86%	66%	75%	516	418	516	418
Petroleum refining	4	86%	73%	80%	516	418	516	418
Rubber and plastic	3	22%	3%	7%	811	1169	415	426
Tires and inner tubes	2	62%	18%	33%	1258	1356	1258	1356
Fabricated Rubber Prod, N.E.C.	1	15%	6%	10%	131	131	415	426
Basic metals & products	12	3%	9%	5%	69	580	281	402
Basic metals & products	12	3%	9%	5%	69	580	281	402
Basic metals	8	10%	18%	14%	88	588	281	402
Fabricated structure, hand tools, heating sanitare ware	4	0.1%	3%	1%	11	475	281	402
Machinery, electrical transport equipment	3	33%	11%	19%	380	372	281	402
Electrical machinery	0	0%	0%	0%			281	402
Machinery and transport equipment	3	50%	15%	27%	380	372	380	372
Motor vehicles	3	69%	58%	64%	380	372	380	372

Source: based on Lara (2012).

Cont Table B.5. Detailed list of matched items, coverage ratio, initial UVR and intermediate UVR, Uruguay vs US, 1988.

Mayor branches	Number of UVRs (matched items)	Coverage ratio (% of matched sales)			Initial UVR		Intermediate UVR	
Branches Industries		UY (1988)	USA (1987)	Average	UY (1988)	USA (1987 adj to 1988)	UY (1988)	USA (1988)
Other industries	29	11%	6%	8%	407	673	281	402
Wood and furniture	20	10%	22%	14%	292	745	281	402
Logging, sawmill, flooring mills and millwork	5	10%	43%	21%	240	789	281	402
Furniture	15	11%	15%	13%	342	629	281	402
Paper, printing and publishing	1	1%	2%	1%	137	137	281	402
Non-metallic minerals	4	30%	6%	13%	501	880	281	402
Cement	2	89%	59%	72%	599	626	599	626
Concrete, plaster and cut stone products	2	2%	5%	3%	43	1438	281	402
Other manufacturing	4	6%	1%	2%	375	520	281	402
Orthopedic and opthalmic instruments	2	5%	4%	5%	658	532	281	402
Other manufacturing	2	7%	0%	1%	290	317	281	402
Total manufacturing	113	32%	15%	22%	281	402		

Source: based on industrial censuses and surveys. For more explanations see Lara (2012).

Table B.6. Product items, unit of measure, quantities, unit value in local currency, and unit value ratios. Brazil and Sweden, 1975.

	Brazil 1975			Sweden 1975			Brazilian unit price	Sweden unit price	Unit value ratios
Product	Unit	Quantity	Value (thousand cruzeiros)	Unit	Quantity	Value (thousand kroner)			
Food									
fruit juice	mil L	5,731,435	283,047	1000 l	140,222	359,595	0.05	2.6	0.02
rice bran	T	258,425	193,414	T	267	1,306	0.7	4.9	0.2
rye flour	kg	426	1,778	T	76,975	93,171	4.2	1.2	3.4
barley flour	kg	885	2,049	T	3,162	3,171	2.3	1.0	2.3
wheat flour	T	3,048,093	4,420,735	T	366,244	541,173	1.5	1.5	1.0
oat flour	T	11,383	41,111	T	1,493	3,062	3.6	2.1	1.8
cereal sprouts	kg	56,816	78,720	T	734	598	1.4	0.8	1.7
crushed wheat	T	11,027	16,267	T	2,923	5,241	1.5	1.8	0.8
tomato puree	kg	69,851	598,041	T	212	2,107	8.6	9.9	0.9
mustard (condiment)	kg	641	3,704	T	5,661	28,203	5.8	5.0	1.2
spices	kg	13,631	134,939	T	2,066	42,546	9.9	20.6	0.5
soups and broths	kg	9,147	185,994	T	5,108	56,756	20.3	11.1	1.8
poultry (fresh and frozen)	T	380,158	2,270,246	T	38,590	274,217	6.0	7.1	0.8
lard	T	96,866	668,086	T	6,694	11,360	6.9	1.7	4.1
venison, horse and goat meat	T	31,241	280,289	T	996	16,578	9.0	16.6	0.5
dried meat	T	122,911	1,322,332	T	2,718	44,214	10.8	16.3	0.7
horns, hooves, nails	kg	2,121	2,360	T	629	38	1.1	0.1	18.4
fowl liver	kg	13,883	35,511	T	217	2,205	2.6	10.2	0.3
beef	T	1,615,672	13,421,705	T	88,239	809,301	8.3	9.2	0.9
lamb	T	9,911	66,354	T	3,302	27,961	6.7	8.5	0.8
pork	T	204,397	2,108,147	T	226,268	1,594,110	10.3	7.0	1.5
blood	kg	1,916	847	T	8,874	5,498	0.4	0.6	0.7
bones	T	46,453	30,075	T	24,643	13,916	0.6	0.6	1.1
sausages	kg	42,373	612,337	T	137,813	1,255,749	14.5	9.1	1.6

Cont.Table B.6. Product items, unit of measure, quantities, unit value in local currency, and unit value ratios. Brazil and Sweden, 1975.

	Brazil 1975			Sweden 1975			Brazilian unit price	Sweden unit price	Unit value ratios
Product	Unit	Quantity	Value (thousand cruzeiros)	Unit	Quantity	Value (thousand kroner)			
fish (fresh, refrigerated, frozen)	T	76,533	382,834	T	12,621	48,700	5.0	3.9	1.3
fish (salted, dried, smoked)	kg	18,506	107,287	T	4,298	45,247	5.8	10.5	0.6
fish (preserved)	T	127,747	485,818	T	19,399	222,409	3.8	11.5	0.3
crustaceans and molluscs (conserved and dried)	T	14,551	7,706	T	1,505	35,236	0.5	23.4	0.0
fermented milk and yoghurt	kg	22,967	149,246	T	132,081	141,445	6.5	1.1	6.1
cream	T	76,664	450,560	T	114,207	649,897	5.9	5.7	1.0
condensed milk	T	41,103	416,715	T	8,982	11,683	10.1	1.3	7.8
skimmed milk powder	T	129,004	1,831,439	T	49,383	223,721	14.2	4.5	3.1
milk	mil L	5,224,272	8,706,513	T	1,800,779	1,751,382	1.7	1.0	1.7
butter	T	47,274	770,431	T	43,999	375,030	16.3	8.5	1.9
fresh cheese	kg	24,965	325,612	T	4,555	29,217	13.0	6.4	2.0
processed cheese	kg	19,314	291,006	T	4,645	45,203	15.1	9.7	1.5
parmesan cheese	kg	10,326	218,331	T	75,042	594,053	21.1	7.9	2.7
whey	L	5,983	532	T	113,105	22,007	0.1	0.2	0.5
raw sugar	T	925,951	1,076,338	T	134,669	269,382	1.2	2.0	0.6
molasses	T	2,633,377	598,430	T	58,782	16,730	0.2	0.3	0.8
candies	kg	204,500	1,367,382	T	35,246	328,308	6.7	9.3	0.7
chocolate candies	kg	24,030	540,753	T	33,473	438,992	22.5	13.1	1.7
chocolate bars	T	28,318	485,880	T	2,881	23,174	17.2	8.0	2.1
cocoa powder	T	11,418	86,706	T	3,856	33,198	7.6	8.6	0.9
bread (different kinds)	T	1,849,917	5,986,403	T	288,946	1,192,106	3.2	4.1	0.8

Cont. Table B.6. Product items, unit of measure, quantities, unit value in local currency, and unit value ratios. Brazil and Sweden, 1975.

	Brazil 1975			Sweden 1975			Brazilian unit price	Sweden unit price	Unit value ratios
Product	Unit	Quantity	Value (thousand cruzeiros)	Unit	Quantity	Value (thousand kroner)			
cookies and wafers	kg	419,452	2,311,802	T	27,932	250,954	5.5	9.0	0.6
pasta	T	548,307	1,939,150	T	12,587	43,633	3.5	3.5	1.0
pudding mix	T	3,548	38,819	T	163	1,065	10.9	6.5	1.7
ice cream powder	T	7,951	103,801	T	313	3,034	13.1	9.7	1.3
cocoa butter and cocoa powder (no sugar)	kg	12,393	83,925	T	1,349	18,846	6.8	14.0	0.5
fodder (of animal origin)	kg	112,403	163,629	T	24,871	22,915	1.5	0.9	1.6
fish flour (and flour made of crustaceans and molluscs)	T	99,883	100,008	T	24,109	23,518	1.0	1.0	1.0
natural yeast and baking soda	kg	65,611	309,650	T	9,886	30,004	4.7	3.0	1.6
margarine	T	141,051	1,226,843	T	147,202	747,308	8.7	5.1	1.7
peanut oil	T	14,568	110,618	T	1,350	6,101	7.6	4.5	1.7
cottonseed oil	T	79,356	551,690	T	1,185	5,923	7.0	5.0	1.4
corn (maize) oil	T	19,626	206,907	T	1,103	9,493	10.5	8.6	1.2
soybean oil	T	615,468	4,286,653	T	11,471	38,050	7.0	3.3	2.1
Beverage									
spirit	1000 l	743,416	2,111,692	1000 l	37,818	157,794	2.8	4.2	0.7
sparkling wine	1000 l	26,833	81,585	1000 l	2,178	7,060	3.0	3.2	0.9
vermouth (and other types of wine)	1000 l	57,308	300,287	1000 l	4,134	12,167	5.2	2.9	1.8

Cont. Table B.6. Product items, unit of measure, quantities, unit value in local currency, and unit value ratios. Brazil and Sweden, 1975.

	Brazil 1975			Sweden 1975			Brazilian unit price	Sweden unit price	Unit value ratios
Product	Unit	Quantity	Value (thousand cruzeiros)	Unit	Quantity	Value (thousand kroner)			
beer	1000 l	1,584,713	3,080,898	1000 l	456,206	897,380	1.9	2.0	1.0
water (still and sparkling)	1000 l	303,494	150,117	1000 l	53,968	71,849	0.5	1.3	0.4
sparkling beverages	1000 l	2,060,271	2,732,792	1000 l	250,638	391,307	1.3	1.6	0.8
Tobacco									
cigars and cigarillos	1000	169,211	57,793	1000 st	247,493	36,548	0.3	0.1	2.3
tobacco (for smoking and chewing)	kg	218,818	1,942,686	T	6,053	110,513	8.9	18.3	0.5
cigarettes	1000	95,528,436	3,846,799	1000 st	10,319,321	333,704	0.04	0.03	1.2
Textile and clothing									
gloves	pair	117,158	585	dozen pair	18	1,262	0.00	70.1	0.00
female underwear	1000	43,021	148,230	1000 st	374	42,044	3.4	112.4	0.03
male underwear	1000	23,990	143,291	1000 st	1,017	55,085	6.0	54.2	0.1
bathing suits	1000	520	19,161	1000 st	56	17,183	36.8	306.8	0.1
jumpers, pullovers, sweaters, etc.	1000	1,017	56,353	1000 st	9,720	168,601	55.4	17.3	3.2
socks and stockings	dozen	496,660	420,161	dozen pair	2,080	216,912	0.8	104.3	0.01
trousers	1000	78,706	3,578,518	1000 st	6,407	313,139	45.5	48.9	0.9
shorts	1000	22,996	314,473	1000 st	437	5,342	13.7	12.2	1.1
bra	dozen	25,164	329,266	1000 st	1,855	20,805	13.1	11.2	1.2

Cont. Table B.6. Product items, unit of measure, quantities, unit value in local currency, and unit value ratios. Brazil and Sweden, 1975.

	Brazil 1975			Sweden 1975			Brazilian unit price	Sweden unit price	Unit value ratios
Product	Unit	Quantity	Value (thousand cruzeiros)	Unit	Quantity	Value (thousand kroner)			
nightwear	1000	19,223	534,282	1000 st	493	9,817	27.8	19.9	1.4
jackets and coats	1000	2,658	309,915	1000 st	2,087	261,945	116.6	125.5	0.9
blazer	un (1st)	1,006	229,585	1000 st	584	89,751	228.3	153.7	1.5
swimming clothes	1000	4,819	195,216	1000 st	64	3,761	40.5	58.8	0.7
bath and morning robes	dozen	1,123	47,410	1000 st	49	3,683	42.2	75.2	0.6
skirts	1000	8,071	268,660	1000 st	1,940	80,741	33.3	41.6	0.8
dresses	un (1st)	22,849	885,027	1000 st	1,303	79,045	38.7	60.7	0.6
ties	1000	2,981	50,817	1000 st	1,594	20,826	17.0	13.1	1.3
gloves (not jersey)	par	1,521	25,645	1000 par	114	1,846	16.9	16.2	1.0
scarves	un (1st)	104	1,773	1000 st	128	802	17.1	6.3	2.7
bed linen	un (1st)	3,420	75,922	1000 st	1,466	47,523	22.2	32.4	0.7
blankets	un (1st)	13,547	551,095	1000 st	320	14,608	40.7	45.7	0.9
winter caps	1000 st	3,095	23,572	1000 st	1,857	24,885	7.6	13.4	0.6
men's hats	un (1st)	19,087	150,267	1000 st	61	2,018	7.9	33.1	0.2
women's hats	un (1st)	21	1,366	1000 st	1,777	17,411	65.1	9.8	6.6
Footwear									
leather boots and ski boots	par	3,145	227,459	1000 par	949	56,751	72.3	59.8	1.2
leather shoes and sandals	par	106,849	4,788,578	1000 par	2,578	134,147	44.8	52.0	0.9
plastic slippers,and sandals	par	19,528	275,658	1000 par	101	2,834	14.1	28.1	0.5
sports shoes	par	33,660	606,848	1000 par	1,282	51,295	18.0	40.0	0.5
leather slippers	par	4,108	96,528	1000 par	470	8,596	23.5	18.3	1.3

Cont. Table B.6. Product items, unit of measure, quantities, unit value in local currency, and unit value ratios. Brazil and Sweden, 1975.

	Brazil 1975			Sweden 1975			Brazilian unit price	Sweden unit price	Unit value ratios
Product	Unit	Quantity	Value (thousand cruzeiros)	Unit	Quantity	Value (thousand kroner)			
Stone, clay and glass									
Cement	t	16,717,194	5,566,926	t	3,406,146	450,554	0.3	0.1	2.5
Roof tiles, building ornaments and other	1000 units	1,001,207	578,833	1000 st	7,599	8,658	0.6	1.1	0.5
Iron and steel									
Mica slate	1000 units	230,000	22,525	units	90	20	0.1	0.2	0.4
different steal wires	t	697,115	2,679,605	t	20,721	109,001	3.8	5.3	0.7
4 different types of steel bar	t	687,034	2,540,068	t	3,953,583	196,138	3.7	0.0	74.5
steel	t	2,682,660	5,578,944	t	538,932	136,523	2.1	0.3	8.2
pig iron	t	6,812,964	5,456,636	t	28,296	17,782	0.8	0.6	1.3
railway	t	195,961	565,058	t	43,740	43,244	2.9	1.0	2.9
iron tubes	t	935,774	3,461,609	t	78,901	245,303	3.7	3.1	1.2
reinforcing bar	t	724,078	1,986,300	t	1,768,428	1,748,600	2.7	1.0	2.8
aluminium ingots	t	57,589	469,914	t	184,295	410,679	8.2	2.2	3.7
liquid aluminium	t	76,877	458,789	t	3,151	18,665	6.0	5.9	1.0
copper wire	t	35,505	600,650	t	1,280	9,279	16.9	7.2	2.3
aluminium wire	t	10,958	114,797	t	6,048	31,302	10.5	5.2	2.0
aluminium tubes	t	3,040	68,918	t	5,718	52,740	22.7	9.2	2.5
copper tubes	t	1,258	31,842	t	14,700	177,752	25.3	12.1	2.1
aluminium plates	t	6,935	89,183	t	47,619	322,998	12.9	6.8	1.9
gold, unprocessed	t	4,112	170,313	t	1,846	38,406	41.4	20.8	2.0
iron and steel chains	t	9,785	176,027	t	45,578	196,116	18.0	4.3	4.2
staples but not for paper	t	11,891	110,566	t	193	2,826	9.3	14.6	0.6

Cont. Table B.6. Product items, unit of measure, quantities, unit value in local currency, and unit value ratios. Brazil and Sweden, 1975.

	Brazil 1975			Sweden 1975			Brazilian unit price	Sweden unit price	Unit value ratios
Product	Unit	Quantity	Value (thousand cruzeiros)	Unit	Quantity	Value (thousand kroner)			
Metal products and Mechanical engineering									
steam turbine	units	434	47,899	units	179	154,669	110.4	864.1	0.1
different types of ovens for industrial purposes	units	3,521	214,638	units	191	2,121	61.0	11.1	5.5
washing machine	units	1,672	47,822	units	71,657	90,365	28.6	1.3	22.7
refrigeration and freezer furniture	units	48,423	150,789	units	485,598	386,412	3.1	0.8	3.9
sewing machines	units	31,241	216,836	units	51	162	6.9	3.2	2.2
plows	units	135,847	305,721	units	11,389	51,704	2.3	4.5	0.5
gas oven	units	1,652,849	941,317	units	3,720	2,302	0.6	0.6	0.9
3 different screws	t	99,172	1,348,310	t	1,957	17,012	13.6	8.7	1.6
nuts	t	257,128	682,256	t	52,588	477,551	2.7	9.1	0.3
nails	t	87,385	483,279	t	26,078	103,595	5.5	4.0	1.4
tweezers and pliers	1000 units	3,216	41,444	1000 st.	1,319	26,441	12.9	20.0	0.6
lie	1000 units	2,476	31,898	1000 st.	12	250	12.9	20.8	0.6
hammer	dozens	1,991	31,770	1000 st.	510	9,865	16.0	19.3	0.8
shovels	1000 units	2,340	34,015	1000 st.	918	14,318	14.5	15.6	0.9
shears	dozen	21	3,664	1000 st.	40	2,899	175.3	72.5	2.4
Leather									
Calf skin	sq meters	134,624	63,185	1000 sq foot	896	5,335	0.5	6.0	0.1

Cont. Table B.6. Product items, unit of measure, quantities, unit value in local currency, and unit value ratios. Brazil and Sweden, 1975.

	Brazil 1975			Sweden 1975			Brazilian unit price	Sweden unit price	Unit value ratios
Product	Unit	Quantity	Value (thousand cruzeiros)	Unit	Quantity	Value (thousand kroner)			
Chemicals									
chloridric acid	kg	56,771	25,504	t	200,424	11,557	0.4	0.1	7.8
fosforic acid	kg	277,478	412,013	t	121,070	50,144	1.5	0.4	3.6
chlorette	kg	17,820	35,758	t	18,516	18,547	2.0	1.0	2.0
potassium chlorate	kg	10,384	26,874	t	84,582	91,809	2.6	1.1	2.4
peroxide	kg	1	40	t	5,066	9,789	71.4	1.9	37.0
Sulfuric acid	kg	1,037,807,064	399,198	t	792,593	59,962	0.4	0.1	5.1
Polymerization products, copolymers	tones	305,152	2,406,407	t	318,337	807,459	7.9	2.5	3.1
Other carbonates	kg	20,359,643	34,648	t	1,065	9,545	1.7	9.0	0.2
Wood									
Wood boxes	cubic meter	252,705	267,458	cubic meter	89,900	38,602	1.1	0.4	2.5
wood wool	ton	3,578	4,836	ton	3,037	1,236	1.4	0.4	3.3
pressure-creosoted	cubic meter	8,644	16,500	cubic meter	191,827	129,650	1.9	0.7	2.8
batten	cubic meter	5,867,641	3,664,045	cubic meter	4,361,187	1,872,225	0.6	0.4	1.5
batten	cubic meter	3,123,489	2,828,029	cubic meter	3,582,203	1,763,670	0.9	0.5	1.8
wood-flour	ton	3	1	ton	5,665	2,530	0.3	0.4	0.7
coffin	units	347,788	123,974	st.	86,061	34,323	0.4	0.4	0.9
wood house	units	2,246	161,814	st	22,246	1,685,323	72.0	75.8	1.0
parquet block	square meter	5,858,320	162,235	1000 square meters	3,297	130,623	27.7	39.6	0.7
plywood	square meter	44,835,921	1,029,025	1000 square meters	60,553	136,305	23.0	2.3	10.2
particle board	square meter	102,398,000	924,470	1000 square meters	609,667	436,345	9.0	0.7	12.6

Cont. Table B.6. Product items, unit of measure, quantities, unit value in local currency, and unit value ratios. Brazil and Sweden, 1975.

	Brazil 1975			Sweden 1975			Brazilian unit price	Sweden unit price	Unit value ratios
Product	Unit	Quantity	Value (thousand cruzeiros)	Unit	Quantity	Value (thousand kroner)			
Paper									
cellulose and mechanical pulp	tones	1,465,115	2,616,443	tones	5,165,661	8,011,934	1.8	1.6	1.2
paper for packaging and prepared for packaging	tones	324,472	1,082,743	tones	87,041	134,750	3.3	1.5	2.2
HD paper + kraft paper + shrink paper	tones	410,010	1,443,902	tones	1,569,227	2,831,624	3.5	1.8	2.0
writing papers and notepaper	tones	29,644	171,073	tones	68,083	205,028	5.8	3.0	1.9
parchment paper or sulphite	tones	174,641	888,210	tones	876	4,462	5.1	5.1	1.0
papers for printing, coated, florpost, offset, satin & gummed	tones	243,720	964,280	tones	160,901	401,992	4.0	2.5	1.6
paper for mimeograph	tones	93	876	tones	7,725	41,397	9.4	5.4	1.8
Newsprint	tones	139,658	434,930	tones	1,438,752	2,049,768	3.1	1.4	2.2
Paper rolls for machines	tones	2,386	18,732	tones	4,037	19,328	7.9	4.8	1.6
Toilet paper	tones	80,932	558,645	tones	61,893	230,414	6.9	3.7	1.9
Envelopes	tones	19,862	75,662	tones	17,940	154,095	3.8	8.6	0.4
napkins and paper towels	tones	9,934	116,292	tones	29,688	131,921	11.7	4.4	2.6
waterproof bags, kraft paper bags, multi-coated paper bags paper bags (N.E.)	tones	188,223	1,238,674	tones	31,166	137,565	6.6	4.4	1.5

Source: based on industrial censuses. For more explanations see Lara and Prado (2018b).

APPENDIX C

Table C.1. Value added per labour, Brazil, at constant cruzeiros of 1970.

	Food and beverages	Tobacco	Textiles	Wood and furniture	Paper and printing	Leather and rubber and apparel	Chemical	Non metallic minerals	Metals	Total
1945	5,735	9,169	3,728	4,508	7,319	5,088	21,755	4,832	10,499	6,453
1946	6,576	8,795	3,569	4,536	7,389	4,822	23,415	4,784	11,151	6,732
1947	7,440	9,611	4,692	5,338	8,727	5,779	24,446	5,539	11,945	7,711
1948	9,495	12,086	5,397	6,181	10,144	6,657	24,939	6,313	13,423	8,869
1949	12,218	14,168	6,117	6,942	11,437	7,600	29,220	6,978	13,983	10,249
1950	13,300	14,788	5,846	7,380	12,581	8,211	34,258	8,310	16,127	11,218
1951	13,758	12,629	4,709	6,798	11,982	7,675	32,727	8,559	16,843	10,836
1952	13,284	13,535	5,777	7,039	12,815	8,600	35,317	9,890	20,573	11,998
1953	13,953	18,555	6,571	7,040	13,231	8,515	41,693	8,524	12,361	11,406
1954	15,523	15,314	6,260	6,765	12,869	8,023	37,696	9,049	13,146	11,733
1955	15,660	15,841	6,653	7,360	13,408	9,118	39,057	8,770	14,432	12,218
1956	18,266	20,463	6,929	7,364	13,115	9,180	44,382	8,603	15,028	13,068
1957	17,345	24,969	6,896	7,502	13,129	10,032	59,010	9,984	17,740	14,643
1958	21,038	28,991	7,225	8,515	15,277	9,916	54,623	11,238	15,584	15,132
1959	22,479	23,055	8,307	7,737	16,938	12,883	53,213	10,950	17,139	16,561
1960	23,484	27,203	9,011	8,828	18,045	12,112	57,091	11,797	22,102	18,297
1961	25,122	32,811	8,790	9,369	17,705	11,877	61,081	11,705	23,288	19,075
1962	23,090	37,163	9,228	9,688	16,745	11,062	55,411	11,196	20,574	17,828
1963	24,650	31,843	8,704	10,727	19,859	13,425	54,395	12,799	20,492	18,888
1964	21,725	29,561	9,955	10,666	16,574	14,093	50,954	12,756	20,248	18,316
1965	22,459	29,549	11,417	9,643	17,984	14,413	51,328	13,982	19,508	18,914
1966	28,442	24,107	12,524	11,864	20,363	14,767	67,442	14,914	24,248	23,328
1967	27,093	32,290	11,337	10,703	22,303	12,948	55,009	16,349	23,859	22,037
1968	26,103	41,357	12,551	11,677	21,557	14,532	60,894	17,901	24,741	23,105
1969	28,326	48,210	14,723	12,900	22,789	15,756	48,431	18,633	27,476	24,026
1970	26,330	56,025	15,827	12,916	25,950	16,508	58,885	17,684	27,357	24,628
1971	27,557	55,062	18,291	14,195	27,374	18,156	63,653	20,053	30,627	27,290
1972	31,193	51,537	22,275	14,315	30,143	19,084	66,896	22,960	34,418	30,579
1973	33,414	51,878	26,211	14,846	35,001	19,363	74,567	24,138	36,787	33,161
1974	36,300	64,194	29,466	16,409	40,645	23,507	74,788	29,110	43,043	37,266
1975	37,155	62,065	35,246	19,106	43,087	23,608	79,093	31,976	40,214	37,878
1976	39,933	63,129	39,696	19,335	44,619	28,430	89,346	35,379	45,170	42,184
1977	41,173	58,269	41,356	19,385	44,648	30,098	78,388	36,236	47,812	42,905
1978	40,821	56,358	47,436	19,572	46,560	31,598	84,551	36,662	50,781	45,189
1979	40,171	60,051	63,832	19,382	51,986	35,678	87,154	36,458	53,708	48,988
1980	36,965	78,742	74,294	17,002	54,805	43,000	80,010	34,450	61,203	51,538

Source: See explanatory notes for Brazil.

Table C.2. Number of labourers, Brazil.

	Food and beverages	Tobacco	Textiles	Wood and furniture	Paper and printing	Leather and rubber and apparel	Chemical	Non metallic minerals	Metals	Total
1945	173,755	11,776	267,743	70,356	45,584	75,317	49,249	76,805	97,151	867,736
1946	181,453	11,716	277,398	74,330	48,196	79,172	52,088	83,515	103,564	911,433
1947	189,601	11,657	287,401	78,552	50,966	83,236	55,092	90,811	110,464	957,781
1948	198,235	11,598	297,764	83,037	53,906	87,522	58,268	98,745	117,894	1,006,970
1949	207,395	11,539	308,501	87,803	57,027	92,041	61,628	107,372	125,902	1,059,208
1950	199,224	12,180	308,793	90,757	57,789	93,786	61,548	106,339	130,995	1,061,411
1951	191,436	12,856	309,085	93,827	58,599	95,620	61,467	105,317	136,412	1,064,619
1952	184,013	13,570	309,377	97,020	59,457	97,544	61,387	104,304	142,185	1,068,857
1953	198,366	13,546	327,889	111,960	63,564	112,183	60,767	109,914	164,706	1,162,895
1954	197,102	12,351	331,792	109,082	64,036	108,285	75,206	113,051	174,137	1,185,042
1955	191,871	12,085	346,734	110,707	68,222	111,424	75,323	112,805	178,405	1,207,576
1956	183,468	10,872	337,409	112,938	68,904	109,174	69,988	106,466	196,973	1,196,192
1957	169,324	10,630	291,527	102,340	68,624	104,711	65,673	104,960	188,686	1,106,475
1958	171,849	10,498	308,750	106,828	71,941	115,850	73,349	106,237	217,260	1,182,562
1959	221,323	10,832	297,303	118,259	77,229	117,775	85,167	131,705	239,409	1,299,002
1960	215,460	11,627	306,886	117,257	80,069	120,105	85,919	127,870	262,997	1,328,192
1961	209,779	12,481	316,778	116,265	83,067	122,742	86,678	124,146	289,081	1,361,017
1962	204,272	13,398	326,989	115,283	86,231	125,725	87,443	120,531	317,949	1,397,821
1963	230,295	13,747	318,664	105,384	81,068	111,952	94,266	119,755	321,339	1,396,470
1964	244,311	13,863	317,176	107,581	88,663	124,846	98,121	125,425	343,338	1,463,324
1965	237,947	13,875	280,432	107,130	84,796	121,093	95,763	115,294	324,758	1,381,088
1966	216,228	16,554	270,767	112,211	88,307	128,082	116,667	117,594	318,758	1,385,168
1967	211,475	16,112	260,540	112,176	95,309	133,150	123,170	115,525	332,059	1,399,516
1968	220,176	13,932	281,038	122,462	99,855	141,779	129,226	125,916	362,524	1,496,908
1969	227,821	13,644	270,393	123,227	102,032	136,934	133,424	129,247	369,838	1,506,560
1970	305,451	12,483	313,317	178,044	126,517	188,422	151,686	171,066	470,971	1,917,957
1971	292,848	13,458	298,174	160,654	122,093	179,365	151,150	156,464	479,335	1,853,540
1972	280,788	14,510	283,762	144,976	118,080	170,949	150,615	143,108	488,282	1,795,070
1973	351,546	16,992	332,009	218,786	148,654	258,767	201,185	179,523	688,049	2,395,511
1974	344,066	16,705	316,979	227,699	151,020	274,924	197,316	186,919	778,621	2,494,249
1975	378,648	18,904	304,576	252,076	156,992	334,026	208,405	224,491	870,841	2,748,959
1976	393,561	20,511	323,853	261,235	166,442	355,497	222,786	224,065	914,908	2,882,858
1977	415,620	23,746	319,820	265,016	171,090	364,051	233,908	244,650	973,813	3,011,714
1978	431,732	24,249	327,506	281,201	181,654	410,153	250,720	255,633	1,022,934	3,185,782
1979	445,241	26,784	337,682	286,372	189,450	427,924	273,971	260,421	1,065,635	3,313,480
1980	480,707	16,032	345,682	328,007	191,795	484,563	275,659	308,663	1,134,630	3,565,738

Source: See explanatory notes for Brazil.

Explanatory notes: Brazil

IBGE started offering annual figures for output and employment in manufacturing in 1952. In 1949, the Census of Brasil provides information on value added and number of workers. Colistete (2007) filled the gap between 1949 and 1952 by linear interpolation. In this work this procedure as the best way to establish a time series of labour productivity that begins in 1949. Before 1949, the supply of information is scarce.

Series of labour and value added per labour at constant cruzeiros of 1970

For the long-term series of labour and value added per labour, I used the series kindly provided by Colistete for the 1945–1980 period.

Criteria adopted:

- Metals are defined by metallurgical products.
- Machinery is defined by mechanical industry.
- Transport equipment and electrical material and communication series is defined by Colistete' series of "Material eletrico e material de comunicações".
- Rubber series excludes plastics.

Table C.3. Value added, Chile, at constant Chilean pesos of 1953.

	Food	Beverages	Tobacco	Textiles	Apparel
1939	3,939,336,172	835,449,526	2,064,495,868	2,148,553,721	467,003,752
1940	4,774,409,905	1,034,878,621	2,725,152,874	2,464,133,762	1,147,166,297
1941	5,140,829,235	822,815,818	2,924,789,885	2,488,147,917	930,004,789
1942	4,751,691,119	951,052,298	4,193,610,865	3,252,093,321	978,341,262
1943	4,412,942,157	941,063,139	2,938,780,167	3,644,237,975	1,231,576,197
1944	4,761,443,609	1,249,505,303	2,470,863,952	4,107,371,906	1,207,784,543
1945	5,115,228,695	1,369,817,772	3,704,600,462	4,562,573,319	1,199,835,152
1946	5,486,293,677	1,135,962,341	3,069,910,271	4,518,926,001	1,128,372,538
1947	5,605,770,242	1,505,256,888	2,775,821,670	4,876,142,214	929,193,952
1948	4,918,156,371	1,410,398,046	2,838,232,789	5,567,639,477	1,339,371,909
1949	6,065,386,682	1,598,810,590	2,978,360,184	6,124,687,490	1,385,093,628
1950	6,048,381,092	1,710,393,126	2,431,575,744	6,727,459,717	1,437,684,595
1951	6,179,434,679	1,884,742,043	2,027,727,894	6,359,399,831	1,215,689,272
1952	6,265,409,095	2,080,986,231	2,230,326,592	6,792,503,048	1,379,321,026
1953	6,622,988,000	2,087,024,000	2,141,079,000	7,844,788,000	1,610,712,320
1954	6,778,422,345	2,164,009,608	2,297,241,506	6,998,177,317	1,155,046,280
1955	8,163,001,990	1,827,064,500	2,817,227,911	7,278,246,246	1,179,266,455
1956	7,266,926,756	1,976,216,291	3,149,413,838	7,431,605,696	1,149,899,883
1957	9,447,331,624	2,655,379,878	2,416,513,719	6,804,005,919	2,209,743,883
1958	9,054,073,870	2,646,207,582	2,689,391,287	6,804,005,919	2,146,040,654
1959	9,785,716,203	2,804,429,699	2,981,961,050	7,833,801,409	2,391,703,525
1960	10,114,955,253	3,208,010,751	3,319,541,547	7,002,609,335	2,214,475,310
1961	10,380,175,599	3,249,286,086	3,589,605,944	7,561,641,173	2,604,026,435
1962	11,148,400,048	3,836,313,071	3,854,043,999	8,076,538,918	2,877,765,063
1963	11,623,967,565	3,588,661,062	3,398,310,329	9,349,071,917	2,761,952,566
1964	12,072,098,494	3,327,250,607	3,603,671,798	9,687,433,292	2,718,084,196
1965	12,373,900,956	4,157,343,454	3,882,175,707	10,099,351,488	2,904,086,085
1966	13,672,566,097	4,604,492,915	4,501,073,284	10,224,398,084	3,014,634,377
1967	13,654,275,039	4,888,834,111	4,771,137,681	11,062,945,840	2,902,331,350
1968	14,312,753,138	4,604,492,915	4,349,162,060	10,695,161,736	2,574,195,943
1969	14,183,938,360	4,328,223,340	4,501,382,733	11,122,968,206	2,793,002,599
1970	14,255,502,126	4,194,693,046	4,249,131,333	10,267,355,267	2,697,757,349
1971	15,414,835,130	5,290,562,359	5,353,818,496	11,775,373,072	3,060,718,977
1972	15,157,205,574	5,677,339,764	5,492,991,682	12,096,227,924	3,179,131,990
1973	14,599,008,201	6,183,833,985	5,710,449,785	10,855,589,163	3,014,383,450
1974	15,529,337,155	4,245,342,468	6,062,731,912	10,513,343,987	2,705,479,936
1975	14,570,382,695	4,015,117,822	5,253,787,769	6,673,780,924	2,234,402,079
1976	15,185,831,080	4,627,515,380	5,710,449,785	6,577,524,468	1,915,201,782
1977	14,641,946,461	5,553,018,456	6,127,969,343	7,262,014,819	2,262,718,234

1978	14,870,950,511	6,146,998,042	6,358,474,932	7,839,553,553	2,193,214,944
1979	15,142,892,821	6,796,231,543	6,441,109,011	7,743,297,097	2,208,660,119
1980	15,703,179,855	6,578,752,133	6,782,487,789	7,518,741,481	2,718,860,607

Cont. Table C.3. Value added, Chile, at constant Chilean pesos of 1953.

	Wood and furniture	Paper and printing	Leather and rubber and plastics	Chemicals	Petroleum
1939	1,718,427,261	1,004,233,601	1,428,833,531	1,870,674,915	
1940	1,587,352,028	1,151,205,216	1,326,414,649	2,151,771,766	
1941	2,115,008,826	1,523,590,030	1,582,134,570	2,573,435,506	
1942	2,601,360,472	1,512,065,998	1,430,348,942	2,718,159,077	
1943	3,259,416,687	1,544,504,105	1,737,822,594	2,684,386,807	
1944	2,047,776,867	1,499,354,075	1,833,553,423	2,932,277,544	
1945	1,743,862,386	1,652,140,992	2,129,646,697	3,557,462,938	
1946	1,789,450,589	1,850,477,770	2,202,666,667	4,305,405,121	
1947	2,066,983,054	1,896,579,996	2,160,816,231	4,999,817,466	
1948	1,723,695,374	1,831,357,496	2,410,172,298	4,151,954,619	
1949	1,631,106,055	2,163,977,655	2,550,907,849	5,118,598,046	
1950	1,554,494,738	2,106,655,697	2,808,834,751	5,437,088,169	
1951	1,517,850,631	1,922,154,713	1,921,577,078	4,201,153,473	207,051,794
1952	1,256,631,192	2,082,101,507	2,252,132,919	4,879,972,404	198,678,237
1953	1,555,298,000	2,760,359,000	2,594,914,680	4,070,568,000	270,651,000
1954	1,246,139,284	2,742,337,853	3,309,116,000	3,655,958,461	196,119,841
1955	787,652,715	1,865,536,524	2,324,115,549	2,790,416,905	425,436,799
1956	944,283,500	2,248,540,796	1,910,312,926	3,467,380,191	348,106,081
1957	1,681,875,414	2,188,706,425	2,560,328,494	4,575,239,501	715,659,385
1958	1,569,456,481	2,471,034,508	2,846,747,594	4,988,936,180	822,399,373
1959	1,774,455,712	2,586,089,839	3,182,089,202	4,968,456,146	858,934,537
1960	1,941,981,966	2,684,550,652	3,010,357,709	5,128,200,408	1,015,104,453
1961	1,864,831,717	3,154,507,430	3,442,482,445	5,513,225,039	1,120,411,690
1962	2,259,400,130	3,065,339,548	3,549,926,538	5,545,993,093	1,462,839,303
1963	2,160,206,954	3,316,691,195	3,523,030,531	5,562,377,120	1,482,897,824
1964	2,398,270,577	3,345,012,508	3,697,995,081	5,468,168,965	1,594,652,443
1965	2,629,721,323	3,719,163,596	3,936,088,677	5,414,920,878	1,586,055,934
1966	2,907,462,217	3,890,419,032	4,147,137,280	5,230,600,576	1,922,036,166
1967	2,504,076,632	3,859,442,596	3,899,124,438	5,029,896,247	2,290,253,307
1968	2,479,829,411	3,959,673,491	3,857,706,280	5,021,704,233	2,444,274,095
1969	2,385,595,894	3,945,796,371	4,050,696,460	5,634,352,150	2,632,483,200
1970	2,812,126,553	3,759,359,680	4,131,398,018	6,071,240,418	2,576,264,896
1971	2,705,493,888	4,652,120,593	4,841,791,332	7,231,254,096	3,143,336,486

1972	3,858,614,564	4,017,936,473	4,807,609,344	7,552,643,167	3,385,319,622
1973	2,995,633,929	4,032,423,520	4,499,089,462	7,412,035,449	3,167,779,227
1974	2,819,566,041	3,925,736,079	4,178,914,783	6,483,020,165	3,136,003,664
1975	1,532,534,576	3,436,121,801	2,488,189,462	4,002,298,274	2,710,699,971
1976	1,790,436,835	3,686,390,125	2,864,241,775	4,414,078,021	2,813,359,483
1977	1,482,937,988	4,070,901,163	3,392,767,989	5,559,026,586	2,920,907,544
1978	1,450,700,206	3,973,104,405	3,063,010,745	5,503,787,840	3,329,101,318
1979	2,068,177,729	4,324,703,514	3,153,695,616	6,267,086,883	3,485,534,860
1980	1,797,575,843	5,787,086,423	2,842,644,679	6,403,570,822	3,238,202,872

Cont. Table C.3. Value added, Chile, at constant Chilean pesos of 1953.

	Non metallic minerals	Metals	Total
1939	771,408,231	1,407,395,908	15,514,157,687
1940	1,000,791,141	1,758,242,201	17,976,555,739
1941	1,227,408,331	1,528,226,720	20,759,400,172
1942	1,383,726,820	1,159,917,058	22,844,133,113
1943	1,375,665,452	1,442,749,961	25,034,645,836
1944	1,360,196,241	2,369,097,233	26,941,891,039
1945	1,617,937,643	3,354,511,941	29,574,854,490
1946	1,883,357,397	3,525,845,941	29,819,150,996
1947	2,279,420,077	4,176,059,516	30,771,223,149
1948	2,312,436,655	4,198,363,850	31,727,599,440
1949	2,176,878,357	3,758,973,128	35,124,305,335
1950	2,338,674,107	4,739,645,690	37,678,726,530
1951	2,315,587,488	6,499,893,360	36,157,353,043
1952	2,266,309,112	6,194,498,966	38,566,813,799
1953	2,457,062,000	6,564,108,000	40,828,640,000
1954	2,661,291,254	9,127,737,682	51,056,133,403
1955	1,831,899,910	8,122,061,218	40,403,757,588
1956	2,148,753,727	8,778,131,682	41,091,215,452
1957	2,494,205,918	9,376,151,883	50,741,269,188
1958	2,665,938,129	9,663,080,153	52,099,544,080
1959	3,320,156,075	11,700,824,172	59,230,487,264
1960	3,033,935,723	11,119,853,709	57,823,702,554
1961	3,333,785,615	11,711,890,276	61,850,017,413
1962	3,767,205,004	13,858,714,464	67,768,215,158
1963	4,315,112,534	15,200,084,363	72,231,118,375
1964	4,009,810,826	17,282,092,799	75,772,335,058
1965	3,998,907,193	18,007,713,051	79,410,571,377
1966	4,227,883,474	20,196,430,347	84,940,690,581

1967	4,072,506,712	19,647,867,760	84,552,612,040
1968	4,309,660,717	19,795,679,293	84,310,062,952
1969	4,684,601,200	20,858,242,801	87,935,395,659
1970	4,434,640,878	20,583,516,119	87,682,465,470
1971	5,210,379,807	22,679,651,173	100,581,905,102
1972	5,309,502,004	23,137,687,209	103,364,137,179
1973	5,451,720,808	21,789,135,407	98,895,703,843
1974	5,865,448,236	23,811,246,475	95,186,061,073
1975	3,279,651,806	19,287,085,333	68,459,771,117
1976	3,408,941,627	18,559,021,072	71,832,173,635
1977	3,762,333,806	19,540,921,384	79,082,839,049
1978	4,150,203,271	24,373,183,601	84,984,543,456
1979	4,925,942,200	27,327,435,651	91,560,728,366
1980	6,502,800,550	28,971,172,668	97,512,175,710

Source: See explanatory notes for Chile.

Table C.4. Number of labourers, Chile.

	Food	Beverages	Tobacco	Textiles	Apparel
1939	21,763	3,509	1,628	17,085	3,834
1940	24,159	3,574	1,573	18,845	4,710
1941	24,635	3,660	1,539	20,855	4,580
1942	25,253	3,798	1,381	21,692	4,785
1943	25,084	3,932	1,711	22,258	5,343
1944	26,177	4,051	1,527	23,344	5,434
1945	26,746	4,463	1,481	24,671	6,780
1946	27,228	4,112	1,497	26,725	6,933
1947	27,689	4,421	1,422	29,163	6,459
1948	30,221	4,556	1,431	32,475	9,481
1949	30,283	4,489	1,423	35,337	11,316
1950	32,845	4,275	1,436	38,338	11,705
1951	30,978	4,648	1,358	39,387	12,982
1952	32,256	4,532	1,361	41,490	13,114
1953	31,149	4,899	1,315	39,639	12,840
1954	32,591	4,760	1,292	42,982	12,134
1955	33,036	4,685	1,307	43,330	12,261
1956	33,533	4,845	1,252	42,681	10,530
1957	35,765	5,195	1,241	37,194	18,981
1958	35,462	5,477	1,132	36,561	16,007
1959	35,161	5,774	1,033	35,939	13,499
1960	34,863	6,087	943	35,327	11,384
1961	33,803	6,311	1,072	34,742	12,030
1962	33,230	6,823	1,345	35,000	12,242
1963	35,550	7,120	1,369	36,907	11,871
1964	37,337	6,768	1,312	39,157	11,800
1965	38,695	6,947	1,412	40,881	12,201
1966	39,342	7,333	1,102	41,868	12,825
1967	39,647	7,473	1,160	43,858	13,097
1968	30,580	10,221	1,465	36,780	11,787
1969	31,350	7,466	1,385	37,061	9,427
1970	33,502	7,689	1,299	37,110	9,529
1971	34,514	7,107	1,478	36,539	9,279
1972	36,455	8,241	1,416	38,331	9,525
1973	37,816	9,220	1,528	39,081	9,441
1974	38,122	8,918	1,534	36,244	8,680
1975	41,352	8,677	1,230	31,307	8,448
1976	44,855	8,443	986	27,042	8,223
1977	52,296	8,988	854	28,810	9,248
1978	58,274	10,262	925	31,803	13,059
1979	64,935	11,716	1,001	35,106	18,440
1980	62,801	10,815	1,115	28,746	17,308

Cont. Table C.4. Number of labourers, Chile.

	Wood and furniture	Paper and printing	Leather and rubber and plastics	Chemicals	Petroleum
1939	7,812	8,830	11,396	5,789	
1940	9,907	10,482	12,764	6,856	
1941	9,168	9,460	12,889	7,440	
1942	9,842	9,680	13,183	8,986	
1943	10,788	9,047	13,828	9,962	
1944	11,481	9,148	14,644	10,841	
1945	11,685	9,849	15,502	11,076	
1946	12,378	9,933	15,318	10,678	
1947	13,103	9,989	16,940	11,651	
1948	11,204	10,207	16,782	12,222	
1949	11,870	9,986	17,488	12,590	
1950	10,622	9,540	17,781	12,262	
1951	11,650	9,752	16,138	10,499	338
1952	11,446	9,799	16,784	10,542	332
1953	11,244	9,998	16,536	10,935	282
1954	12,117	9,985	16,055	11,253	516
1955	11,877	9,933	15,970	11,693	778
1956	12,236	10,398	14,058	12,343	1,353
1957	16,174	11,291	17,864	12,063	1,166
1958	15,273	11,826	16,326	11,844	1,203
1959	14,422	12,386	14,920	11,628	1,242
1960	13,618	12,973	13,636	11,417	1,282
1961	13,675	13,180	14,552	11,994	1,262
1962	11,729	11,304	14,906	13,288	1,270
1963	12,961	12,021	14,775	14,053	1,262
1964	14,695	12,349	14,778	14,674	1,293
1965	15,864	13,357	15,193	14,762	1,372
1966	16,456	13,657	15,973	15,069	1,311
1967	15,156	13,912	16,653	16,265	1,289
1968	14,204	12,452	19,608	13,160	2,202
1969	11,238	13,250	19,738	13,419	2,336
1970	13,329	13,295	19,436	13,800	2,413
1971	13,395	14,768	18,867	13,308	2,463
1972	14,369	14,336	19,740	16,922	2,645
1973	15,738	15,334	20,063	17,859	2,565
1974	15,427	14,923	19,027	38,124	2,683
1975	16,017	14,927	18,329	24,648	2,566
1976	16,630	14,932	17,657	15,935	2,455
1977	16,326	15,945	17,946	16,905	2,194
1978	21,537	17,027	20,592	16,810	2,321
1979	28,411	18,182	23,627	16,715	2,455
1980	26,399	17,910	21,862	15,881	2,344

Cont. Table C.4. Number of labourers, Chile.

	Non metallic minerals	Metals	Total
1939	8,485	11,738	102,414
1940	9,687	13,222	116,493
1941	10,298	15,233	120,589
1942	10,470	16,571	126,397
1943	9,920	20,244	132,935
1944	10,868	21,742	139,493
1945	11,264	24,731	148,469
1946	13,143	21,417	149,562
1947	13,421	23,627	158,206
1948	13,320	26,508	168,693
1949	13,625	27,150	175,902
1950	13,727	31,144	183,985
1951	13,941	30,319	184,101
1952	14,151	31,070	189,027
1953	13,813	32,189	186,618
1954	14,109	34,159	193,847
1955	14,379	34,997	196,189
1956	15,645	34,530	195,552
1957	12,515	39,300	212,196
1958	12,027	42,102	210,103
1959	11,558	45,104	208,030
1960	11,107	48,320	205,978
1961	11,170	50,489	209,190
1962	11,343	55,093	212,612
1963	12,004	55,674	220,906
1964	12,535	61,681	234,709
1965	12,175	64,487	244,150
1966	12,394	67,530	252,453
1967	13,096	70,635	260,530
1968	11,265	77,938	243,721
1969	11,979	76,793	236,987
1970	11,425	79,188	243,521
1971	10,970	84,705	249,050
1972	11,882	83,394	259,009
1973	13,175	80,785	264,294
1974	12,628	76,497	274,418
1975	11,501	72,273	255,123
1976	10,474	68,283	237,184
1977	10,260	64,240	245,420
1978	10,970	65,387	271,867
1979	11,730	66,554	301,164
1980	10,772	64,714	282,490

Source: See explanatory notes for Chile.

Explanatory notes: Chile

Output and value added in current prices 1938-1967, Chile

Sources:

Between 1938-1956: Statistic industrial yearbooks of the *Dirección de Estadística y Censos Chile.* This data does not come from censuses or surveys, the way of collecting the data is not explicit in the yearbooks. According to the explanations in Muñoz (1971) this data is limited to the industrial modern sector, thus workshops are not included (with less than five employees).

Between 1951-1956: value added is not explicit in the yearbook. It is estimated by output minus inputs (national and imported) and fuel and electric energy consumed in the production process. Data come from industrial yearbooks.

In 1957: Census of Manufactures of the *Dirección de Estadística y Censos Chile.* Unfortunately, data from statistic yearbook is not available for 1957, therefore I use this data directly (without adjustment).

1958-1959: no data available.

1960-1969: data obtained from the publication: *Manufacturing industries, Dirección de Estadística y Censos Chile.*

> 1960-67: Industrial survey includes establishments with 10 employees or more. Survey conducted by the *Statistics National Institute, Chile.*
>
> 1968-69: Industrial survey includes establishments with 50 employees or more. Survey conducted by the *Statistics National Institute, Chile.*

Explanatory notes:

1. Since 1951 apparel and footwear are joined. In order to follow apparel and footwear separately I use weights to divide into both industries. These weights are obtained from an average between the share of apparel and footwear in the sum of both for the years 1950 (industrial yearbook), 1957 (census data) and 1967 (census data).
2. In 1939: an earthquake devastated the province of Ñuble and for this reason it is not included in the yearbook. As this province represented slightly 0.5% of total output in the manufacturing sector in 1939, I assume that its exclusion does not change the final results.
3. In order to obtain a long time series the metal industry aggregates several industries, such as basic metals, metal products, and machinery.

Currency:

- 1938-1959: Chilean pesos.
- 1960-1975: Chilean escudos. It replaced the peso at a rate of 1 escudo = 1000 pesos.
- 1976-2015: Chilean pesos. The current peso was introduced on 1975 by decree 1,123, replacing the escudo at a rate of 1 peso for 1,000 escudos.

Every figure has been checked and digitized as they appear in the yearbooks and censuses, however, it may persist some inconsistencies which are corrected. The most remarkable cases are: 1) in 1954 apparel and footwear´s value added and output increases in more than 400 percent and then it falls dramatically; 2) tobacco value added in 1939 is extremely low due to a high increase in inputs. This increase is not permanent and consistent with the production series. For apparel and footwear the decision has been to consider an average ratio input/output for the years 1953 and 1955 and through this ratio calculate the new output and value added for 1954.

Apparel & footwear: output, input and value added, in Chilean pesos						
	1952	1953	1954	1955	1956	Average 1953 & 1955
Output	4,734,299,000	6,189,943,000	**21,226,648,000**	17,122,743,000	23,509,627,000	
Inputs	2,731,406,000	3,313,671,000	5,691,242,000	10,059,848,000	12,878,669,000	
Value added	2,002,893,000	2,876,272,000	15,535,406,000	7,062,895,000	10,630,958,000	
Inputs/Output	58%	54%	27%	59%	55%	56%
New Output 1954			**10,162,932,143**			

Tobacco: output, input and value added, in Chilean pesos						
	1938	1939	1940	1941	1942	Average 1938 & 1940
Output	134,696,864	149,484,517	187,008,492	212,958,838	281,973,639	
Value added	97,517,000	**41,211,591**	151,192,514	162,268,451	240,229,400	
Value added/Output	0.72	0.28	0.81	0.76	0.85	0.77
New value added 1939		**114,539,013**				

These two changes in tobacco in 1939 and apparel in 1954, implies an adjustment in total manufacturing.

Output and value added in constant prices 1938-1985, Chile

1938-1957:

I use the following Price indexes to deflate output and value added. Source: *Crecimiento industrial de Chile 1914-1965* (Oscar Muñoz page 176-177).

Food: 1938-1950 section cost of food from the cost of living index. 1951-1961 index of wholesale prices of food goods, *Dirección de Estadísticas y Censos.*

Beverages: index of retail prices of beer, *Dirección de Estadísticas y Censos.*

Tobacco: index of retail prices of cigarettes, *Dirección de Estadísticas y Censos.*

Textiles: index of wholesale prices of textiles, *Dirección de Estadísticas y Censos.*

Apparel: section cost of food from the cost of living index, *Dirección de Estadísticas y Censos.*

Footwear: index of retail price of footwear, *Dirección de Estadísticas y Censos.*

Wood products: index weighted by the indexes of wholesale prices of lingue and raulí woods, *Dirección de Estadísticas y Censos.* The weights are the share of each good in the total output value in 1950 with quantities produced.

Paper: index of wholesale prices of printing paper, *Dirección de Estadísticas y Censos.*

Rubber: index of wholesale prices of tire 600*16, *Dirección de Estadísticas y Censos.*

Chemicals: 1938-1950 index weighted by the indexes of wholesale prices of soap and candles. 1950-1961 index weighted by the indexes of wholesale prices of gum, matches, soap, candles, and sulfuric acid. The weights are the share of each good in the total output value in 1950 with quantities produced. *Dirección de Estadísticas y Censos.*

Petroleum: index of wholesale prices of petroleum in Santiago city. *Dirección de Estadísticas y Censos.*

Non metallic minerals: 1938-1950 index of wholesale prices of concrete. 1950-1961 index of wholesale prices, building materials. *Dirección de Estadísticas y Censos.*

Metal products: index of wholesale prices of flat irons. *Dirección de Estadísticas y Censos.*

Total manufacturing: index of industrial wholesale prices. *Servicio Nacional de Estadística y Censos.*

Explanatory notes:

Between 1938-1949: textiles and rubber use the same price deflator than total manufacturing.

Price deflator of leather and rubber: it is used the deflator index of rubber.

1957-1979:

Series of constant prices are adjusted by the variation of Output Index base 1953=100 and Output Index base 1968=100.

Between 1957-1959 Output index by industries 1953=100 obtained from *Estadística chilena 1960 (1963), Servicio Nacional de Estadística y Censos.*

Between 1960-1968 Output index by industries 1953=100 from *Indicadores económicos y sociales de Chile 1960-2000, Banco Central de Chile*.

Between 1968-1979 Output index by industries 1968=100 from *Indicadores económicos y sociales de Chile 1960-2000, Banco Central de Chile*.

Explanatory notes:

Paper and printing, leather and rubber, and metals are aggregated, and the weights come from yearbook 1953 and census of manufacturing 1967.

Between 1979-1985 Output index by industries 1979=100 from *Indicadores económicos y sociales de Chile 1960-2000, Banco Central de Chile*.

Employment 1938-1985, Chile

Between 1938-1956: Statistic industrial yearbooks of the *Dirección de Estadística y Censos Chile.* This data does not come from censuses or surveys, the way of collecting the data is not explicit in the yearbooks.

In 1957: Census of Manufactures of the *Dirección de Estadística y Censos Chile.* Unfortunately, data from statistic yearbook is not available for 1957, therefore I use this data directly (without adjustment).

1958-1959: no data available. It was estimated taking the years 1960 and 1957 and using linear growth rate.

1960-1969: data obtained from the publication: *Manufacturing industries, Dirección de Estadística y Censos Chile.*

1960-67: Industrial survey includes establishments with 10 employees or more. Survey conducted by the *Statistics National Institute, Chile.*

1968-69: Industrial survey includes establishments with 50 employees or more. Survey conducted by the *Statistics National Institute, Chile.*

1970-1985: data obtained from manufacturing census and industrial surveys, *Dirección de Estadística y Censos Chile.*

1970-75: Industrial survey includes establishments with 50 employees or more. Survey conducted by the *Statistics National Institute, Chile.*

1976-1985: Industrial survey includes establishments with 50 employees or more. Survey conducted by the *Statistics National Institute, Chile.*

Explanatory notes:

Since 1951 apparel and footwear are joined. In order to follow apparel and footwear separately I use weights to divide into both industries. These weights are obtained from an average between the share of apparel and footwear in the sum of both for the years 1950 (industrial yearbook), 1957 (census data) and 1967 (census data).

Table C.5. Value added at constant millions pesos of 1936, Uruguay.

	Food	Beverages	Tobacco	Textile	Paper	Printing	Rubber	Petroleum	Chemi-cals	Total
1930	16,939	6,470	2,674	2,803	672	2,344	252		2,703	65,316
1931	18,290	7,173	2,795	3,282	745	2,526	298		2,913	69,107
1932	19,749	7,953	2,922	3,843	827	2,721	352		3,139	73,119
1933	21,325	8,818	3,054	4,500	917	2,932	416		3,383	77,363
1934	23,026	9,776	3,192	5,268	1,017	3,159	491		3,646	81,854
1935	24,863	10,839	3,337	6,169	1,129	3,403	581		3,929	86,605
1936	26,846	12,017	3,488	7,223	1,252	3,667	686		4,234	91,632
1937	27,950	13,426	3,494	7,211	1,324	3,877	786		4,365	103,054
1938	29,100	15,000	3,500	7,200	1,400	4,100	900	10,100	4,500	115,900
1939	31,200	14,500	3,900	7,900	1,600	4,400	900	10,700	4,900	119,900
1940	32,300	11,800	3,900	7,500	1,500	4,500	1,200	10,900	4,700	117,200
1941	30,300	15,300	4,000	10,600	1,800	4,500	800	10,700	5,200	123,900
1942	35,400	16,000	4,300	10,000	2,000	4,400	900	7,600	5,500	125,900
1943	33,700	15,600	3,600	11,700	2,000	4,400	600	5,800	5,900	124,300
1944	32,600	16,900	3,000	14,500	2,100	4,500	800	6,300	5,900	130,600
1945	32,700	14,900	3,500	16,700	2,200	4,600	1,000	8,600	6,000	136,700
1946	33,200	18,600	3,800	19,600	2,300	5,100	1,300	12,100	6,000	154,000
1947	32,800	21,200	4,000	20,300	2,000	5,300	1,600	13,200	6,200	161,400
1948	35,885	22,992	4,433	21,238	2,338	5,817	2,060	14,275	7,051	176,017
1949	39,261	24,935	4,913	22,219	2,733	6,384	2,651	15,437	8,019	191,957
1950	42,954	27,042	5,446	23,245	3,194	7,007	3,413	16,695	9,121	209,342
1951	46,995	29,327	6,036	24,319	3,734	7,690	4,394	18,054	10,373	228,300
1952	51,416	31,805	6,689	25,443	4,364	8,440	5,656	19,524	11,797	248,976
1953	56,252	34,493	7,414	26,618	5,101	9,264	7,281	21,115	13,417	271,524
1954	61,544	37,408	8,217	27,848	5,963	10,167	9,373	22,834	15,259	296,114
1955	59,056	36,287	7,191	26,746	4,928	11,147	7,731	20,537	14,482	279,980
1956	63,468	37,317	7,715	30,346	4,567	11,465	16,696	17,241	14,059	300,553
1957	55,774	33,850	9,104	26,258	9,662	11,799	15,390	13,140	16,647	289,742
1958	50,844	34,328	9,381	25,735	6,265	11,270	10,959	11,235	17,644	272,881
1959	59,999	24,925	6,752	24,078	8,762	9,561	7,718	8,585	16,228	249,460
1960	95,998	27,589	6,903	18,625	10,244	11,877	11,459	9,581	15,384	256,753
1961	95,998	30,620	6,876	19,201	7,761	9,609	8,116	9,668	15,925	251,472
1962	102,622	36,867	7,529	16,954	7,994	9,138	6,387	10,789	14,572	252,478
1963	99,742	38,214	8,278	18,452	8,700	7,735	4,813	10,644	14,158	251,220
1964	102,622	27,252	8,780	21,793	11,641	9,455	5,860	10,606	16,037	267,566
1965	111,070	30,620	8,182	21,659	11,525	9,763	5,486	11,447	15,050	267,063
1966	109,438	33,836	7,226	24,232	11,051	8,514	6,687	10,461	17,566	272,092
1967	101,374	31,294	7,529	20,161	10,935	8,590	5,559	10,229	19,270	259,770
1968	115,102	33,315	6,477	21,313	10,935	9,840	4,731	10,277	16,451	270,584

Source: See explanatory notes for Uruguay.

Table C.6. Number of labourers, Uruguay.

	Food	Beverages	Tobacco	Textile	Paper	Printing	Rubber	Petroleum	Chemicals	Total
1930	18,094	2,633	1,112	2,494	730	2,954	152	15	1,630	54,158
1931	18,482	2,810	1,113	2,967	761	2,950	201	15	1,705	55,969
1932	18,878	2,999	1,113	3,529	793	2,946	266	15	1,783	57,841
1933	19,282	3,200	1,114	4,197	827	2,941	352	15	1,865	59,776
1934	19,695	3,415	1,115	4,992	862	2,937	466	15	1,951	61,775
1935	20,117	3,645	1,115	5,938	898	2,933	616	15	2,041	63,842
1936	20,548	3,890	1,116	7,063	936	2,929	815	15	2,135	65,977
1937	20,631	4,317	1,060	7,620	1,013	3,079	909	137	2,281	70,707
1938	20,714	4,791	1,006	8,221	1,096	3,236	1,013	1,255	2,436	75,776
1939	20,728	4,645	994	8,513	1,153	3,542	1,065	1,331	2,571	78,079
1940	22,735	4,419	994	8,084	1,424	3,630	1,006	1,362	2,483	78,722
1941	23,958	4,234	981	9,029	1,374	3,664	1,124	1,362	2,881	82,720
1942	26,335	4,596	935	9,126	1,474	3,612	1,147	1,362	2,918	85,092
1943	28,283	4,895	999	9,299	1,463	3,574	980	1,362	3,085	88,535
1944	28,119	5,282	1,057	10,496	1,476	3,693	1,139	1,362	3,100	93,518
1945	27,420	5,304	978	10,947	1,558	3,738	1,420	1,362	3,126	96,235
1946	28,036	5,586	953	11,355	1,518	4,085	1,745	1,507	3,167	102,182
1947	28,512	6,117	953	12,232	1,545	4,268	1,974	1,645	3,231	107,434
1948	28,046	6,017	937	16,468	1,300	4,050	2,000		3,100	109,918
1949	29,427	6,478	935	16,599	1,410	4,392	2,176		3,656	116,999
1950	30,876	6,974	932	16,732	1,530	4,762	2,366		4,313	124,537
1951	32,396	7,508	929	16,865	1,659	5,164	2,574		5,087	132,560
1952	33,991	8,083	926	17,000	1,800	5,600	2,800		6,000	141,100
1953	36,089	8,581	983	20,675	2,429	5,405	2,998		6,646	152,853
1954	38,316	9,111	1,044	25,144	3,277	5,216	3,209	3,881	7,362	165,585
1955	37,501	10,254	1,012	24,523	2,770	5,864	2,768	3,938	7,016	161,879
1956	38,754	9,901	986	24,056	2,562	5,881	4,882	3,746	7,422	170,969
1957	40,698	10,259	1,004	24,928	3,252	6,514	5,051	5,210	8,209	184,538
1958	41,842	10,086	950	25,818	3,013	6,291	3,415	4,211	8,207	191,468
1959	47,738	10,304	996	26,759	3,393	6,412	3,613	4,198	8,430	206,642
1960	47,452	8,675	1,010	26,607	3,094	6,033	3,568	5,389	8,421	200,593
1961	42,809	8,016	994	24,543	2,858	6,061	3,331	6,200	7,802	198,778
1962	38,620	7,408	978	22,640	2,640	6,090	3,110	7,133	7,228	196,979
1963	34,841	6,845	963	20,884	2,439	6,118	2,904	8,206	6,696	195,197
1964	34,216	6,980	948	21,530	2,440	6,042	3,020	6,980	6,898	189,567
1965	33,603	7,118	934	22,196	2,442	5,966	3,141	5,937	7,107	184,099
1966	33,001	7,258	919	22,883	2,443	5,892	3,267	5,050	7,322	178,788
1967	32,409	7,401	905	23,591	2,445	5,819	3,398	4,296	7,543	173,631
1968	31,828	7,547	891	24,321	2,446	5,746	3,534	3,654	7,771	168,623

Source: See explanatory notes for Uruguay.

Explanatory notes: Uruguay

Value added at constant prices

1939-1959: depart from the series of value added in millions of pesos 1936, extracted from the paper: "*Una revisión del desempeño de la industria manufacturera en Uruguay entre 1930 y 1959*", (IECON Arnábal, Bertino & Fleitas, 2013). IECON: Year 1954 value added was estimated assuming that the relationship between value added and gross output is the same as 1955. Sources used by this paper IECON: Manufacturing census of 1930 reclassified in the manufacturing census of 1936, manufacturing census of 1936, Millot Silva & Silva, Estadísticas Retrospectivas del Uruguay 1961, National Accounts 1956, Manufacturing census of 1968.

1960-1980: employ the Physical Volume Index (1961=100) elaborated from the Central Bank of Uruguay, extracted from statistical bulletins (Nr 23 & 25). From 1960 onwards I extrapolate the series of value added at constant prices 1939-1959 using the variation of the Physical Volume Index.

When data was a missing value, I employ a linear growth rate between the available years.

Employment:

For this period there are no annual data, therefore the construction of the series requires a set of assumptions in order to homogenize the long-term data. This new series is part of a joint work with Melissa Hernández, which will be published in 2019-2020.

Until 1967, information from industry was scarce. The data for this period arise from sporadic censuses and from the Industrial Register carried out by the Directorate of Industries; however, these only go as far as 1960.

In addition to that, *Banco República* conducted an Industrial Survey since 1957 and therefore it was possible to access some data from these surveys. Likewise, Commission on Investment and Economic Development *(Comisión de Inversiones y Desarrollo Económico -CIDE*) conducted complementary studies of some industries to provide inputs for the "Economic Study of Uruguay" and the "National Economic Development Plan 1965-1974". As a result, for several years there are no data on employment in manufacturing industry or they are of poor quality. In these cases, a linear interpolation was chosen.

Detailed data by years:

1930. Master's thesis by Hernández, M. (2015), based on data from employees of Millot, Silva and Silva (1973) and series of workers of Maubrigades (2002). Both series were combined in order to obtain data on employed persons.

1936. Industrial Census published by the Ministry of Industry and Labour in 1939.

1938 – 1947. Taken from the Master's Thesis of Hernández, M. (2015) where data was taken from employees of Millot, Silva and Silva (1973) and series of workers of Maubrigades (2002).

Between 1948 and 1954 there were no reliable primary sources. Between 1954 and 1960 the Directorate of Industries prepared the Industrial Register, which was published in "Retrospective Statistics" of the General Directorate of Statistics and Censuses *(DGEyC,* 1965), which generally coincide with the National Accounts of *Banco República.*

1948. Obtained from a publication of the Institute of Economics of the Faculty of Economics in 1969: "Uruguay. Basic Statistics".

1952. Obtained from a publication of the Institute of Economics of the Faculty of Economics in 1969: "Uruguay. Basic Statistics".

For both 1948 and 1952, Food, Beverages, and Tobacco Products, were aggregated into one single figure. Taking into account the structure of these industries disaggregated for 1947 and 1954, the data for each industry was estimated according to that structure.

1954-1959. Data obtained from "Retrospective Statistics" (1961) General Directorate of Statistics and Censuses of the Ministry of Finance.

For this period several industries (given the available data) were aggregated to make it comparable with the rest of the series. On the one hand, "Wood and furniture" was added to branches 25 and 26 "Wood" and "Furniture industry" respectively and on the other hand, "Metals and their products" was added to industries 34, 35, 36, 37 "Smelting and rolling of metals", "Metallurgy", "Mechanics-Metallurgy" and "Electrotechnics" respectively.

1960. Taken from the publication of CIDE in *1963* and its origin is estimated from the Industry Directorate of the Ministry of Industry and Labour.

1963. Data obtained from the Population and Housing Census.

For both 1960 and 1963 "Apparel and Leather and its manufactures" was considered by adding the industries "Apparel and footwear" and "Leather" (24 and 29 respectively, also "Wood and Furniture" was considered (adding the following branches: 25 and 26).

On the other hand, "Paper, cardboard and their products and Printing" was taken into account by adding industries 27 and 28, "Paper" and "Printing" and "Metals and their products" by adding: Basic Metals; Metallic Products; Machinery; Electrotechnics (respectively 34, 35, 36 and 37).

1968. Data obtained from the General Directorate of Statistics and Censuses - *DGEyC*- (1968), I National Economic Census. Manufacturing industry sector.

In the years and periods presented below, a linear interpolation (linear growth rate) was performed between the years for which data were available: 1931-1935, 1937, 1949-1951 and 1953.

Table C.7. Value added at constant million dollars of 1947, United States.

	Food & beverage	Tobacco	Textile	Wood &furniture	Paper and printing	Leather & rubber & app	Chemicals	Non metallic minerals	Metals &machinery	Total
1939	7,927	556	3,279	2,701	4,552	3,819	3,728	1,248	11,587	39,468
1940	8,687	567	3,423	3,013	4,926	3,910	4,604	1,417	16,123	47,041
1941	9,237	597	4,169	3,717	5,387	4,679	5,460	1,914	26,822	63,576
1942	10,155	515	4,861	4,004	5,980	5,348	6,606	1,984	37,402	79,004
1943	10,972	492	5,020	4,083	6,664	6,423	7,930	2,006	50,885	98,175
1944	11,834	594	4,947	3,983	7,167	7,025	8,099	1,890	51,517	100,938
1945	12,231	529	4,862	3,795	7,377	7,347	7,896	1,792	39,226	87,799
1946	10,987	584	5,791	4,348	7,541	7,933	7,383	2,244	24,821	74,380
1947	9,116	641	5,323	3,866	7,162	7,273	7,308	2,299	28,189	74,384
1948	9,029	657	5,682	4,023	7,440	7,430	7,894	2,447	29,228	77,469
1949	9,116	651	5,245	3,609	7,420	7,243	7,757	2,286	26,341	73,356
1950	9,436	661	5,979	4,387	8,229	8,086	9,369	2,763	32,219	84,668
1951	9,640	699	5,916	4,299	8,528	7,906	10,620	3,059	36,038	91,866
1952	9,844	722	5,869	4,300	8,333	8,305	11,030	2,924	38,288	95,637
1953	10,019	710	6,010	4,529	8,879	8,508	11,862	2,991	43,721	103,521
1954	10,223	688	5,620	4,626	9,055	8,460	12,045	2,965	37,681	97,693
1955	10,834	707	6,416	5,241	10,034	9,555	13,830	3,428	43,774	110,033
1956	11,417	721	6,587	5,280	10,652	9,694	14,862	3,630	45,335	114,832
1957	11,621	755	6,275	5,021	10,788	9,794	15,511	3,623	46,117	116,546
1958	11,912	813	6,197	4,950	10,682	9,577	15,931	3,442	38,642	109,005
1959	12,494	850	7,009	5,584	11,638	10,735	18,159	3,993	44,679	122,031
1960	12,844	868	6,868	5,367	12,001	10,803	18,838	3,859	45,894	124,773
1961	13,193	896	7,087	5,468	12,317	10,951	19,754	3,832	45,244	125,802
1962	13,630	907	7,555	5,865	12,900	11,655	21,709	4,074	50,754	136,085
1963	14,125	935	7,821	6,124	13,609	12,164	23,573	4,316	53,921	144,655
1964	14,766	947	8,461	6,570	14,426	12,996	25,505	4,517	58,332	154,253
1965	15,087	954	9,194	6,954	15,431	14,024	28,040	4,793	66,840	169,678
1966	15,669	954	9,772	7,326	16,625	14,845	30,401	4,934	74,924	184,417
1967	16,368	965	9,772	7,287	17,143	14,904	31,763	4,840	74,693	188,531
1968	16,805	967	10,896	7,523	17,706	16,055	35,284	5,122	78,203	199,157
1969	17,358	939	11,458	7,660	18,805	16,731	37,942	5,297	81,850	208,070
1970	17,650	972	11,208	7,420	18,438	15,915	39,503	5,028	75,630	201,214
1971	18,203	959	11,832	7,666	18,864	16,538	41,851	5,277	74,957	203,956
1972	19,164	996	12,972	8,975	20,314	18,629	46,657	5,842	84,077	223,838
1973	19,543	1,048	13,503	9,252	21,271	19,638	50,824	6,312	96,132	242,005
1974	19,805	1,024	12,285	8,487	20,997	18,968	52,221	6,211	94,767	238,577
1975	19,659	1,048	11,707	7,610	19,019	17,030	48,026	5,499	81,895	217,667
1976	20,795	1,101	13,003	8,595	21,141	19,620	53,435	6,151	90,274	237,549
1977	21,727	1,059	13,003	9,547	22,617	21,825	57,388	6,608	100,306	256,745
1978	22,484	1,107	13,830	9,943	23,808	22,719	60,412	7,126	109,583	271,827
1979	22,688	1,102	14,283	9,873	24,543	22,001	62,304	7,179	117,433	281,082
1980	23,212	1,118	13,893	9,424	24,500	20,912	59,465	6,487	113,427	273,198

Table C.8. Number of labourers, thousands, United States.

	Food & beverage	Toba-cco	Textile	Wood &fur-niture	Paper and printing	Leather &rubber &apparel	Chemi-cals	Non metallic minerals	Metal& machi-nery	Total
1939	1,133	120	1,126	633	892	1,349	485	312	2,918	9,376
1940	1,177	116	1,135	711	905	1,369	548	335	3,476	10,234
1941	1,255	114	1,283	845	958	1,558	660	393	4,709	12,339
1942	1,333	108	1,288	858	935	1,586	847	396	6,374	14,344
1943	1,350	114	1,226	802	943	1,593	909	376	8,320	16,320
1944	1,384	112	1,131	769	941	1,572	868	351	8,216	16,006
1945	1,365	114	1,082	735	964	1,547	866	348	6,619	14,279
1946	1,436	116	1,220	838	1,116	1,715	816	434	5,272	13,647
1947	1,461	112	1,232	958	1,169	1,723	834	461	5,654	14,312
1948	1,447	115	1,315	997	1,215	1,759	901	491	5,824	14,805
1949	1,463	101	1,170	959	1,203	1,758	820	453	4,986	13,565
1950	1,493	93	1,245	1,097	1,241	1,775	851	491	5,470	14,470
1951	1,474	94	1,195	1,107	1,260	1,730	921	529	6,229	15,311
1952	1,480	93	1,135	1,075	1,255	1,759	959	510	6,506	15,733
1953	1,455	95	1,158	1,081	1,293	1,872	997	506	7,105	16,692
1954	1,647	95	1,037	986	1,332	1,794	917	492	6,377	15,417
1955	1,674	96	1,059	1,059	1,369	1,879	924	525	6,246	15,603
1956	1,706	93	1,044	1,074	1,417	1,903	939	536	7,011	16,526
1957	1,688	88	989	1,021	1,430	1,886	943	526	7,078	16,451
1958	1,718	85	903	939	1,416	1,878	877	553	6,206	15,226
1959	1,718	83	930	985	1,454	1,979	889	596	6,536	15,857
1960	1,719	81	901	958	1,482	1,974	897	581	6,657	15,950
1961	1,702	78	876	907	1,483	1,936	873	567	6,470	15,583
1962	1,683	76	880	916	1,498	1,979	881	573	6,787	15,959
1963	1,643	77	863	940	1,501	2,023	891	574	6,731	15,940
1964	1,646	79	876	947	1,528	2,060	897	581	6,883	16,199
1965	1,641	75	894	979	1,592	2,136	922	605	7,365	16,954
1966	1,643	72	927	1,001	1,652	2,193	962	616	7,993	17,839
1967	1,650	75	929	979	1,670	2,203	983	590	8,197	18,093
1968	1,632	74	959	985	1,683	2,232	997	590	8,253	18,236
1969	1,653	72	968	1,022	1,761	2,275	1,025	608	8,492	18,738
1970	1,619	71	925	979	1,736	2,183	1,025	591	8,007	17,970
1971	1,574	67	907	966	1,681	2,137	990	583	7,472	17,170
1972	1,569	66	953	1,153	1,689	2,259	977	623	7,845	18,034
1973	1,560	69	980	1,201	1,729	2,340	989	644	8,416	18,860
1974	1,553	67	933	1,134	1,722	2,234	1,012	637	8,463	18,714
1975	1,525	66	835	984	1,659	2,039	983	589	7,602	17,175
1976	1,536	65	876	1,055	1,701	2,145	996	599	7,784	17,685
1977	1,520	61	875	1,156	1,721	2,298	1,027	614	8,244	18,515
1978	1,547	59	862	1,204	2,084	2,314	1,044	639	8,738	19,538
1979	1,552	59	842	1,226	1,881	2,299	1,053	654	9,148	19,758
1980	1,538	58	816	1,171	1,909	2,243	1,059	613	8,859	19,310

Explanatory notes: United States

Value added in current prices 1947-1980

Between 1947-1980: Historical statistics of the United States. Millennial edition. Volume 4. Economic Sectors.

Value added in constant prices 1939-1980

Between 1939-1946: estimates before 1947 are covered by variations using series provided by Bakker, Crafts, Woltjer (2015), "A Vision of the Growth Process in a Technologically Progressive Economy: the United States, 1899-1941".

Between 1947-1980 I begin with the value added in current prices year 1947 (census data). I adjust by using indexes of industrial production by industry group 1947-2001, obtained from Historical statistics of the United States.

Employment 1939-1980

Between 1939-1946: estimates before 1947 are covered by variations using series provided by Bakker, Crafts, Woltjer (2015), "A Vision of the Growth Process in a Technologically Progressive Economy: the United States, 1899-1941".

Between 1947-1980: Historical statistics of the United States. Millennial edition. Volume 4. Economic Sectors.

1948: It was estimated using the variation of the manufacturing output indexes between 1947-1948 by industries.

Table C.9. Value added at constant thousand krones of 1910-12, Sweden

	Metal	Stone and clay	Wood	Paper	Food	Textile	Leather	Chemical	Total
1930	633	104	139	219	287	228	86	133	1829
1931	540	90	127	210	275	218	85	130	1675
1932	504	84	119	206	267	221	79	113	1593
1933	519	78	130	223	263	229	81	125	1648
1934	724	97	148	250	286	272	84	139	2000
1935	842	112	146	266	300	279	88	165	2198
1936	928	122	162	285	316	291	92	174	2370
1937	1049	132	176	280	330	300	98	190	2555
1938	1136	138	167	301	365	298	97	191	2693
1939	1222	150	168	314	390	330	119	224	2917
1940	1032	106	146	236	382	334	136	189	2561
1941	1050	109	129	226	355	311	120	197	2497
1942	1080	132	128	265	330	291	113	209	2548
1943	1153	150	135	250	341	304	100	225	2658
1944	1171	147	152	254	370	322	118	261	2795
1945	1008	165	187	313	403	333	144	274	2827
1946	1313	189	236	403	421	341	162	296	3361
1947	1480	199	218	478	415	366	178	321	3655
1948	1694	209	201	473	416	398	191	342	3924
1949	1704	195	195	422	462	373	184	365	3900
1950	2091	218	209	428	439	354	187	459	4385
1951	2109	223	181	478	420	357	177	513	4458
1952	2096	216	163	421	405	317	164	486	4268
1953	2123	225	178	429	410	371	185	564	4485
1954	2247	228	192	448	404	352	201	609	4681
1955	2424	233	194	475	408	355	207	632	4928
1956	2604	233	189	488	418	382	219	643	5176
1957	2792	221	203	501	427	400	231	668	5443
1958	2853	226	204	512	425	396	239	652	5507
1959	3024	242	205	554	445	377	232	655	5734
1960	3382	249	228	609	456	391	233	701	6249
1961	3677	270	237	630	471	436	250	743	6714
1962	4099	284	246	640	499	423	249	813	7253
1963	4230	310	269	706	503	442	275	865	7600
1964	4897	343	306	755	520	485	318	982	8606
1965	5408	362	331	806	521	479	323	1121	9351
1966	5789	363	331	801	556	494	337	1171	9842
1967	5760	403	350	816	571	532	374	1266	10072
1968	6165	443	391	846	596	543	400	1381	10765

1969	6124	445	396	920	625	536	413	1621	11080
1970	6694	445	452	995	628	472	392	1755	11833
1971	6888	434	436	986	628	450	390	1840	12052
1972	6810	420	465	984	631	443	377	2015	12145
1973	7344	439	502	1113	598	465	399	2291	13151
1974	8024	434	511	1099	625	469	407	2371	13940
1975	8406	437	458	1041	620	447	389	2177	13975
1976	8181	432	466	1105	636	444	363	2269	13896
1977	7477	403	447	1105	634	391	348	2172	12977
1978	7100	391	456	1117	610	339	320	2254	12587
1979	7781	409	477	1186	626	343	328	2350	13500
1980	7933	393	458	1176	626	323	315	2563	13787

Source: See explanatory notes for Sweden.

Table C.10. Number of labourers, Sweden

	Metal	Stone and clay	Wood	Paper	Food	Textile	Leather	Chemical	Total
1930	147,537	40,708	65,232	62,800	49,818	66,804	23,029	17,686	473,614
1931	151,476	37,354	64,694	62,779	50,232	69,326	23,466	17,082	476,408
1932	155,617	34,419	64,206	62,767	50,684	71,963	23,936	16,633	480,225
1933	159,967	31,852	63,768	62,765	51,176	74,720	24,442	16,321	485,011
1934	164,537	29,609	63,380	62,772	51,709	77,605	24,986	16,129	490,727
1935	169,336	27,652	63,041	62,788	52,286	80,623	25,570	16,042	497,338
1936	181,491	29,784	64,707	64,370	53,977	83,606	26,614	17,040	521,588
1937	194,592	32,113	66,534	66,006	55,766	86,798	27,708	18,126	547,642
1938	208,714	34,659	68,536	67,697	57,658	90,214	28,856	19,309	575,643
1939	223,940	37,445	70,725	69,446	59,663	93,873	30,061	20,598	605,751
1940	232,259	38,433	71,265	70,720	60,110	95,032	30,551	21,201	619,572
1941	241,013	39,525	71,906	72,074	60,674	96,216	31,081	21,873	634,363
1942	250,237	40,742	72,650	73,512	61,357	97,424	31,652	22,617	650,191
1943	259,973	42,108	73,499	75,039	62,159	98,658	32,266	23,436	667,137
1944	270,268	43,652	74,457	76,662	63,083	99,916	32,925	24,332	685,294
1945	281,176	45,413	75,525	78,384	64,132	101,200	33,632	25,309	704,771
1946	313,448	47,434	76,708	80,214	65,307	102,511	34,388	28,165	748,175
1947	320,038	44,438	75,838	81,490	65,157	104,961	34,201	28,826	754,950
1948	326,855	41,791	74,984	82,790	65,050	107,486	34,024	29,518	762,496
1949	333,906	39,456	74,144	84,114	64,985	110,088	33,856	30,241	770,789
1950	341,199	37,403	73,318	85,462	64,963	112,769	33,697	30,998	779,810
1951	348,744	35,604	72,507	86,835	64,983	115,533	33,547	31,790	789,543
1952	344,771	33,712	68,863	86,362	64,189	166,686	30,920	32,372	827,875
1953	349,143	33,245	68,999	87,848	64,576	164,302	31,027	33,007	832,147
1954	353,687	32,830	69,137	89,365	64,994	161,961	31,152	33,665	836,792
1955	358,412	32,467	69,280	90,914	65,445	159,663	31,295	34,346	841,822
1956	363,330	32,156	69,425	92,495	65,929	157,407	31,457	35,050	847,249
1957	368,452	31,898	69,574	94,110	66,445	155,192	31,638	35,778	853,087
1958	373,791	31,694	69,726	95,760	66,994	153,017	31,839	36,531	859,350
1959	379,360	31,545	69,881	97,444	67,576	150,882	32,060	37,308	866,056
1960	386,680	32,339	70,912	98,029	68,015	135,584	31,629	38,292	861,480
1961	394,204	33,211	71,979	98,633	68,499	122,527	31,231	39,352	859,635
1962	401,939	34,163	73,083	99,255	69,030	111,364	30,864	40,489	860,187
1963	409,887	35,202	74,227	99,896	69,610	101,804	30,526	41,703	862,854
1964	418,055	36,331	75,410	100,555	70,238	93,599	30,218	42,997	867,403
1965	426,448	37,558	76,634	101,232	70,917	86,541	29,937	44,371	873,638
1966	435,071	38,887	77,901	101,929	71,647	80,455	29,683	45,826	881,398
1967	443,929	40,325	79,211	102,644	72,430	75,192	29,454	47,365	890,550

1968	387,732	34,750	76,526	103,787	77,891	73,182	24,586	44,925	823,379
1969	398,411	33,521	76,606	99,091	77,627	69,350	23,870	42,291	820,767
1970	409,535	32,360	76,688	94,872	77,401	65,725	23,210	41,171	820,963
1971	421,131	31,263	76,771	91,078	77,212	62,297	22,602	41,011	823,365
1972	433,226	30,226	76,857	87,661	77,060	59,054	22,041	41,923	828,049
1973	445,847	29,247	76,944	84,582	76,943	55,986	21,526	44,066	835,142
1974	459,026	28,322	77,034	81,802	76,862	53,083	21,052	47,652	844,833
1975	472,796	27,448	77,125	79,289	76,816	50,337	20,617	52,959	857,387
1976	460,473	26,210	74,258	80,681	76,287	46,579	19,295	47,741	831,525
1977	448,778	25,043	71,503	82,458	75,791	43,121	18,058	44,839	809,590
1978	437,672	23,941	68,854	84,666	75,326	39,937	16,901	43,930	791,227
1979	427,120	22,902	66,307	87,359	74,892	37,004	15,819	44,804	776,207
1980	417,089	21,921	63,859	90,599	74,489	34,302	14,806	47,346	764,411

Source: See explanatory notes for Sweden.

Explanatory notes: Sweden

Series extracted from Schön (1988, Table I14, page 301)

Notes:

- Labourers are workers.
- Metals: Mechanical engineering, ironware and foundry, metal, shipyard, electro mechanical, iron mines, iron and steel work
- Stone, clay and glass: glass, chinaware and tile, quarrying and refined stone products, cement, bricks, coal
- Wood: sawmills and planing mills, refined wood products
- Paper: pulp, paper, book printing
- Food: Flour mills, pork butchery, margarine, sugar, tobacco, chocolate and candy, brewery, spirit, bakery, dairy
- Textile and clothing: textile, clothing
- Leather, hair and rubber: tannery, products of leather and fur, shoes, rubber
- Chemical: paint, soap and detergent, oil, matches, explosives, charcoal, chemicals and fertilizers

Table C.11. Ratio labour productivity level Brazil versus United States, US=100

	Food, beverage tobacco	Textile	Paper and printing	Chemi-cals	Wood and furniture	Non metallic mineral	Metals	Machinery	Total
1945	13.25	15.72	10.70	98.12	7.20	11.43	14.80	30.43	17.41
1946	17.30	14.25	12.23	106.42	7.21	11.28	19.02	40.79	19.52
1947	23.43	20.57	15.93	114.77	10.91	13.54	20.82	38.33	23.80
1948	29.86	23.66	18.53	117.07	12.63	15.43	23.96	41.04	27.05
1949	37.91	25.85	20.74	127.07	15.21	16.86	24.68	38.78	29.05
1950	40.40	23.06	21.22	128.02	15.21	18.00	25.16	41.96	29.79
1951	39.88	18.02	19.80	116.76	14.43	18.04	25.48	47.97	27.88
1952	38.05	21.16	21.59	126.32	14.51	21.02	31.39	59.77	29.62
1953	39.55	23.99	21.55	144.16	13.85	17.57	20.10	27.24	28.35
1954	47.58	21.88	21.18	118.06	11.89	18.30	23.00	29.05	27.89
1955	46.18	20.80	20.46	107.35	12.26	16.37	21.65	28.21	26.84
1956	52.37	20.80	19.52	115.36	12.35	15.48	24.23	29.78	29.22
1957	49.07	20.59	19.47	147.59	12.58	17.66	26.60	39.81	30.35
1958	58.52	19.94	22.65	123.71	13.32	22.01	25.09	35.78	32.80
1959	58.36	20.88	23.67	107.17	11.25	19.92	24.33	38.07	33.70
1960	59.71	22.39	24.93	111.84	12.99	21.65	31.84	47.84	36.54
1961	62.03	20.58	23.85	111.05	12.81	21.11	32.57	49.73	35.93
1962	55.70	20.36	21.75	92.51	12.47	19.19	27.74	40.36	33.28
1963	54.98	18.19	24.50	84.58	13.58	20.75	25.66	38.49	34.94
1964	46.71	19.52	19.64	73.72	12.68	19.99	23.88	36.21	33.27
1965	46.97	21.03	20.75	69.43	11.19	21.51	21.69	33.21	33.63
1966	55.77	22.51	22.63	87.80	13.37	22.69	27.06	38.22	37.31
1967	52.51	20.42	24.30	70.04	11.86	24.29	26.62	40.20	34.67
1968	49.82	20.93	22.92	70.79	12.61	25.13	28.94	36.52	34.62
1969	53.35	23.56	23.87	53.83	14.19	26.06	29.35	43.12	37.02
1970	47.95	24.74	27.33	62.86	14.05	25.33	32.38	40.40	34.39
1971	47.33	26.56	27.29	61.95	14.75	27.00	34.96	42.40	35.75
1972	50.17	31.00	28.03	57.63	15.16	29.84	37.90	44.09	38.11
1973	52.09	36.04	31.82	59.70	15.89	30.01	38.94	43.48	39.81
1974	56.18	42.39	37.29	59.63	18.08	36.38	47.19	51.92	45.16
1975	56.60	47.62	42.04	66.60	20.37	41.74	45.18	51.60	46.49
1976	57.72	50.66	40.16	68.51	19.57	41.99	43.01	57.03	47.63
1977	56.12	52.72	38.00	57.71	19.35	41.03	48.60	54.04	47.11
1978	54.48	56.01	45.59	60.11	19.54	40.07	52.69	54.27	49.60
1979	53.74	71.28	44.57	60.60	19.84	40.47	58.17	54.32	50.62
1980	48.29	82.66	47.77	58.62	17.42	39.67	67.89	63.33	50.74

Source: author´s estimates.

Table C.12. Ratio labour productivity level Chile versus United States, US=100

	Food and beverages	Tobacco	Textiles	Paper printing	Leather rubber	Chemical	Non metallic minerals	Total
1939	31.2	94.0	23.0	23.5	23.1	17.1	17.3	25.0
1940	32.8	122.5	23.1	21.3	19.0	15.3	18.6	23.3
1941	33.1	125.0	19.5	30.2	20.3	17.4	18.6	23.2
1942	29.8	218.4	21.2	25.8	15.7	16.8	20.1	22.8
1943	26.2	137.3	21.3	25.5	15.5	13.6	19.8	21.7
1944	26.9	105.1	21.4	22.7	14.4	12.5	17.7	21.3
1945	26.8	185.7	21.9	23.1	15.3	15.0	21.2	22.5
1946	31.9	140.6	19.0	29.1	17.0	18.6	21.1	25.4
1947	41.0	117.4	20.6	32.7	16.0	21.1	25.9	26.0
1948	33.7	119.2	21.1	30.9	18.0	16.7	26.5	25.0
1949	40.9	111.7	20.6	37.1	18.2	18.4	24.1	25.7
1950	38.2	82.0	19.5	35.1	17.4	16.9	23.1	24.3
1951	40.0	69.1	17.4	30.7	13.1	14.6	21.9	22.7
1952	39.4	72.6	16.9	33.7	14.3	17.0	21.3	23.3
1953	40.5	75.0	20.3	42.4	16.8	13.1	22.9	24.5
1954	44.5	84.4	16.0	42.6	20.6	10.9	23.8	24.8
1955	47.3	100.7	14.8	27.0	13.0	6.9	14.9	20.3
1956	41.6	111.6	14.7	30.3	12.1	7.7	15.4	21.0
1957	49.6	78.1	15.3	27.1	12.2	9.9	22.0	23.4
1958	47.6	85.4	14.4	29.2	16.9	9.8	27.1	24.1
1959	48.8	96.9	15.4	27.5	19.2	8.8	32.6	25.7
1960	50.3	113.1	13.8	27.0	19.9	9.0	31.3	24.9
1961	50.6	100.4	14.3	30.4	20.4	8.6	33.6	25.4
1962	53.3	82.6	14.3	33.2	19.3	7.2	35.6	26.0
1963	47.9	70.4	14.9	32.1	18.5	6.3	36.4	25.0
1964	44.9	78.8	13.6	30.3	17.8	5.5	31.3	23.6
1965	45.5	74.4	12.8	30.3	17.6	5.1	31.6	22.6
1966	47.4	106.0	12.3	29.9	16.8	4.6	32.4	22.6
1967	45.8	110.0	12.8	28.5	15.1	4.0	28.9	21.6
1968	52.0	78.2	13.6	31.9	11.6	4.5	33.6	22.0
1969	52.5	85.8	13.5	29.4	11.8	4.7	34.2	23.2
1970	47.5	82.2	12.2	28.1	12.2	4.7	34.7	22.3
1971	49.7	87.0	13.2	29.6	13.4	5.3	40.0	23.6
1972	44.1	88.5	12.3	24.6	11.7	3.8	36.3	22.3
1973	40.7	84.7	10.7	22.5	10.4	3.3	32.1	20.3
1974	38.1	88.9	11.7	22.8	10.2	1.3	36.3	18.9
1975	33.3	92.6	8.1	21.2	6.4	1.4	23.3	14.7
1976	31.7	117.7	8.7	20.9	7.2	2.1	24.1	15.7
1977	26.6	142.2	9.0	20.5	8.1	2.4	25.9	16.1
1978	24.4	126.1	8.2	21.5	6.2	2.3	25.8	15.6
1979	22.6	118.6	6.9	19.2	5.7	2.5	29.1	14.8
1980	23.2	108.6	8.2	26.6	5.7	2.9	43.4	16.9

Source: author´s estimates.

Table C.13. Ratio labour productivity level Uruguay versus United States, US=100

	Food and beverages	Tobacco	Textiles	Paper and printing	Rubber and plastic	Chemical	Total
1939	16.3	18.4	159.1	16.1	48.9	107.2	44.0
1940	14.0	17.5	153.5	14.0	64.9	98.4	39.0
1941	13.9	16.9	180.3	14.3	34.2	96.5	35.0
1942	13.8	20.9	144.9	12.6	34.8	111.3	32.4
1943	11.6	18.2	153.4	11.6	22.4	102.5	28.1
1944	11.0	11.6	157.6	10.8	24.4	93.7	26.7
1945	10.3	16.8	169.4	10.8	24.1	95.4	27.8
1946	12.8	17.3	181.4	12.6	27.4	92.7	33.3
1947	15.8	15.9	191.7	13.2	26.4	100.5	34.8
1948	17.6	17.9	148.9	16.0	33.6	119.1	36.9
1949	18.2	17.7	149.0	16.4	35.3	105.3	36.6
1950	18.6	17.9	144.4	15.7	34.5	85.6	34.6
1951	18.5	19.0	145.3	15.9	42.7	79.2	34.6
1952	18.9	20.2	144.4	16.8	49.8	77.0	35.0
1953	18.7	21.9	123.8	17.2	58.6	75.8	34.5
1954	21.3	23.6	102.0	18.0	63.1	73.8	34.0
1955	19.6	21.0	89.8	16.3	52.9	63.5	29.6
1956	19.6	21.9	99.8	16.2	64.7	55.1	30.5
1957	16.2	22.9	82.8	18.7	53.4	56.1	26.7
1958	15.0	22.4	72.5	16.1	76.5	53.0	24.0
1959	12.8	14.4	59.6	15.0	46.2	42.0	18.9
1960	18.7	13.9	45.8	19.2	68.3	38.8	19.7
1961	20.4	13.1	48.3	15.1	48.9	40.6	18.9
1962	23.7	14.0	43.5	14.7	39.0	36.8	18.1
1963	24.4	15.4	48.6	13.6	30.5	35.8	17.1
1964	22.3	16.8	52.3	16.9	32.6	36.5	17.9
1965	24.0	15.0	47.3	16.8	27.8	31.1	17.5
1966	23.7	12.9	50.1	15.0	30.6	34.0	17.7
1967	21.3	14.0	40.5	14.8	25.2	35.4	17.3
1968	23.2	12.1	38.5	15.5	18.6	26.6	17.7

Source: author´s estimates.

Table C.14. Ratio labour productivity level Brazil versus Sweden, Sweden=100

	Food, beverage and tobacco	Textiles, apparel, leather, footwear, rubber	Wood and furniture	Paper and printing	Chemical and petroleum and plastic	Metals and machinery	Non metallic minerals	Total
1952	33.6	167.0	22.9	38.6	179.5	121.88	41.26	71.2
1953	35.7	156.3	21.0	39.8	186.2	73.21	33.67	66.5
1954	39.7	147.2	18.8	37.7	159.0	74.52	34.83	64.4
1955	40.0	155.2	20.3	37.7	161.9	76.85	32.67	65.9
1956	46.2	148.0	20.9	36.5	184.6	75.52	31.74	67.7
1957	44.1	144.0	19.8	36.2	241.1	84.32	38.52	68.7
1958	54.0	145.9	22.4	41.9	233.5	73.54	42.13	74.7
1959	54.4	181.7	20.3	43.7	231.2	77.44	38.16	79.8
1960	56.2	166.8	21.2	42.6	237.9	91.01	40.96	80.3
1961	59.2	136.2	21.9	40.7	246.8	89.92	38.49	75.7
1962	52.8	129.8	22.2	38.1	210.5	72.66	36.00	68.6
1963	55.2	115.4	22.8	41.2	200.1	71.52	38.85	73.4
1964	47.6	108.0	20.3	32.4	170.2	62.26	36.12	65.1
1965	49.5	112.7	17.2	33.2	155.0	55.40	38.78	64.1
1966	57.7	110.5	21.5	38.0	201.4	65.63	42.71	70.4
1967	55.5	86.4	18.7	41.2	157.0	66.23	43.73	65.1
1968	56.2	86.3	17.6	38.8	151.1	56.04	37.54	58.9
1969	58.3	93.2	19.2	36.0	96.4	64.38	37.52	62.1
1970	54.0	104.2	16.9	36.3	105.4	60.28	34.38	54.5
1971	56.3	116.1	19.3	37.1	108.2	67.44	38.61	59.1
1972	62.6	131.2	18.2	39.4	106.2	78.86	44.17	65.7
1973	70.2	131.1	17.5	39.0	109.4	80.43	42.99	66.1
1974	73.6	142.3	19.1	44.4	114.7	88.68	50.78	71.1
1975	75.7	155.8	24.8	48.2	146.8	81.46	53.69	73.7
1976	78.5	173.7	23.8	47.8	143.4	91.57	57.38	78.0
1977	80.2	184.3	23.9	48.9	123.5	103.36	60.19	83.1
1978	81.9	209.8	22.8	51.8	125.7	112.74	60.01	88.4
1979	78.7	238.4	20.8	56.2	126.8	106.18	54.57	84.4
1980	72.6	271.6	18.3	62.0	112.8	115.89	51.37	81.1

Source: author´s estimates.

Table C.15. Concentration of labour productivity growth by industry. Brazil, 1949-1980

Brazil 1949-1980	LP growth annual rate	VA 1949	Cum relative VA share	RCR	Cum intensive growth cont
Textiles	8.4	9,358,541	19.9	104,303,073	49.5
Leather, rubber and apparel	5.7	3,684,998	27.7	17,163,874	57.7
Tobacco	5.7	680,436	29.2	3,101,222	59.2
Non metallic minerals	5.3	3,410,777	36.5	13,427,855	65.5
Paper & printing	5.2	2,971,532	42.8	11,268,231	70.9
Metals	4.9	7,312,336	58.3	24,694,523	82.6
Food &beverages	3.6	11,920,778	83.7	24,146,050	94.1
Chemicals	3.3	4,626,249	93.5	8,041,141	97.9
Wood &furniture	2.9	3,038,326	100.0	4,403,069	100.0
Brazil 1949-1959	LP growth annual rate	VA 1949	Cum relative VA share	RCR	Cum intensive growth cont
Food &beverages	6.3	11,920,778	25.4	10,012,585	39.2
Chemicals	6.2	4,626,249	35.2	3,798,641	54.1
Leather,rubber and apparel	5.4	3,684,998	43.0	2,561,299	64.2
Tobacco	5.0	680,436	44.5	426,791	65.8
Non metallic minerals	4.6	3,410,777	51.7	1,941,127	73.4
Paper &printing	4.0	2,971,532	58.1	1,429,473	79.0
Textiles	3.1	9,358,541	78.0	3,350,579	92.2
Metals	2.1	7,312,336	93.5	1,650,507	98.6
Wood &furniture	1.1	3,038,326	100.0	347,983	100.0
Brazil 1959-1970	LP growth annual rate	VA 1959	Cum relative VA share	RCR	Cum intensive growth cont
Tobacco	8.4	7,048,930	1.3	10,080,536	4.0
Textiles	6.0	64,839,021	13.5	58,692,993	27.3
Wood &furniture	4.8	29,359,198	19.0	19,651,858	35.1
Non metallic minerals	4.5	35,509,439	25.7	21,839,845	43.8
Metals	4.3	145,105,415	53.0	86,511,798	78.1
Paper & printing	4.0	32,249,281	59.0	17,157,995	84.9
Leather, rubber and apparel	2.3	45,757,380	67.6	12,876,221	90.0
Food &beverages	1.4	104,612,213	87.3	17,920,760	97.1
Chemicals	0.9	67,622,074	100.0	7,207,651	100.0

Source: author´s estimates based on industrial censuses and Colistete (2007).

Cont Table C.15. Concentration of labour productivity growth by industry. Brazil, 1949-1980

Brazil 1970-1980	LP growth annual rate	VA 1970	Cum relative VA share	RCR	Cum intensive growth cont
Textiles	16.7	4,976,927	9.5	18,385,423	30.6
Leather and rubber and apparel	10.0	4,164,779	17.5	6,683,640	41.7
Metals	8.4	17,026,237	50.2	21,065,322	76.7
Paper and printing	7.8	3,322,361	56.5	3,694,241	82.9
Non metallic minerals	6.9	3,134,408	62.6	2,971,775	87.8
Tobacco	3.5	699,831	63.9	283,768	88.3
Food and beverages	3.5	8,412,905	80.0	3,397,862	94.0
Chemicals	3.1	7,957,409	95.3	2,854,663	98.7
Wood and furniture	2.8	2,459,279	100.0	778,042	100.0
Brazil 1980-1990	LP growth annual rate	VA 1970	Cum relative VA share	RCR	Cum intensive growth cont
Textiles	6.6	251,520,048	6.7	224,558,750	30.8
Non metallic minerals	3.1	228,554,620	12.7	81,996,834	42.0
Tobacco	2.3	26,920,740	13.4	6,893,134	42.9
Paper and printing	2.0	221,035,150	19.3	47,169,440	49.4
Metals	1.8	1,398,071,729	56.3	267,008,675	86.0
Chemicals	1.6	675,630,929	74.2	113,447,177	101.5
Food and beverages	0.9	442,288,804	86.0	42,419,747	107.3
Leather and rubber and apparel	-0.2	354,082,327	95.3	-7,212,521	106.3
Wood and furniture	-3.0	175,914,745	100.0	-46,152,214	100.0

Source: author´s estimates based on industrial censuses and Colistete (2007).

Table C.16. Concentration of labour productivity growth by industry. Chile, 1939-1985

Chile 1939-1985	LP growth annual rate	VA 1939	Cum relative VA share	RCR	Cum intensive growth cont
Non metallic minerals	4.6	81,122,525	5.0	571,317,827	21.0
Tobacco	3.8	114,539,013	12.0	536,426,795	40.7
Metals	3.2	132,287,866	20.2	426,841,986	56.4
Paper & printing	2.5	131,711,878	28.3	271,993,538	66.4
Textiles	2.2	270,216,879	44.9	469,082,146	83.6
Food &beverages	1.3	451,412,026	72.6	365,209,421	97.0
Chemicals	1.0	183,501,471	83.9	105,442,577	100.9
Leather &rubber and apparel	0.4	168,452,405	94.3	37,553,136	102.3
Wood &furniture	(2.4)	93,489,566	100.0	(62,660,232)	100.0
Chile 1939-1947	LP growth annual rate	VA 1939	Cum relative VA share	RCR	Cum intensive growth cont
Non met min	8.1	81,122,525	5.0	70,424,889	14.3
Paper &printing	6.6	131,711,878	13.1	88,175,373	32.1
Tobacco	5.5	114,539,013	20.1	61,774,575	44.6
Metals	5.0	132,287,866	28.3	62,721,706	57.3
Textiles	3.6	270,216,879	44.9	89,056,803	75.4
Chemicals	3.6	183,501,471	56.1	60,187,416	87.5
Food &beverages	2.0	451,412,026	83.9	77,703,961	103.3
Leather rubber and apparel	0.7	168,452,405	94.3	10,253,405	105.4
Wood &furniture	(4.1)	93,489,566	100.0	(26,445,492)	100.0
Chile 1947-1957	LP growth annual rate	VA 1947	Cum relative VA share	RCR	Cum intensive growth cont
Metals	3.0	1,243,004,660	11.8	434,820,653	33.0
Food &beverage	2.9	2,495,000,558	35.4	833,904,048	96.2
Non met min	1.6	783,997,354	42.8	135,978,768	106.5
Textiles	0.9	1,995,329,360	61.7	187,713,304	120.7
Paper &printing	0.2	657,033,247	67.9	13,767,132	121.8
Tobacco	(0.0)	590,973,310	73.5	(1,460,312)	121.7
Leather rubber and apparel	(0.2)	1,024,903,511	83.2	(20,133,242)	120.1
Chemicals	(0.7)	1,243,004,660	95.0	(84,536,091)	113.7
Wood &furniture	(4.1)	531,203,935	100.0	(181,039,937)	100.0

Source: authors´s estimates based on industrial censuses, surveys and yearbooks.

Cont Table C.16. Concentration of labour productivity growth by industry. Chile, 1939-85

Chile 1957-67	LP growth annual rate	VA 1957	Cum relative VA share	RCR	Cum intensive growth cont
Tobacco	7.8	16,327,000,000	5.4	18,159,797,672	15.6
Leather rubber apparel	5.9	31,221,900,000	15.9	23,913,157,244	36.1
Wood furniture	4.7	14,465,000,000	20.7	8,517,913,026	43.4
Non metallic minerals	4.5	15,858,000,000	26.0	8,886,011,251	51.0
Paper printing	3.6	16,911,300,000	31.6	7,291,014,790	57.3
Textiles	3.3	40,197,900,000	45.0	15,230,651,891	70.3
Food beverages	2.9	68,648,200,000	67.9	22,780,741,991	89.9
Metals	1.5	62,651,300,000	88.9	10,394,202,395	98.8
Chemicals	0.4	33,406,000,000	100.0	1,424,995,833	100.0
Chile 1967-79	LP growth annual rate	VA 1967	Cum relative VA share	RCR	Cum intensive growth cont
Tobacco	3.8	257,302,300,000	2.7	145,235,139,971	19.7
Metals	3.3	3,439,069,200,000	38.1	1,637,498,189,585	241.8
Non metallic minerals	2.5	314,994,700,000	41.3	110,379,753,052	256.7
Chemicals	1.7	905,274,400,000	50.6	199,149,119,808.3	283.7
Textiles	-1.1	992,483,000,000	60.9	-124,630,961,806	266.8
Paper printing	-1.3	472,562,100,000	65.7	-67,390,910,211	257.7
Food and beverages	-2.6	2,084,860,300,000	87.2	-568,504,378,627	180.6
Leather rubber apparel	-4.8	853,889,100,000	96.0	-377,786,404,355	129.4
Wood furniture	-6.6	387,109,100,000	100.0	-216,551,255,483	100.0
Chile 1979-85	LP growth annual rate	VA 1979	Cum relative VA share	RCR	Cum intensive growth cont
Non metallic minerals	9.7	7,435,963	3.6	5,511,292	11.5
Textiles	7.7	11,259,481	9.0	6,304,085	24.7
Paper printing	6.6	17,768,383	17.5	8,271,972	42.0
Metals	3.6	59,971,856	46.3	14,046,191	71.3
Leather rubber apparel	3.0	17,409,735	54.7	3,381,530	78.4
Food beverages	3.0	48,604,242	78.0	9,436,725	98.1
Tobacco	1.9	7,754,878	81.7	930,981	100.1
Chemicals	0.0	28,640,664	95.5	4,597	100.1
Wood furniture	-0.1	9,463,804	100.0	-33,313	100.0

Source: authors´s estimates based on industrial censuses, surveys and yearbooks.

Table C.17.Concentration of labour productivity growth by industry. Uruguay,1936-1978

Uruguay 1936-78	LP growth annual rate	VA 1936	Cum relative VA share	RCR	Cum intensive growth cont
Paper	3.6	1,251,986	1.8	4,286,992	5.1
Tobacco	3.3	3,488,007	6.7	10,179,088	17.3
Non metallic minerals	3.3	4,539,654	13.1	12,996,331	32.8
Rubber	2.6	685,722	14.1	1,366,982	34.4
Food	2.3	26,562,900	51.5	42,013,021	84.5
Beverage	1.7	12,016,824	68.5	12,179,835	99.1
Printing	1.6	3,667,377	73.6	3,428,778	103.2
Chemical	0.5	4,234,193	79.6	935,301	104.3
Textiles	0.3	7,223,327	89.8	848,608	105.3
Metallurgic	0.1	679,223	90.8	25,286	105.3
Apparel and footwear	-2.7	6,546,125	100.0	-4,471,223	100.0
Uruguay 1936-1955	LP growth annual rate	VA 1936	Cum relative VA share	RCR	Cum intensive growth cont
Rubber	6.5	685,722	0.8	1,589,643.47	7.9
Tobacco	4.4	3,488,007	4.9	4,442,004.96	29.8
Non metallic minerals	2.6	4,539,654	10.3	2,798,837.21	43.6
Printing	2.2	3,667,377	14.6	1,900,992.66	53.0
Leather	2.0	4,894,996	20.4	2,299,664.35	64.4
Paper	1.5	1,251,986	21.9	413,196.82	66.4
Metallurgic	1.5	679,223	22.7	221,172.27	67.5
Food	1.0	26,562,900	54.1	5,454,542.45	94.5
Wood and furniture	0.8	3,534,871	58.3	597,552.35	97.4
Beverage	0.7	12,016,824	72.5	1,748,961.32	106.0
Textiles	0.3	7,223,327	81.0	480,279.83	108.4
Chemical	0.2	4,234,193	86.0	172,944.88	109.3
Electrical machinery	0.1	786,413	86.9	17,421.24	109.4
Apparel and footwear	-0.8	6,546,125	94.7	-974,953	104.5
Vehicle	-1.2	4,512,157	100.0	-918,849	100.0

Source: authors´s estimates based on industrial censuses, surveys and BROU statistics.

ContTable C.17.Concentration of labour productivity growth by industry.Uruguay,1936-78

Uruguay 1955-68	LP growth annual rate	VA 1955	Cum relative VA share	RCR	Cum intensive growth cont
Paper	7.3	16	1.8	24	10.4
Food	6.6	213	26.1	276	128.7
Beverage	1.7	125	40.4	31	142.0
Non metallic minerals	1.0	77	49.1	11	146.7
Chemical	0.2	58	55.8	1	147.3
Tobacco	0.2	24	58.5	1	147.6
Printing	-0.8	37	62.7	-4	146.0
Textiles	-1.7	113	75.6	-22	136.5
Metallurgic	-2.0	70	83.6	-16	129.4
Petroleum	-4.6	73	91.9	-34	115.0
Apparel and footwear	-4.9	49	97.5	-24	104.9
Rubber	-5.5	22	100.0	-11	100.0
Uruguay 1968 78	LP growth annual rate	VA 1968	Cum relative VA share	RCR	Cum intensive growth cont
Petroleum	7.7	2,177,937	2.8	2,386,342	10.9
Non metallic minerals	7.7	4,771,514	9.0	5,211,293	34.8
Rubber	6.5	4,423,562	14.8	3,901,560	52.7
Tobacco	5.4	4,919,158	21.2	3,368,041	68.1
Printing	3.5	2,261,128	24.1	937,544	72.4
Beverage	3.5	7,378,418	33.7	3,018,632	86.3
Paper	2.8	1,330,991	35.4	430,863	88.2
Textiles	2.7	14,356,304	54.1	4,365,472	108.2
Chemical	1.4	6,787,502	62.9	975,435	112.7
Metallurgic	0.2	5,164,222	69.6	113,393	113.2
Food	- 0.7	17,325,054	92.1	-1,166,334	107.9
Apparel and footwear	- 3.3	6,102,938	100.0	-1,721,050	100.0

Source: authors´s estimates based on industrial censuses, surveys and BROU statistics.

Table C.18. Concentration of labour productivity growth by industry. Sweden, 1930-79

Sweden 1930-1979	LP growth annual rate	VA 1930	Cum relative VA share	RCR	Cum intensive growth cont
Chemicals	4.0	88	3.4	545.47	7.3
Non metallic minerals	4.0	157	9.5	944.74	20.0
Leather rubber and apparel	3.5	160	15.8	751.51	30.0
Metals	3.0	842	48.6	2,890.66	68.8
Paper printing	2.7	339	61.8	922.82	81.1
Wood furniture	2.5	251	71.6	593.82	89.1
Textiles	2.1	370	86.0	650.83	97.8
Food beverages and tobacco	0.8	359	100.0	164.70	100.0
Sweden 1930-1939	LP growth annual rate	VA 1930	Cum relative VA share	RCR	Cum intensive growth cont
Non metallic minerals	5.1	157	6.1	89	16.0
Chemicals	4.2	88	9.5	39	23.1
Paper printing	2.9	339	22.8	101	41.2
Metals	2.7	842	55.6	229	82.4
Food beverages tobacco	1.4	359	69.6	48	91.1
Wood furniture	1.2	251	79.3	29	96.3
Leather rubber and apparel	0.6	160	85.6	10	98.0
Textiles	0.3	370	100.0	11	100.0
Sweden 1939-1949	LP growth annual rate	VA 1939	Cum relative VA share	RCR	Cum intensive growth cont
Leather rubber and apparel	3.2	184	4.6	68.6	52.9
Non metallic minerals	2.1	208	9.9	48.6	90.4
Chemicals	1.0	165	14.1	18.1	104.4
Paper printing	1.0	424	24.8	46.5	140.2
Wood furniture	1.0	343	33.4	36.8	168.6
Food beverages and tobacco	0.8	443	44.6	38.8	198.5
Textiles	-0.4	507	57.4	-18.3	184.3
Metals	-0.7	1,688	100.0	-109.4	100.0

ContTable C.18.Concentration of labour productivity growth by industry.Sweden, 1930-79

Sweden 1949-1959	LP growth annual rate	VA 1949	Cum relative VA share	RCR	Cum intensive growth cont
Metals	4.6	3,874	41.4	2,177.2	85.3
Non metallic minerals	4.5	428	46.0	236.4	94.5
Chemicals	3.8	455	50.9	206.8	102.6
Leather rubber and apparel	2.9	432	55.5	143.2	108.3
Paper printing	1.3	1,006	66.3	134.0	113.5
Wood furniture	1.1	727	74.1	83.9	116.8
Food beverages and tobacco	-0.8	1,102	85.8	-81.2	113.6
Textiles	-3.0	1,323	100.0	- 347.3	100.0
Sweden 1959-1969	LP growth annual rate	VA 1959	Cum relative VA share	RCR	Cum intensive growth cont
Textiles	12.0	1,626	8.0	3,403.6	18.1
Leather rubber and apparel	9.1	630	11.1	876.3	22.8
Chemicals	8.1	1,196	17.0	1,415.1	30.3
Metals	6.8	10,139	66.8	9,412.0	80.5
Wood furniture	5.8	1,366	73.5	1,041.1	86.0
Non metallic minerals	5.6	899	77.9	656.7	89.5
Paper printing	5.0	2,358	89.5	1,492.7	97.5
Food beverages and tobacco	2.0	2,131	100.0	474.4	100.0
Sweden 1969-1979	LP growth annual rate	VA 1969	Cum relative VA share	RCR	Cum intensive growth cont
Paper printing	3.9	5,471	12.4	2,529.0	23.7
Wood furniture	3.4	3,836	21.2	1,502.3	37.7
Chemicals	3.2	2,967	27.9	1,093.1	48.0
Non metallic minerals	3.0	2,019	32.5	697.1	54.5
Textiles	1.8	2,317	37.8	461.8	58.8
Leather rubber and apparel	1.8	1,089	40.3	216.1	60.9
Metals	1.7	21,614	89.4	4,002.3	98.3
Food beverages and tobacco	0.4	4,654	100.0	177.7	100.0

Source: own estimates based on industrial censuses and Schön, Industri och hantverk 1800-1980.

Table C.19.Concentration of labour productivity growth by industry.United States,1939-85

US 1939-1985	LP growth annual rate	VA 1939	Cum relative VA share	RCR	Cum intensive growth cont
Chemicals	4.7	2,555	10.7	18,868	22.9
Textiles	4.3	1,822	18.2	11,020	36.2
Tobacco	3.4	350	19.7	1,265	37.8
Leather rubber and apparel	3.3	2,371	29.6	8,348	47.9
Metals	3.3	8,543	65.2	28,678	82.7
Non metallic minerals	2.5	911	69.0	1,974	85.0
Paper printing	2.3	2,636	80.0	5,011	91.1
Food beverages	2.1	3,556	94.8	5,696	98.0
Wood furniture	1.8	1,245	100.0	1,629	100.0
US 1939-1947	LP growth annual rate	VA 1939	Cum relative VA share	RCR	Cum intensive growth cont
Leather rubber and apparel	5.1	2,371	9.9	1,163	23.4
Textiles	5.1	1,822	17.5	882	41.2
Metals	2.9	8,543	53.1	2,182	85.1
Non metallic minerals	2.8	911	56.9	224	89.6
Tobacco	2.7	350	58.3	82	91.3
Paper printing	2.3	2,636	69.3	528	101.9
Chemicals	1.7	2,555	80.0	357	109.1
Wood furniture	-0.7	1,245	85.2	-68	107.7
Food beverages	-1.4	3,556	100.0	-383	100.0
US 1947-1957	LP growth annual rate	VA 1947	Cum relative VA share	RCR	Cum intensive growth cont
Chemicals	6.5	7,308	10.3	6,410	26.9
Tobacco	4.1	641	11.2	320	28.2
Textiles	3.9	5,323	18.6	2,494	38.6
Non metallic minerals	3.3	2,299	21.9	877	42.3
Metals	2.7	28,189	61.5	8,650	78.6
Paper and printing	2.1	7,162	71.5	1,657	85.5
Leather rubber and apparel	2.1	7,273	81.8	1,675	92.5
Wood furniture	2.0	3,866	87.2	845	96.1
Food beverages	1.0	9,116	100.0	942	100.0

Cont Table C.19.Concentration of labour productivity growth by industry.United States,1939-85

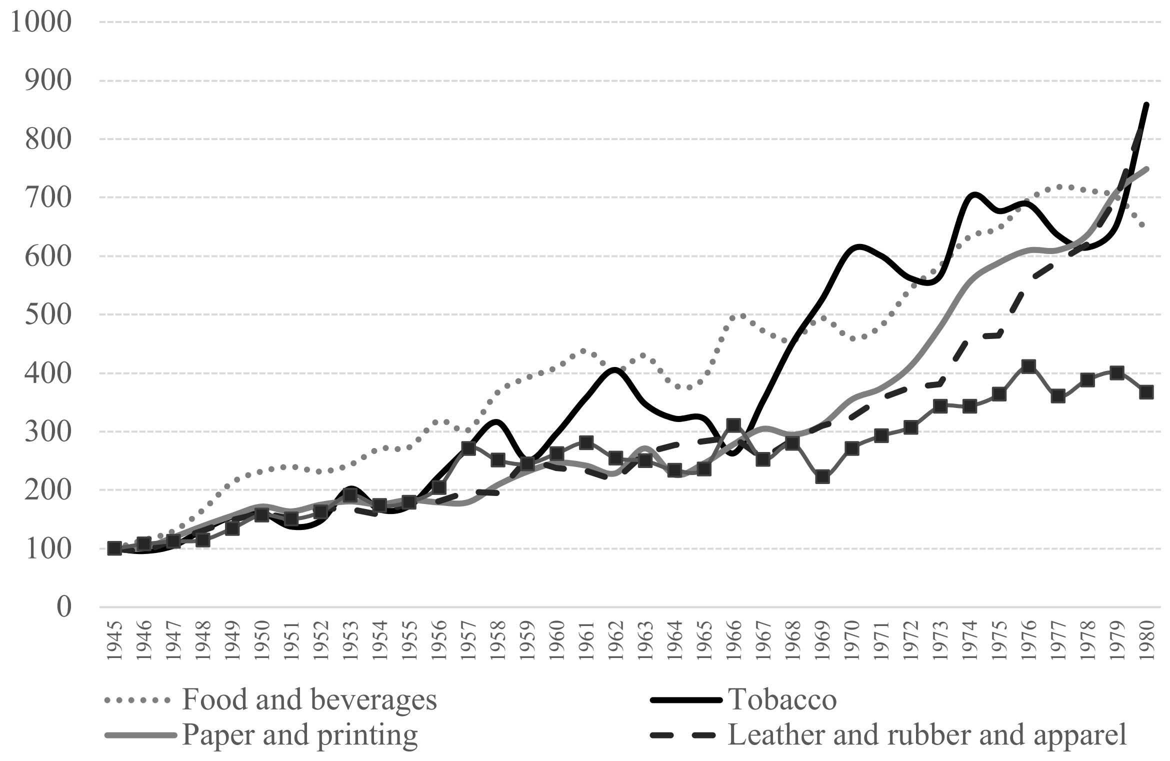
US 1957-1967	LP growth annual rate	VA 1957	Cum relative VA share	RCR	Cum intensive growth cont
Chemicals	7.0	15,622	11.1	15,066	23.2
Textiles	5.2	5,197	14.8	3,419	28.4
Wood furniture	4.2	5,799	19.0	2,979	33.0
Tobacco	4.1	1,246	19.9	621	34.0
Food beverages	3.7	16,347	31.5	7,208	45.1
Metals	3.4	66,954	79.3	26,685	86.1
Paper printing	3.1	13,637	89.0	4,920	93.7
Leather rubber and apparel	2.7	10,421	96.4	3,155	98.5
Non metallic minerals	1.8	4,980	100.0	951	100.0
US 1967-1977	LP growth annual rate	VA 1967	Cum relative VA share	RCR	Cum intensive growth cont
Chemicals	5.6	28,976	11.8	21,133	22.3
Textiles	3.7	8,153	22.7	11,738	34.6
Metals	3.5	118,518	26.0	3,365	38.2
Leather rubber and apparel	3.5	19,491	33.9	7,871	46.5
Food beverages	3.0	26,621	34.8	712	47.2
Tobacco	2.9	2,032	83.1	39,733	89.1
Non metallic minerals	2.8	8,333	86.4	2,599	91.8
Paper printing	2.5	24,111	96.3	6,757	98.9
Wood furniture	1.0	9,143	100.0	1,002	100.0
US 1977-1985	LP growth annual rate	VA 1977	Cum relative VA share	RCR	Cum intensive growth cont
Metals	4.5	264,960	47.6	111,835	63.7
Textiles	4.1	16,105	50.5	6,134	67.2
Leather rubber and apparel	3.8	43,130	58.3	15,002	75.7
Food beverages	3.1	56,062	68.4	15,301	84.4
Tobacco	2.7	4,334	69.2	1,009	85.0
Wood furniture	2.2	25,140	73.7	4,864	87.8
Non metallic minerals	2.1	19,130	77.1	3,389	89.7
Chemicals	1.8	73,099	90.3	11,217	96.1
Paper printing	1.5	54,151	100.0	6,852	100.0

Source: authors´s estimates based on industrial censuses, and surveys.

Figure C.1. Index Labour productivity for different industries, Brazil, 1945=100.

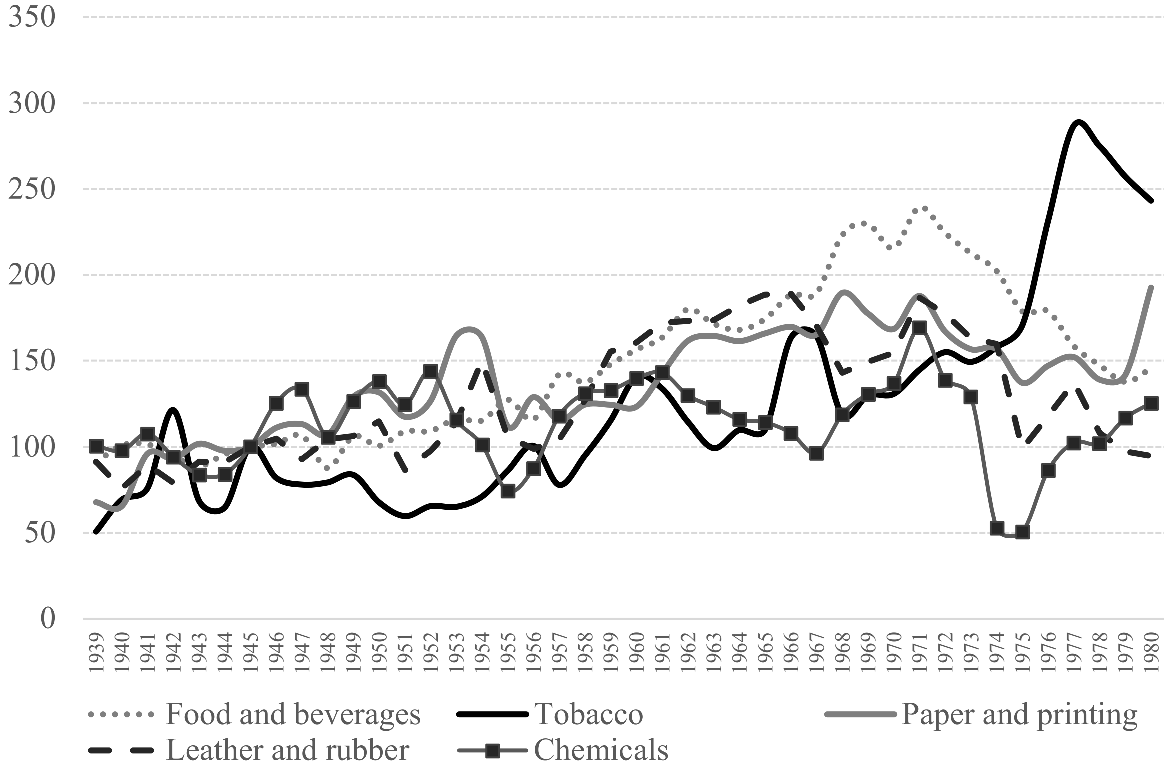
Source: author´s estimates.

Figure C.2. Index Labour productivity for different industries, Brazil, 1945=100



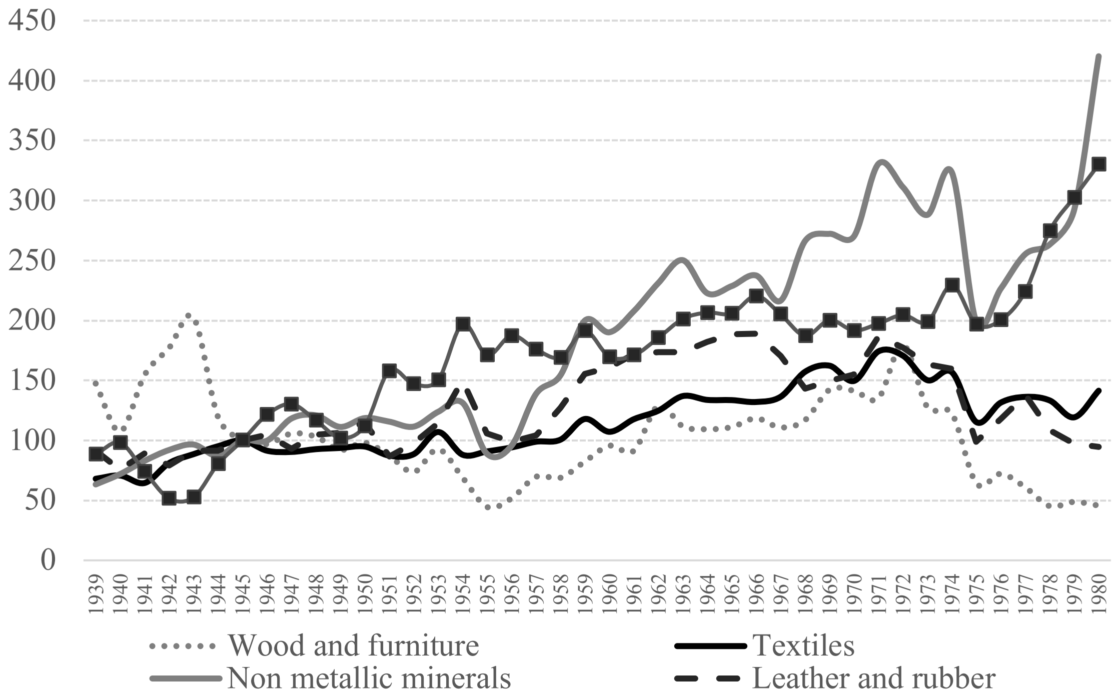
Source: author´s estimates.

Figure C.3. Index Labour productivity for different industries, Chile, 1939=100.



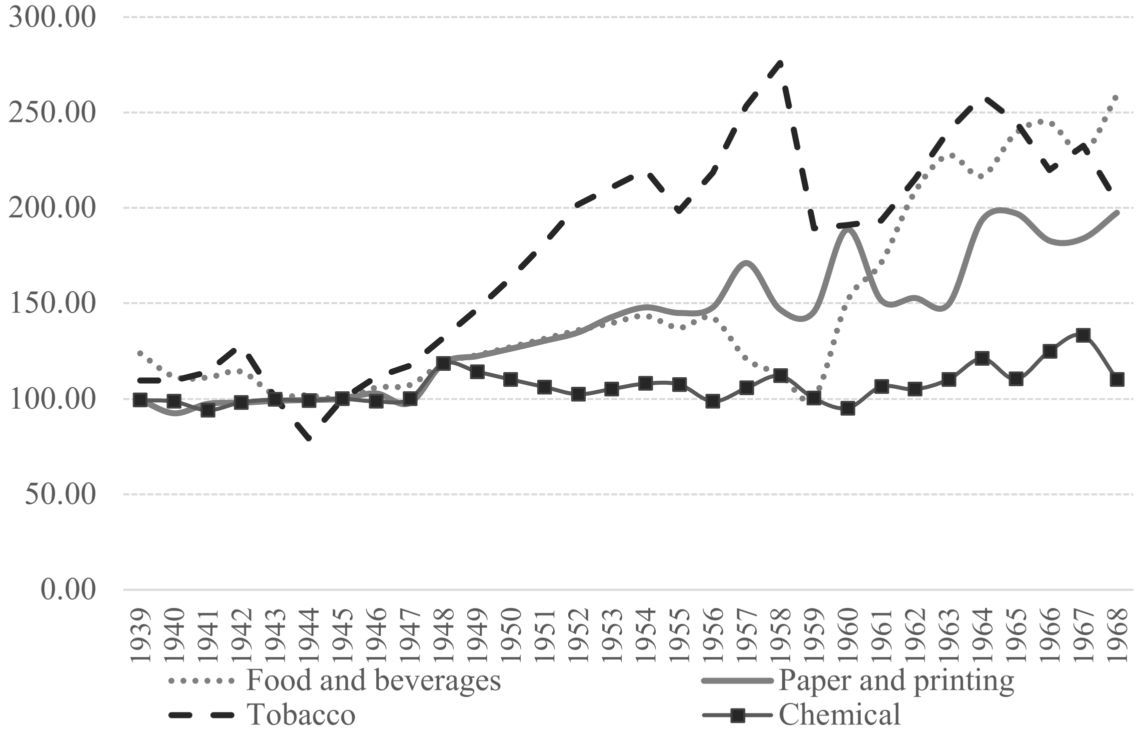
Source: author´s estimates.

Figure C.4. Index Labour productivity for different industries, Chile, 1939=100.



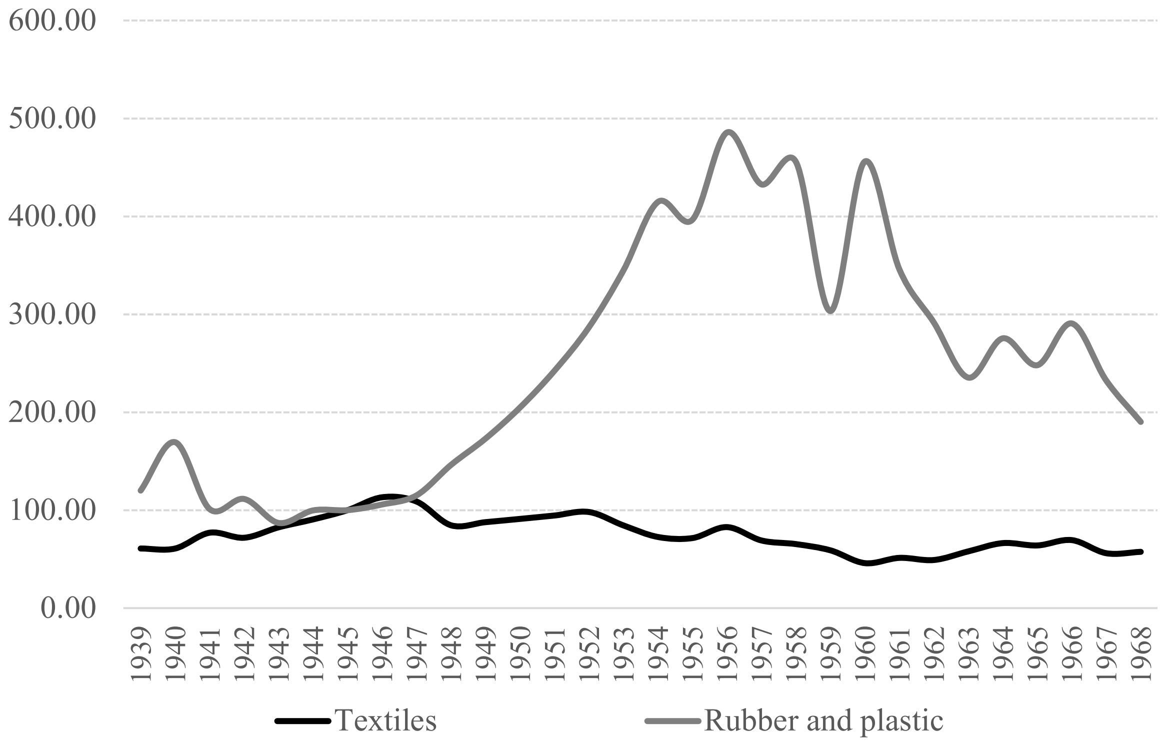
Source: author´s estimates.

Figure C.5. Index Labour productivity for different industries, Uruguay, 1939=100.



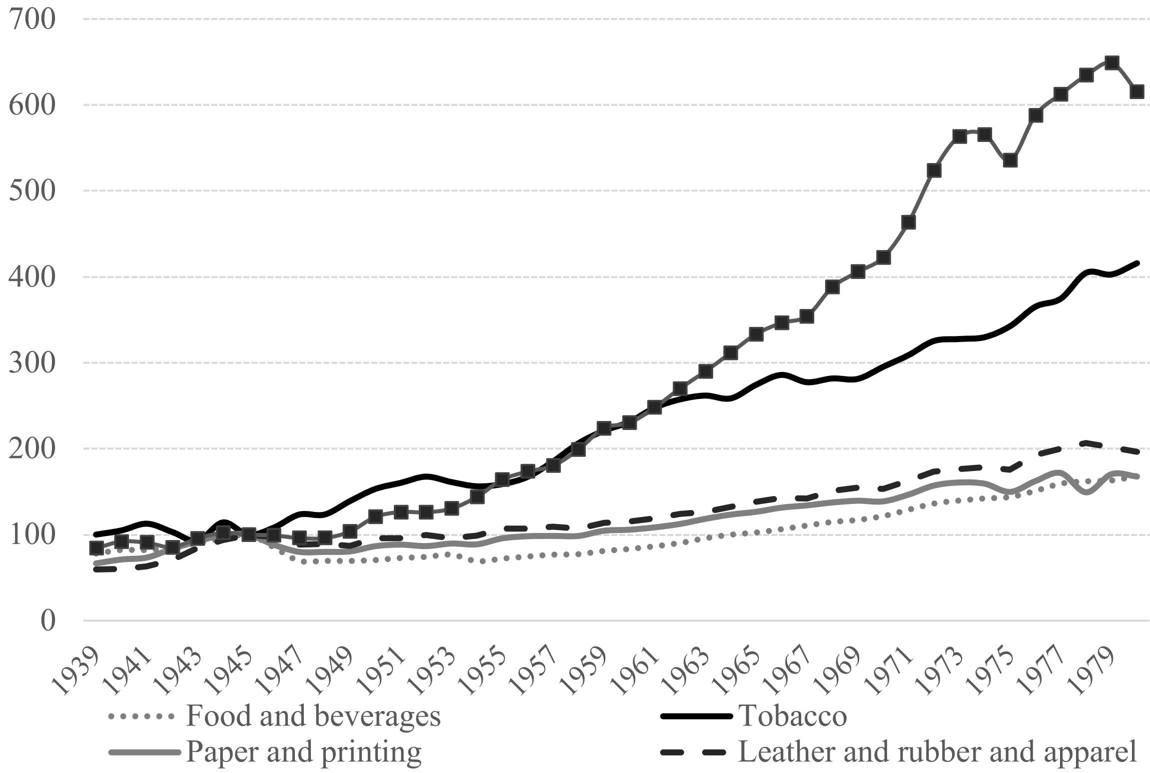
Source: author´s estimates.

Figure C.6. Index Labour productivity for different industries, Uruguay, 1939=100.



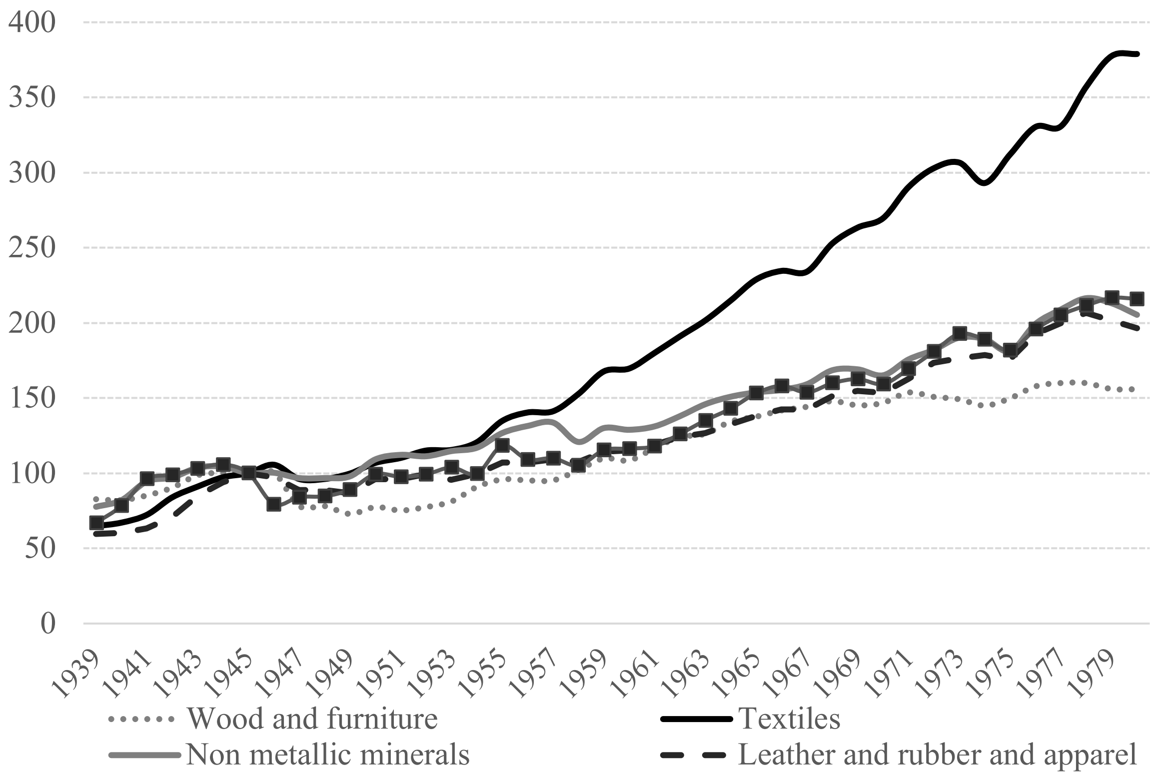
Source: author´s estimates.

Figure C.7. Index Labour productivity for different industries, United States, 1939=100



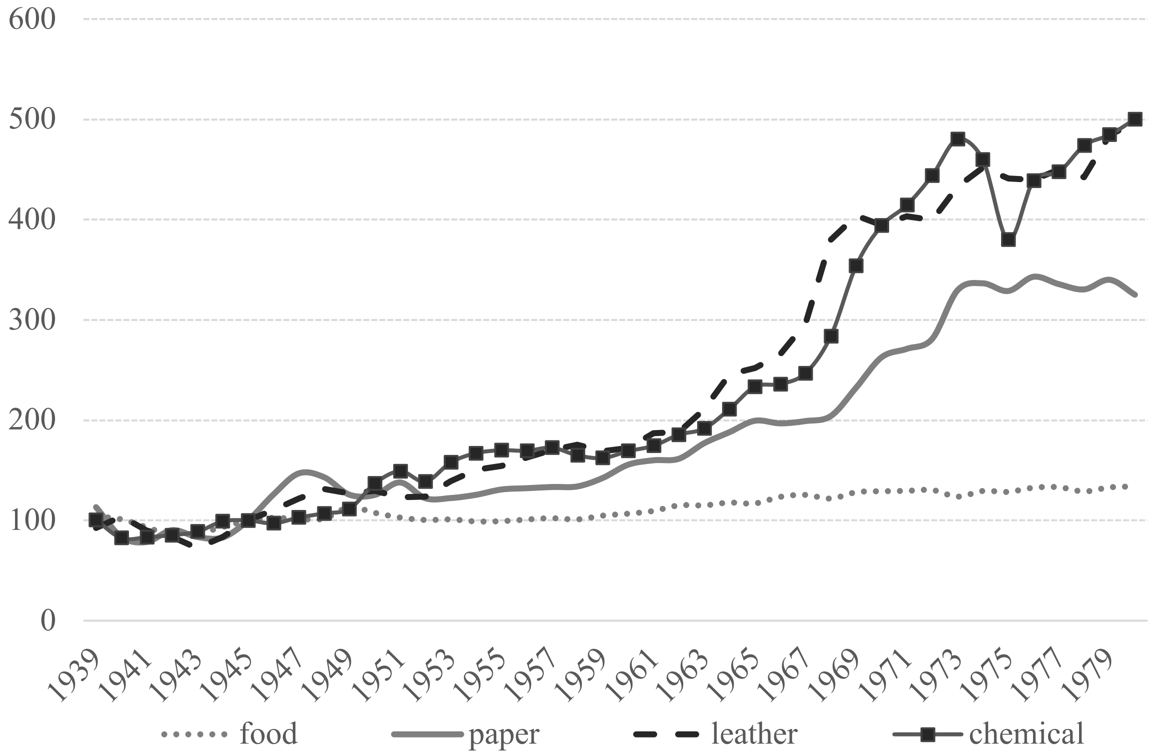
Source: author´s estimates.

Figure C.8. Index Labour productivity for different industries, United States, 1939=100



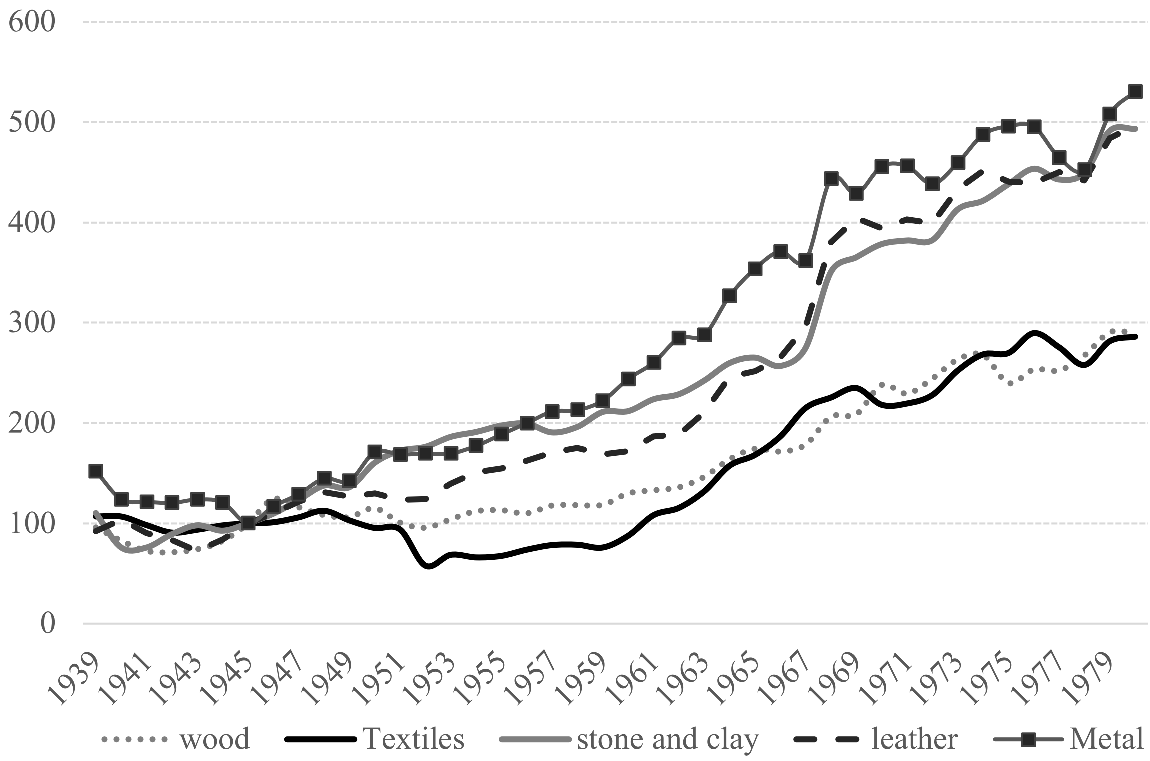
Source: author´s estimates.

Figure C.9. Index Labour productivity for different industries, Sweden, 1939=100



Source: author´s estimates.

Figure C.10. Index Labour productivity for different industries, Sweden, 1939=100



Source: author´s estimates.