Explorations in Latin American economic history

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Chapter 4

Did 'Import Substitution' Promote Structural Change?
A Comparative Study of Manufacturing Productivity in Mexico, Argentina, and Brazil, 1935-1975

"For all its faults, IS (import substitution) promoted rapid structural change.
Labor moved from agriculture to industry, and within industry from
lower-productivity activities to higher-productivity ones.
So much for the inherent inefficiency of IS policies!"

Dani Rodrik, *weblog* (June, 2010)

4.1 Introduction

Import substitution was perhaps one of the most debated topics on economic policy in Latin America during the middle of the twentieth century. Promoting a country's industrialization by reducing imports and substituting them with locally produced industrial products was a policy consensus until the late 1970s. The debt crises and the subsequent economic collapse suffered in the 1980s produced a radical change in the views of the development strategy based on trade protectionism. Thereafter, a vast strand of policy studies sponsored by international organizations analyzing the growth performance of Latin America emerged suggesting new policy directions.[153] The culprit was clear: excessive protectionism granted by industrial policies generated large distortions, resource misallocation and low productivity. In other words, import substitution policies failed to deliver sustained growth in the region. However, there were other views.

[153] Seminal cross-country policy studies suggesting structural reforms to liberalize trade during the 1980s are associated to the works of Balassa (1983), Bell, *et al.* (1984), Bhagwati (1985), and Krueger (1981).

Various economists from the United Nations - Economic Commission for Latin America and the Caribbean (UN-ECLAC) suggested that import substitution should not bear the weight of failure for the collapse of the 1980s; instead, external shocks, debt mismanagement, and political instability were the underlying causes of an unfavorable environment that 'interrupted' the rapid pace of industrial productivity in the region.[154] According to that view, the manufacturing sector served as an 'engine of growth' and tariff policies targeting this sector generated a process of structural transformation in domestic industries; fostering the reallocation of employment from low to high-productivity activities. Hence, import substitution policies favored the expansion of industry, employment, and technological learning, yielding as a result high aggregate productivity growth, and ultimately an increase in the standards of living of Latin Americans during those years (1930s-1970s).[155]

Despite the vast literature on this topic, existing quantitative evidence on the industrial sector has been largely focused on the last years of protectionism (late-1970s) and the liberalization period (1980s-1990s) overlooking the dynamics and productivity performance in previous decades (1930-1960s): lack of consistent data disaggregated by industrial activity has obscured empirical research preventing a systematic assessment of the effects of protectionism on productivity prior to 1970.

This chapter proposes to add breadth to the existing historical literature on Latin American industrialization by exploring the dynamics of productivity growth within manufacturing industries during the period of import substitution from a comparative perspective. Relying on official industrial censuses, it covers the period right after the Great Depression (1935/39) until the mid-1970s (1974/75).

The relevance of this study is related to the current industrial policy debate in the region; despite marked productivity improvements, major Latin American countries are still underperforming, falling short of the reform expectations from trade liberalizations, and thus, lagging behind high-income OECD countries.[156] As a consequence, in recent years several economists have claimed that Latin American policymakers should 'experiment' with new growth strategies including pro-active industrial policies to induce a 'growth-enhancing' structural change and boost productivity growth as accomplished allegedly during the years of import substitution.[157]

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[154] For e.g. Fajnzylber (1983), and Macario (1964). See a review in Baer (1994) and Ocampo and Ros (2011).

[155] See for instance, Astorga *et al.* (2005), Astorga *et al.* (2003), Cardoso and Fishlow (1992), Di Maio (2009), Katz and Kosacoff (2003), Moreno-Brid and Ros (2009), and Thorp (1998).

[156] See Pagés (2010) for a survey of the recent productivity performance of Latin American countries in comparison with other OECD (Organisation for Economic Cooperation and Development) countries.

[157] For example, Cimoli, *et al.* (2009), Greenwald and Stiglitz (2006), Lin (2012), Rodrik (2008), among others.

These growth strategies based on upgrading the quality of economic institutions, also include a typology of industrial policies that resemble the 'old' development strategies from the years of protectionism (e.g. Rodrik, 2005). These policies are mainly characterized by a series of macroeconomic stimulus, industry subsidies, and trade (and non-trade) barriers.

However, in the midst of this renewed debate it is necessary to revisit the claim that protectionist policies were indeed effective in the past as several authors argue. The argument advanced in this study is that one of the most important channels through which tariff policies may have impacted growth is by changing the sectoral distribution of employment towards the most productive activities that increase aggregate productivity (total manufacturing output per worker).

Therefore, if tariffs were important in driving labor productivity growth through this channel (structural change), then protected manufacturing sectors should have experienced faster output growth than non-protected sectors or have higher levels of labor productivity.

Brazil, Mexico, and Argentina have been exemplified as the powerhouses of import substitution policies in Latin America after the Great Depression; therefore, this study takes their manufacturing industries as a benchmark to provide a comparative analysis seeking a relationship between labor productivity growth and industry protection during the middle decades of the twentieth century.

This chapter examines the existence of a *structural bonus/burden* within manufacturing industries on whether there were significant labor input shifts from less to more productive manufacturing branches induced by tariff policies. With this purpose, the analysis employs disaggregated data from official industrial censuses and produce new estimates of labor productivity for 1935/39, 1950, and 1975. Then, it decomposes the components of productivity growth in manufacturing industries by applying a shift-share analysis to this newly compiled data.

4.2 Literature review and recent debate

Structural change is broadly defined as a process of reallocation of labor, capital, and intermediate inputs from traditional to modern economic activities.[158] This is typically characterized by a change in the economic structure that involves the movement of the labor force from low-productivity to high-productivity activities generating a rise in overall productivity and an expansion of aggregate incomes.[159] With rising overall incomes, a decline occurs in the share of food consumption (Engel's law) and a rise in the share of

[158] See a synthesis and broad quantitative evaluation in Herrendorf *et al.*, (2014).

[159] See in Chenery *et al.,* (1986) and Harberger (1998).

resources allocated to investment. In a closed economy framework, this shift in demand away from agricultural goods aided by a faster rise of productivity in manufacturing produces a natural reallocation of production inputs (Syrquin, 1988).

Large shifts in factors inputs are considered as part of a secular process across the stages of economic development; from agriculture to industry, and subsequently from industry to services. As argued by Chenery (1986), structural transformation within the industrial sector may entail shifting the pattern of specialization from traditional to more sophisticated goods, a process which would generate higher productivity growth at the aggregate level.

Within a sector, this structural transformation can be 'partially' visible on the reallocation of labor. Because of the well-known existence of large inter-sectoral differences in labor productivity (i.e. temporal disequilibrium in factor markets), labor tends to shift towards more productive sectors.[160] Determined by changes in domestic demand, and by the patterns of international trade (comparative advantage), this process of structural change can be accelerated by industrial policies, such as import substitution.

The primary goal of substituting imported goods is to change the country's pattern of trade with the purpose of upgrading and/or developing a new competitive industrial base.[161] Erecting a variety of barriers to the importation of foreign goods and substituting them for domestically produced goods, these policies promote new economic activities that require the reallocation of the labor force (and other inputs such as capital and intermediates) across and within sectors of the economy. The replacement of imports (of consumer, intermediate, and capital goods) with domestic production comes from the premise that by creating 'infant' industries and targeting existing 'priority' ones with a variety of industry incentives, the economy would be more diversified, self-sufficient, and resilient to the fluctuations of the international business cycle. This ultimately would enhance domestic welfare over time.

Protection reduces the competitiveness of newly import-competing products by raising the price of their output in domestic markets to favor local producers. In addition to the 'traditional' import barriers such as tariffs, and quotas, the protectionist 'toolbox' can be extensive and accompanied by a series of measures including: subsidies, tax breaks, low interest loans directed to selected industries, and also the manipulation of exchange rates (Bruton, 1998).

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[160] As formally exposed by Syrquin (1984: 78): "because of the shift of labor from low to high (average) productivity sectors, the growth of the aggregate labor productivity exceeds the weighted average of the corresponding sectoral growth rates".

[161] The technical definition of import substitution generally refers to the position when the import share of the supply of a specific good declines in relation to that of domestic production either because a new tariff is levied on imports of that product, or because devaluation raises import prices (Chenery, 1970).

Although the original argument ('infant industry') for protectionism as a comprehensive set of industrial policies dates back to the classical work of Alexander Hamilton (1790) and later of Friedrich List (1841), a modern theory of protection has emerged in the last decades setting a case for industry policy. Currently, it is possible to identify three strands of approaches on the welfare gains of protectionism: models with a *Schumpeterian* approach, a *Marshallian* approach, and a *strategic trade* argument.

The first strand (Schumpeterian) argues that targeting of high-technology sectors via a combination of trade protection, subsidies, and tax breaks may provide large incentives to invest in new technologies and processes. This, in turn, would lead to a stage of 'accumulation' characterized by rapid growth in productivity, and then to a phase of 'assimilation' where innovation processes enhance welfare and competitiveness (Fagerberg, 1994; Nelson and Pack, 1999).

On the other hand, authors who are inclined to support the Marshallian approach and/or the strategic trade argument claim that the temporary protection (targeting) of a sector/industry that displays *Marshallian externalities* enhances productivity growth by raising total output in those sectors. It is argued that sectors with these externalities can arise through localized industry-level knowledge spillovers, input-output linkages together with transportation costs which give rise to geographic agglomeration of industries (Krugman, 1991).[162]

At the empirical level, there are several cross-country studies that have analyzed the effect of tariffs on welfare and structural change, giving rise to the so-called 'tariff–growth paradox'. These studies have addressed with large country samples the shifting effects of tariff protection on economic growth over time; protection promoted growth before the Second World War, but inhibit it thereafter (e.g. Clemens and Williamson, 2004; and Jacks, 2006). In a related cross-country study, Irwin (2002) explored if trade tariffs had an impact on growth by shifting resources out of agriculture to industry during the nineteenth century. His findings suggest that although there was a correlation between tariffs and growth, the evidence is conditional on the country's comparative advantage and the institutions in place. He concludes: "tariff policies are complex and vary greatly across countries in ways depending strongly on resources, institutions, and government strategies".[163]

Although there are empirical cross-country studies on structural change focused on the 'total-economy' and at a sectoral level (agriculture, manufacturing, and services) such as Timmer and de Vries (2009), Duarte and Restuccia (2010), Debowicz and Segal (2014) there are also several studies at the industry level. These studies have sought at a more disaggregated level a relationship between productivity growth and tariff protection;

[162] See a full theoretical explanation in Harrison and Rodriguez-Clare (2009).

[163] D. Irwin, 'Did import substitution promote growth', p. 22.

however, with the exception of Baldwin and Krugman (1988), most of them have found little support for this relationship. Seminal studies are found in Krueger and Tuncer (1982) for the manufacturing industries in Turkey, Lee (1996) for South Korea, and Beason and Weinstein (1996) for Japan.

Moreover, at the micro-level (plant level) studies using more recent data for a sample of manufacturing plants such as Muendler (2004) for Brazil, Pavcnik (2000) for Mexico, Eslava *et al.* (2010) for Colombia, have tended to confirm this weak relationship. One of the most peculiar cases is shown in Luzio and Greenstein (1995) for the unsuccessful attempt of the Brazilian government to promote productivity growth within the microprocessor industry through tariff protection in the mid-1980s.

In a study on the dynamics of manufacturing industries, Timmer and Szirmai (2000) presented evidence testing the *structural-bonus hypothesis* for a group of Asian countries. Using a shift-share method, they explored if labor and capital shifted from less productive manufacturing branches towards more productive branches. The results failed to confirm this effect, however, after this study, further analyses using this method have been carried out for other regions (except for Latin American manufacturing).[164] Katz (2000) analyzed through a sample of Latin American manufacturing industries from 1970 to 1992 the process of productivity catch-up relative to the levels of United States. However, in that study there was a limited year-coverage for the period of protectionism and the phenomenon of shifting resources within and between industrial branches (structural change) was not explored.

Recent debate

During the years of import substitution in Latin America, specifically for the period of 'explicit' industrial protection between 1930 and 1975 the evidence on the link of productivity growth and manufacturing protection is still not clear.[165] In fact, although the structural problems of the import substitution model in Latin America and its political and economic consequences were notably emphasized long ago in the seminal works from Albert Hirschman (1968), on the empirical side the issue on the dynamics of productivity growth for these years has remained speculative and controversial due to serious data problems (see e.g. Edwards, 1993).

Whereas some authors have argued that overall productivity grew faster in Latin America thanks to protectionist policies than in any other period in the history of the

[164] See also a comparison of Taiwan and South Korean manufacturing in Dollar and Sokoloff (1994).

[165] It is labelled 'explicit protection' because prior to this period trade tariffs levels were also high as they were inherited from post-independence tax regimes. It was after the Great Depression when governments embraced tariff policies in the official discourse as elements of their industrial promotion programs (Sokoloff and Zolt, 2007).

region (e.g. Astorga *et al.* 2003; Thorp, 1998), others consider Latin America's current productivity gap (post-1980) and stagnant growth performance as a legacy of the policies of the import substitution period (1930-c.1975).[166] The latter studies argue that erecting barriers to international trade and prolonging them for more than three decades meant missing the opportunity to build technological capabilities and upgrading domestic industrial structures based on competition and openness that would have raised labor productivity and spurring domestic innovation.[167]

Moreover, although during this period of protectionism Latin American industries increased their shares in the world economy presumably aided by trade protection, it is claimed that the benefits of this 'inward-looking development' strategy were 'offset' by the consequential costs of distortions and rent-seeking activities that impacted negatively on productivity growth (Taylor, 1998).

On the other hand, more recently McMillan and Rodrik (2011) have documented that after the import substitution period (after the liberalization in the 1980s) as trade barriers declined, Latin American industries became more productive and efficient, but this occurred at a major cost for the region: a productivity 'growth-reducing' structural change. These authors showed with sectoral-based evidence that liberalization instead of promoting the reallocation of employment towards the most productive sectors, shifted employment to the less productive such as agriculture and the informal sector.

These findings have re-opened the debate not only on whether protectionism or openness are good for growth by inducing or reducing structural change, but on how the structure of regulation (i.e. protection) can be complementary to market competition within a sector.[168] For instance, Nunn and Trefler (2010) showed with cross-country evidence that the *skill-bias* of the structure of tariffs is positively correlated with productivity growth. That is, there are productivity gains when tariffs targeted *skill-intensive* industries. Yet, theirs and the other existing studies are cross-country correlations between productivity growth and tariff protection, and are based on GDP (Gross Domestic Product) per capita, a variable that neglects the shifting dynamics within industries. The present study aims to contribute in filling this lacuna by showing historical evidence with disaggregated data in manufacturing for Brazil, Mexico and Argentina.

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[166] See e.g. Cole *et al.* (2005), Edwards (2009), and Taylor (1998).

[167] There is growing body of empirical studies suggesting that export-oriented regimes lead to rapid technological development in labour-intensive industries. This is because exposure to international trade induce firms to acquire new technical expertise, facilitating the acquisition of new skills by workers and thus, increasing overall productivity. See a review in Syverson (2011) and Tybout (2000).

[168] See for e.g. a debate in Lin and Chang (2009), and further empirical evidence in Aghion *et al.* (2012).

4.3. Industry and protectionism in Latin America after 1930: a brief historical overview

As mentioned previously, Latin American countries grew rapidly during protectionism. The years after 1930 and especially in the aftermath of the Second World War have been considered as the twentieth century's 'golden age' of economic growth around the world and Latin America was not an exception.

Countries like Mexico and Brazil grew even faster than some advanced industrial countries. By 1980 their real incomes (per capita) where nearly four and five-times the 1930 levels respectively (see table 4.1). Although these GDP levels were still behind countries like the United States and the United Kingdom, the growth performance of Latin America during this period was unprecedented.[169]

Table 4.1: Levels of GDP per capita in selected countries, 1930 and 1980 (1990 Geary–Khamis dollars)

Year	United Kingdom	United States	Mexico	Brazil	Argentina
1930	5 441	6 213	1 618	1 048	4 080
1980	12 931	18 577	6 320	5 195	8 206
Increase in GDP per capita (%)	237	300	390	495	205

Source: Based on Maddison (2007) updated by Bolt and van Zanden (2014).

Countries in the region experienced the 'stylized' sectoral transition from agriculture to industry, and to services. As figure 4.1 shows, in Mexico, Brazil and Argentina, the share of agricultural employment fell sharply followed by an increase in the industry and services employment shares. As in other major industrial economies such as the United Kingdom, the United States, and Italy, industrial policies attempted to speed up this process of structural change, which in some cases failed or had little effect.[170]

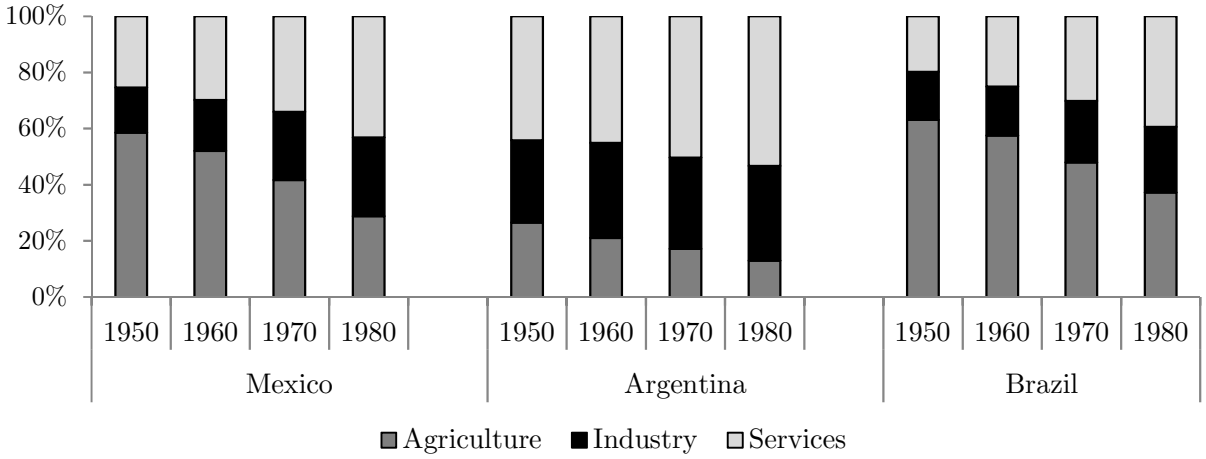
After the outbreak of the Great Depression, protectionist policies enacted by the United States and the United Kingdom such as the Smoot-Hawley tariff in 1930 and the British General Tariff in 1931 affected negatively the commercial flows around the world. Latin American countries that were highly dependent on commodity-trade were severely

[169] An exception is Argentina which had a relatively higher real GDP growth rates in the late nineteenth century. See Taylor (1994).

[170] See for example, Broadberry and Crafts (1996) for the case of the United Kingdom, Cole and Ohianian (2004) for the United States, and Giordano and Giugliano (2014) for Italy.

hit. Exports, tax revenues, and total employment collapsed by the early-1930s in major Latin American economies. Thereafter, a period of 'explicit' government interventions began aiming to foster domestic manufacturing industries.

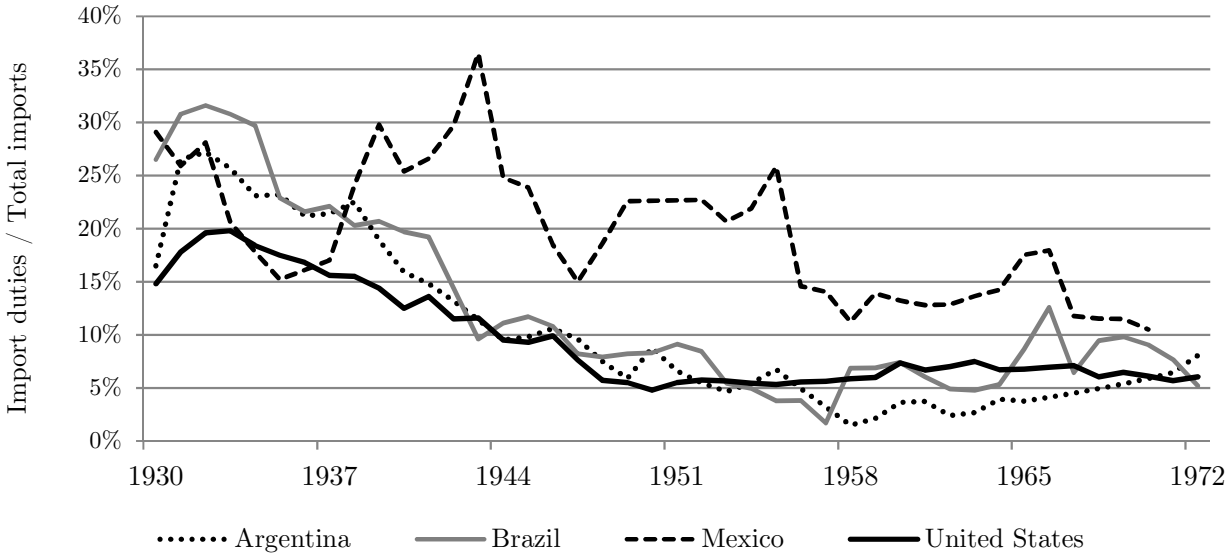
Figure 4.1: Sectoral employment shares of Mexico, Argentina, and Brazil, 1950-1980 (%)



Source: Data from GGDC 10-sector database (Timmer and de Vries, 2009).

However, protectionist policies did not appear as a coordinated regional policy effort. Although many Latin American governments reacted with protectionist measures after 1930, high tariffs were already a common feature before the Great Depression (see for e.g. Coatsworth and Williamson, 2004).

Figure 4.2: Average tariffs in Argentina, Brazil, Mexico, and United States, 1930-1972



Note: Unweighted average of country's own tariffs (total economy).
Source: Data from Clemens and Williamson (2004).

Most of the conventional literature has portrayed protectionism in Latin America as part of nationalist projects influenced by 'dependencia' economists like Raúl Prebisch (1949). Yet, it was the administration of the United States back then who advised governments in Mexico and Argentina with plans and procedures to implement tariffs, tax reforms, and other industry incentives aiming to channel American private investments into the targeted industries (Maxfield and Nolt, 1990).

Moreover, most of these protectionist measures were enacted gradually over the years at the behest of manufacturers and in response to the existing conditions of international markets (Haber, 2006). As figure 4.2 shows, although the average level of tariffs was higher than in the United States there was a clear downward trend in the protection of major Latin American countries from 1930 to the early-1970s.

It is difficult to make a generalization of a single regional Latin American set of industrial policies since there was no uniform 'development strategy' based on import substitution. Instead, the 'typology' of protectionism erected in these countries was diverse. According to Baer (1994) and Teitel and Thoumi (1986) in Chile and Venezuela protection followed different stages based on gradual horizontal integration. In larger economies like Brazil, Mexico, and Argentina there was an 'urge' to foster industrialization based on vertical integration, i.e., promote both final consumer goods industries, and intermediate and the capital goods sector.

Table 4.2: Average rate of effective protection in Argentina, Brazil, and Mexico's manufacturing in the mid-twentieth century
(Percentages of industrial value added)

	Consumption goods	Intermediate goods	Capital goods	All manufacturing
Argentina	164	167	133	162
Brazil	230	68	31	118
Mexico	22	34	55	27

Note: The effective rate of total protection is the percentage by which the value added at a particular stage of processing in a domestic industry can exceed what it would be without protection. Data for Argentina is for 1958 and Brazil for 1966 and Mexico for 1959.
Source: Little, Scitovsky and Scott (1970), p. 174.

As is shown in figure 4.2, average total tariffs levels were higher in Mexico, but effective protection within manufacturing was much higher in Argentina and Brazil during this period. Table 4.2 shows this feature; whereas Argentina and Brazil's effective protection was heavily directed to the production of consumption and intermediate goods,

in Mexico effective protection was relatively lower and more directed to the protection of capital goods.

Latin American industrial corporatism after 1935

Cliometric studies have tended to neglect a common factor that assisted industrial targeting programs: *corporatism*. This scheme was fundamental in mediating disputes between labor and capital. But more importantly, this allowed governments to expand their influence on manufacturing industries by creating special programs directed to facilitate high investment rates together with the coordination of domestic labor markets. Government officials along with company managers would set wage restraints to factory workers, and subsequently industrialists (owners) would reinvest their profits. Since most of employers' associations and trade unions were attached to the state, corporatism aimed to control labor relations at the firm level, setting wage demands to the growth of labor productivity.

Similarly to the European type of labor market coordination after the Second World War, manufacturing wages were set to move in tandem with productivity levels (see e.g. Eichengreen, 2008). Governments headed by Getúlio Vargas (1930-45, 1951-54) in Brazil; Lázaro Cárdenas (1934-40) and Manuel Ávila-Camacho (1940-46) in Mexico; and Agustin Justo (1932-38) and Juan Perón (1946-55) in Argentina, engaged effusively in corporatist schemes to facilitate the implementation of their industrial policies.

In the following decades (1940s to 1960s), trade unions gained political ground in the industrial sector throughout the region. Labor rights and benefits were implemented such as a social security program and a minimum wage for urban workers. In Brazil, the coalition of political forces led by Getúlio Vargas brought an era of government interventions in the midst of conflicting interests between landowners, industrialists, and workers. Vargas advocated a program of economic modernization by imposing tariffs to favor agro-businesses and textile manufacturers. The so-called *Estado Novo* (new state) established a new Constitution which gave absolute power to the executive branch, a feature that facilitated discretionary policy measures. Although at the beginnings of Vargas' administration the agenda tended to favor trade unions, it rather repressed them aiming to compact industry wages and prices (Colistete, 2001).

Brazilian industrialists and unions were in a continuous conflict of interests and often trade unions controlled the economic agenda towards an economic reform that industrialists rejected. It has been argued that this lack of 'social compact for growth' prevented industrial real wages to grow in tandem with labor productivity (Colistete, 2007).

In the same period, the Mexican economy was experiencing a secular decline in mining and oil activities which where the leading sectors at the end of the nineteenth century. In turn, these were being replaced by agricultural and manufacturing production. The severe shortages of imported manufactured goods caused by the Great Depression in the United States raised their relative prices and thus, the profitability of producing them domestically. Thereafter a corporatist industrial model emerged in Mexico propelled by the rise of the Partido Nacional Revolucionario (National Revolutionary Party).[171] This new political movement 'unified' the interests of the government and industrial workers to promote national development.

The administration of Lázaro Cárdenas in the mid-1930s, was heavily involved in worker's organizations resulting in the creation of the Mexican Workers' Confederation (Confederación de Trabajadores de México). In this, the majority of trade unions were organized and attached to the political party. The consolidation of this scheme provided the basis of both popular support for the industrial policies to protect Mexican manufacturers offering preferential tariffs, together with a tight control of industry wages through trade union arrangements. In the following decades (1950s and 1960s) high output growth and low ('stable') inflation rates would characterize the Mexican economy, a period also known as the *desarrollo estabilizador* (stabilizing development).[172]

For the case of Argentina, unquestionably the most prosperous Latin American country at the start of the twentieth century, the period after the Great Depression until the 1970s has been generally considered as a 'growth reversal'.[173] The country experienced a decline in GDP growth rates in relation to the United States and other advanced countries. However, manufacturing remained a fundamental sector in terms of employment and it witnessed substantial changes, including the emergence of important sectors such as transportation and machinery equipment. The new industries produced for the domestic market and a large share of these firms had foreign, especially British ownership (Taylor, 1998). During these years, governments such as the administration of Juan Perón began to intervene directly in 'national' industries. Perón's regime aimed at diversifying an economy that was dominated by food processing, leather, textiles, and other less-capital intensive industries.

The five-year economic plans instructed by Perón raised industrial workers' pay, but also included fostering high (and medium)-capital intensive industries like the machinery and transportation industries via subsidies and trade tariffs. Previously, during the so-called *infamous decade* (1930-1943) Argentinian trade unions had begun to occupy a space in public life which strengthened labor-industrialists negotiations which at the

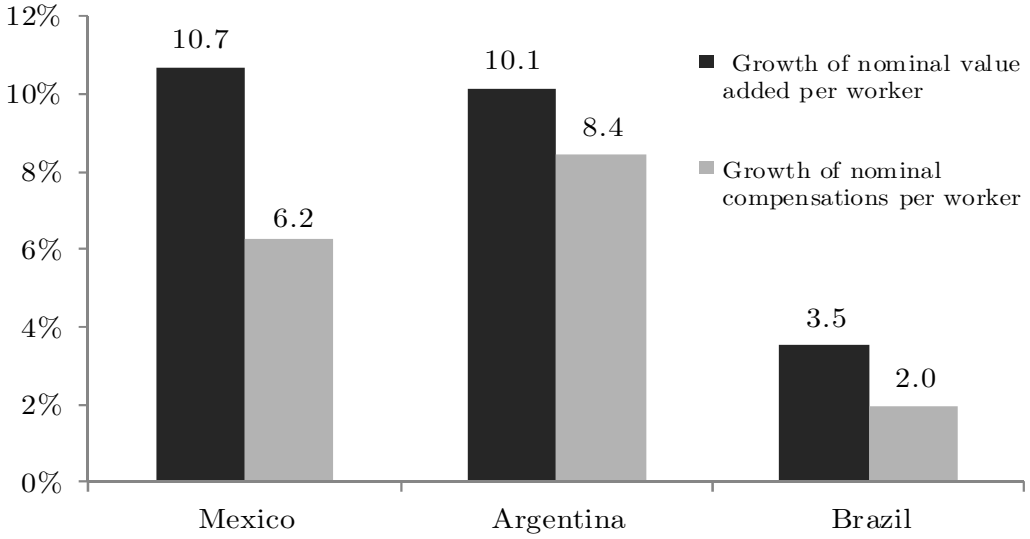
[171] The party was renamed later as Partido Revolucionario Institucional (PRI) in 1946.

[172] The term 'desarrollo estabilizador' appeared for the first time in Mexico's official annual economic report for the World Bank in 1970.

[173] della Paolera and Taylor (2003).

time was formalized in the General Confederation of Labor (Confederación General del Trabajo*)*. In the same way to their trade union's counterparts in Mexico and Brazil, collective bargaining demands in Argentina were subject to labor productivity increases, a corporatist arrangement that supported import substitution policies of the Perón regime and subsequent governments.[174]

Figure 4.3. Growth of total manufacturing nominal value added per worker and nominal compensations per worker in Mexico, Argentina, and Brazil, c.1950-1975
(% compound growth rates)



Note: Growth rates are annual average compound growth rates of nominal values in local currencies for the period 1947/1950 to 1974/75. Nominal compensations refer to the sum of total wages, salaries and other paid benefits.
Source: See next section and appendix B.

However, as figure 4.3 depicts, in spite of these arrangements, workers' compensations lagged behind productivity (total value added per worker) during this period.[175] The message of this overview of the institutional arrangements in the industrial sector is that overall labor productivity within each of these countries interacted not only with the level of tariff policies in specific branches. The prevailing corporatist schemes

[174] During Peron's regime (by 1955) the so-called *Congreso de la productividad* (Congress for productivity) was instituted aiming to align the interests of unions, industrialists, and government.

[175] Figure 4.3. is displayed purposely in nominal terms. Collective wage bargaining was usually set in nominal terms and were adjusted for inflation only after prolonged periods of time and/or the expiration of the collective contract. There is vast evidence indicating the existence of the 'money illusion' phenomena in these countries (e.g. Dornbusch and Edwards, 1991); workers preferred to see their nominal wages rise, giving them the illusion that their living standards were improving, even though in real (inflation-adjusted) terms they may not be better off.

imposed to compress industry wages were a key element for implementing the industrial policies during the years of import substitution.

4.4 Data description, adjustments, and limitations

Detailed statistical data of the industrial sector for most of the Latin American countries in the years previous to 1960 suffer from large discontinuities and inconsistencies. There have been various efforts to collect and reconstruct statistical information with a consistent time-span based on the SNA (System of National Accounts).

For instance, ECLAC (Economic Commission for Latin America and the Caribbean) assembled country-based statistics on economic and social variables since 1930. Unfortunately, in their industry-specific studies most of the information related to the manufacturing sector is not disaggregated by the type of industrial activity or branch. Their aggregate results on 'sector totals' are derived from interpolations linking growth rates between missing years. On the other hand, the datasets of United Nations Industrial Development Organization (UNIDO) contain highly disaggregated data (3-digit level); however, their data only include the years after 1970.[176]

For longer periods previous to 1970, the widely used historical datasets such as Mitchell (2007), Penn World Tables, Maddison (2007) and Bolt and van Zanden (2014) have provided a series of sound long-term GDP information which have been used to make international comparisons of output and productivity including Latin American countries.[177] However, the issue of employing GDP at an aggregate level (or the share of manufacturing in total GDP) as proxy for industrial productivity is that these measures by themselves do not capture the intra-industry dynamics of a changing economy over time. The sectoral disaggregation by Timmer and de Vries (2009) (GGDC 10-sector database) comprises industrial sectors including manufacturing since the year 1950; yet, it does not further disaggregate by manufacturing branches.

Therefore, the statistical data employed in this study draws on primary sources obtained from *industrial censuses*, or 'censos industriales' in Spanish/Portuguese (currently renamed as 'censos económicos' or 'censo nacional económico'). These censuses are official country surveys of economic units elaborated by national statistical offices every three to five years depending on the country of analysis and cover the manufacturing branches of 3-digit level industries.

In Argentina, national censuses have been conducted since 1869. In 1914, the census included a subsection devoted to the manufacturing sector labeled as 'censo de las

[176] The same applies for the ECLAC-PADI dataset (Program of Analysis of Industrial Dynamics).

[177] Another similar source is the Montevideo-Oxford Latin America database (MoxLAD) which covers 20 Latin American countries for this period; however, the manufacturing sector is largely incomplete.

industrias'. However, the disaggregation of manufacturing branches was conducted for the first time in 1934 and published the following year (1935). Similarly, in Mexico, the first *censo industrial* was conducted by 1930. In Brazil, this statistical collection of manufacturing industries was conducted in 1939 and published in 1940.

Consistency and adjustment

For comparison purposes the present analysis establishes three reference benchmark-years according to the date that matched a similar census-year between these countries: 1935/39, 1947/49/50, and 1974/75.[178]

Table 4.3: Industry census country/year sample

Country	Reference year of census data
Mexico	1935, 1950 1975
Brazil	1939, 1949, 1975
Argentina	1935, 1947, 1974

Source: Data for Mexico is from *Segundo Censo Industrial* (1935), *Quinto Censo Industrial* (1957), *Décimo Censo Industrial* (1976); For Brazil, data is from *Recenseamento geral do Brasil* 1940, and 1950: Censo Industrial; and 1975 from *IBGE*, Censo Industrial: Brasil, Serie Nacional, Vol. 2, Part I, Rio de Janeiro, (1981). For Argentina data is from *Censo Industrial de 1935 (Comisión Nacional del Censo Industrial 1938), Censo Industrial de 1947* (IV *Censo General de la Nación 1946*) and *Censo Económico Nacional de la República de Argentina de 1973 y 1974* (1974).

However, the information in these censuses cannot be compared directly in their original form for two main reasons; firstly, their classification methodology is different. Thus, I re-classified the industrial activities originally compiled by the national statistical offices to get a harmonized classification. I followed the one corresponding to the manufacturing codes of the ISIC (International Standard Industrial Classification, revision 3) two-digit divisions or groups of three-digit major industries (see appendix A).[179]

From these censuses, I use disaggregated data on value added, and employment for 11 manufacturing branches.[180] To achieve consistency in our estimates, I have

[178] Other censuses for this period where available however only the mentioned 'census dates' matched across this country sample. For Argentina, the following industry census after 1947 was officially conducted for the year 1954; therefore, I opted to include the former (IV Censo Industrial 1947).

[179] In this study 'aggregated' various 3-digit level industries into 2-digit level in order to make cross-country comparisons following a standard ISIC classification (see appendix A).

[180] Data of investments by industry were not included in this analysis. Besides the additional data and assumptions needed to estimate the real stock of physical investments, the data quality of investments

constructed/adjusted the value added figures into the modern definition of gross value added introduced in 1993 in the SNA.

The branches analyzed are: Food, Beverages, and Tobacco (ISIC 31), Textile, Textile Products, and Wearing Apparel (321), Leather, Leather Products and Footwear (323+324), Wood, Wood Products, and Cork (33), Paper, Printing and Publishing (34), Chemical Products, Rubber and Plastic Products (355+356), Non-metallic Mineral Products (36), Basic and Fabricated Metals (37+381), Machinery and Transport equipment (382+384), Electrical Machinery, Electrical Apparatus, and Precision Instruments (383) and Other Manufacturing (Miscellaneous) (385+39).

The second reason why these figures should be properly adjusted for comparison purposes is the changing value of currency units over time. All data of gross value added by industry/branch are originally expressed in their own local currencies. However, to compare industrial productivity across countries and sectors, an important issue arises in converting real value added into common currency units.

The proper rate of exchange in common currencies is to use a PPP (Purchasing Power Parity).[181] Recent research has shown that relative prices vary largely across tradable and non-tradable sectors and using aggregate PPPs raises doubts in converting production-side figures (see e.g. Bernard and Jones 1996).

Ideally, the proper way to adjust and deflate our data would have been to take manufacturing unit value ratios based on the production surveys and to construct industry-specific PPPs (see, Inklaar and Timmer, 2013). The 'industry of origin' methodology has been a common technique to derive price indices by industry taking unit values for each specific product, and matching them with its counterpart (or with the United States).

However, a major drawback to construct deflators based on unit-value ratios for these countries is that the official industry censuses published in those years do not report data on quantities and values of the goods produced in each industry which are necessary for that adjustment technique. This adjustment issue could raise concerns on the data employed in this study especially considering the government price-setting schemes that kept the prices of most import-substituted goods artificially low, and the hyperinflation

recorded over time is much less consistent than value added or employment series for cross-country comparisons. Information on hours-worked were not available in these surveys.

[181] Maddison and van Ark (1989) conducted a comparative study of Brazil, Mexico and the United States for the year 1975 to derive PPPs based on an 'industry of origin' approach. However, their study (in order to match the prices of industrial items/products) selected only 38 and 47 percent of the manufacturing censuses for Brazil and Mexico respectively. The present study included the 'total' of the manufacturing census of 1975.

episodes in Argentina during the Perón era (1950s) and the years around the mid-1970s (a similar case in Brazil).[182]

In order to solve this data issue, I follow an alternative approach to adjust gross value added: I employ information of the price changes of the commodities traded between industries before retail; that is from a producer price index. Thus, this study uses 'wholesale price indices' of each country to adjust the disaggregated nominal figures into constant terms (base 1975=100).[183] After adjusting for inflation, I converted the data into 1975 dollars using US exchange rates for the respective years of analysis. I follow this adjustment drawing on the quantitative findings by Maddison and van Ark (1989) that established that the PPP exchange rates of Mexico and Brazil did not vary substantially from those countries' market exchange rates with the US dollar in 1975.[184]

In order to verify the robustness of this assumption and check whether the price dynamics within manufacturing industries evolved in the same direction as the aggregate (total economy) wholesale price deflator, I derived a disaggregated wholesale price index for Brazil based on a combination of secondary data (see appendix B 'prices'). With this, I proceeded to make adjustments on the industry census data comparing estimates (on gross value added) with disaggregated and aggregated wholesale price deflators. The deflation procedure was applied to the data for the benchmark years of the country in accordance to the censuses mentioned above (table 4.3); however, it is important to determine if price changes within branches differed across time.

As shown in figure 4.4, wholesale price trends of other sectors did differ from the 'total' wholesale price index for Brazil. These differences are taken into account in this study in order to test whether this may impact the results of our productivity estimates.

Another limitation is the range and coverage of the censuses. I am employing in total three industrial censuses across eleven aggregated branches for each of the three countries to ultimately establish three benchmark estimates. Industrial censuses for these countries do not cover seasonal workers and therefore, it can be argued that employment figures can be underestimated because they and part-time workers are not included. A possible solution would have been to compare industry employment with figures from population censuses; however, for this period such data were not available by type of industry in most of Latin American countries.

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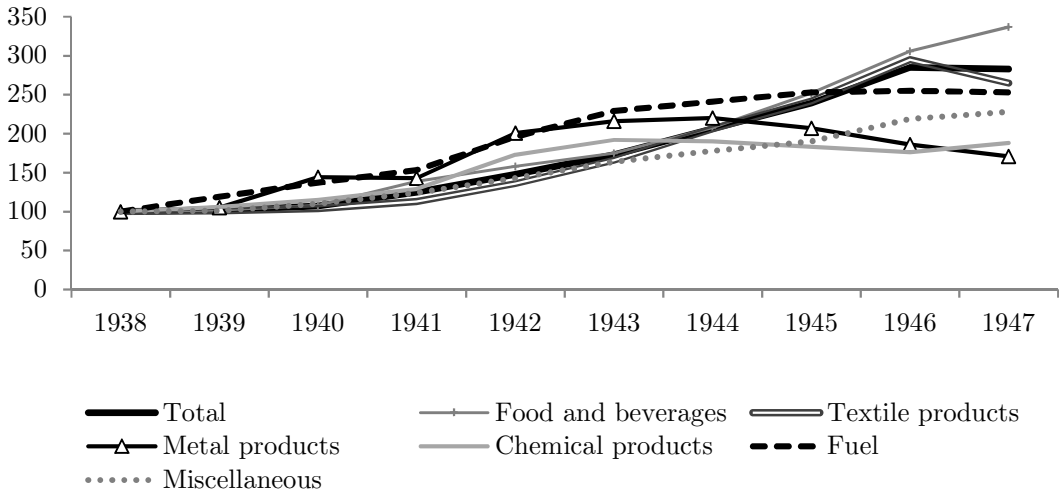
[182] See this data adjustment issue in Frankema and Visker (2011) for the case of Argentina.

[183] I use average index numbers of one year prior, during, and one after the census reference year to derive the deflators because these censuses include data for the year prior to its publication (e.g. the average wholesale price index for Mexico in 1950 was derived from the unweighted average growth of the index for 1949-1950).

[184] Figures in US dollars are only displayed in tables 4.1.A. to 4.1.C of the appendix.

Figure 4.4: Wholesale price index, Brazil 1938-1947
(1938=100)



Source: Derived from Bulhões (1948). See detailed table in appendix B.

The analysis follows a definition of labor productivity as the branch's gross value added over total workers-engaged in the respective branch. It would have been preferred to employ hours worked for a more accurate productivity measure, however, due to the limitations of the original source already mentioned, I proceeded in using data on the number of persons engaged within each industrial branch.

Labor shares are shown in table 4.4. They indicate that a large proportion of the labor force in all three countries in 1935/39 and 1947/50 were concentrated in 'traditional' or low-technology intensity branches such as food, and textile manufacturing (near to a quarter or a third of total employment) and to a lesser extent on medium-low or medium-high-technology branches.[185]

The picture changes by the mid-1970s where the shares in traditional branches declined relatively and employment began to spread out into other more sophisticated branches. For instance, the most dramatic change in Mexico and Brazil is that the share of the branch of textiles declined from 37% and 34.7% to 13.7% and 16.4% respectively.[186] This contrasts with a smaller share in textiles in Argentina. Its economic structure was more diversified relative to Mexico and Brazil already in 1935. In a technology-

[185] Categories of low, medium, and high-technology intensity are based on the OECD classification of R&D intensities. See in T. Hatzichronoglou, 'ISIC Rev. 3 Technology intensity definition'. See detailed categories in the appendix of this chapter, table 4.2.D.

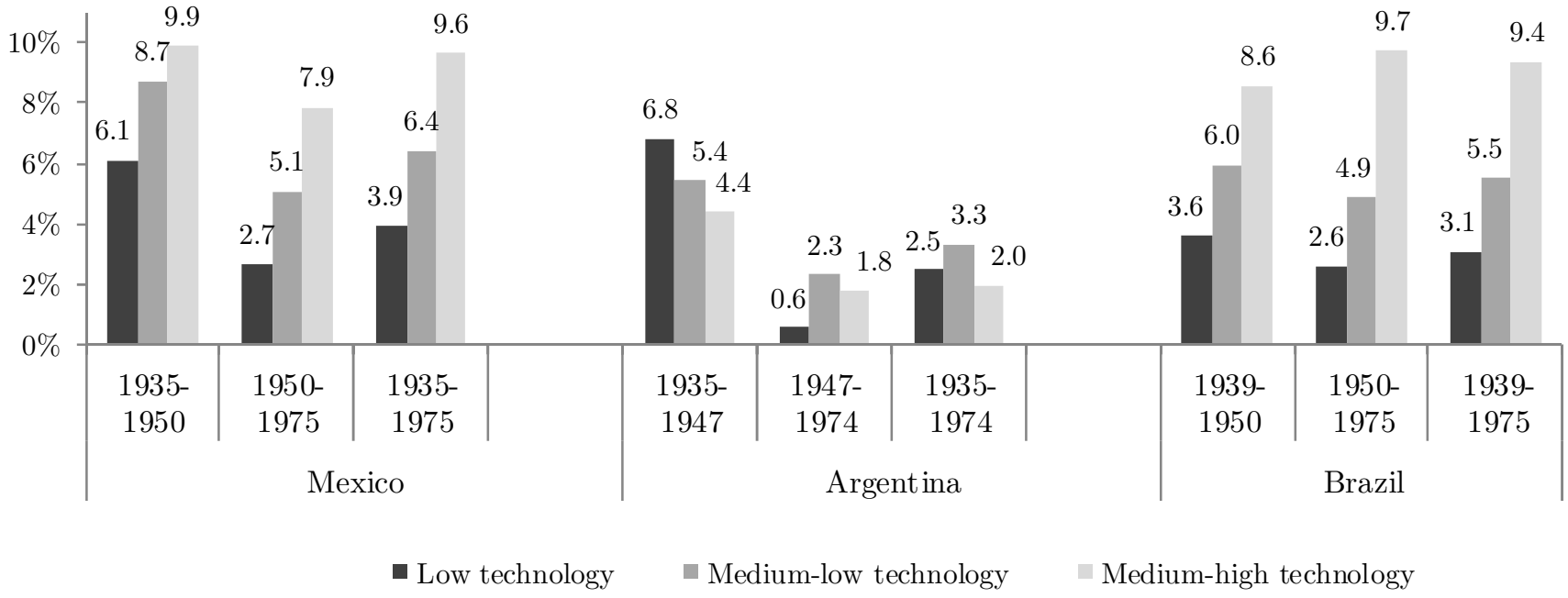
[186] However, as table 4.5 shows, the relative value added per worker in the leather and footwear branch remained extraordinarily high for the case of Brazil. Industry-case studies have indicated how the Brazilian government favored the generation of leather shoe exporting clusters. By the late-1970s, Brazil became the third largest (after Italy and Korea) leather shoe exporter in the world. See for e.g. Schmitz (1995).

classification view from 1950 to 1975 the branches that expanded the most in terms of employment were the ones based on medium-high technology intensity.

Figure 4.5 shows the change in industrial employment over this period. It depicts according to a classification based on the OECD (Organization for Economic Cooperation and Development) extraordinary high growth rates of employment across industries, for Mexico and Brazil. Medium-high technology intensity branches reached around nine percent annually (compound growth rate).[187]

[187] Changes in employment shares could have been also driven by the growth of the population or by increasing the rates of labor force participation. However, the discussion of this analysis focuses on the factors of labor absorption and the movements within industries that raised overall labor productivity.

Figure 4.5. Growth of industrial employment by period according to classification of 'technological intensity'
(% compound growth rates)



Note: Based on OECD classification (Hatzichronoglou, 1997). Since the aircraft and pharmaceutical industry represented a very small share in total manufacturing employment during this period, the high-technology classification was not shown for graphical purposes.
Source: See text.

Table 4.4: Employment shares by manufacturing branch in Mexico, Argentina, and Brazil c.1935-1975 (%)

Industry	Mexico			Argentina			Brazil		
	1935	1950	1975	1935	1947	1974	1939	1949	1975
Food, Beverages, and Tobacco	24.5	26.5	23.2	22.5	24.3	21.0	25.0	21.9	15.2
Textile, Textile Products, and Wearing Apparel	37.0	30.0	13.7	16.0	19.2	13.0	34.7	31.7	16.4
Leather, Leather and Footwear	5.2	1.3	2.9	3.2	5.1	3.1	1.8	1.6	0.9
Wood, Products of Wood, and Cork	6.1	6.3	4.5	6.3	10.5	5.7	8.1	8.2	8.7
Pulp, Paper, Printing and Publishing	4.8	4.2	5.3	6.2	1.9	4.7	5.4	5.7	5.6
Chemicals, Chemical Products, and Rubber	3.6	6.3	12.6	3.4	6.0	9.7	5.9	6.4	8.1
Non-metallic Mineral Products	5.0	5.5	6.0	12.5	6.9	6.8	7.0	9.8	8.5
Basic and Fabricated Metals	10.2	12.1	12.3	8.1	10.2	13.4	7.5	7.9	11.7
Electrical Machinery, Electrical Apparatus, and Prec. Instrum.	1.0	1.7	6.8	5.1	2.1	4.4	0.6	1.2	4.6
Machinery and Transport Equipment	0.9	4.7	10.7	9.1	10.2	17.1	2.5	3.6	16.2
Other Manufacturing	1.8	1.5	2.0	7.5	3.5	1.0	1.3	2.1	4.0
Total*	100	100	100	100	100	100	100	100	100

Note: Data refers to total employment (workers + employees by branch). Shares are the ratio of total employment branch to total manufacturing.
* Total sum may not sum up to 100 due to rounded decimals.
Source: Table 4.3.

Table 4.5. Relative labor productivity levels by manufacturing branch in Mexico, Argentina, and Brazil c.1935-1975

Industry	Mexico			Argentina			Brazil		
	1935	1950	1975	1935	1947	1974	1939	1950	1975
Food, Beverages, and Tobacco	1.23	1.14	0.83	1.22	1.17	0.98	1.29	1.17	0.90
Textile, Textile Products, and Wearing Apparel	0.89	0.63	0.63	0.85	1.14	0.81	0.83	0.76	0.58
Leather, Leather and Footwear	0.70	0.74	1.77	1.00	0.92	0.52	1.00	2.68	2.50
Wood, Products of Wood, and Cork	0.55	0.61	0.47	0.71	0.60	0.44	0.70	0.65	0.55
Pulp, Paper, Printing and Publishing	1.15	0.95	1.07	1.45	1.01	0.98	1.00	1.08	1.08
Chemicals, Chemical Products, and Rubber	1.49	1.83	1.69	1.25	1.47	2.06	2.05	1.68	2.35
Non-metallic Mineral Products	1.13	0.72	0.87	1.09	1.05	0.68	0.80	0.72	0.71
Basic and Fabricated Metals	0.86	1.64	1.11	0.83	0.85	1.09	0.19	1.20	1.05
Electrical Machinery, Electrical Apparatus, and Prec. instrum.	1.61	1.08	0.86	0.38	0.85	0.99	3.30	1.34	1.20
Machinery and Transport Equipment	0.69	0.88	1.10	0.97	0.75	0.94	1.50	1.10	1.03
Other Manufacturing	1.37	0.65	0.70	0.64	0.73	0.53	0.89	0.88	0.79
Total	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Note: Data refers to the level of value added per worker employed of branch relative to the total manufacturing value added per worker level
Source: Table 4.3.

In Argentina these branches (medium-high technology) did not exceed the growth of the medium-low and low ones. This feature is attributable to a catch-up effect. It has been documented how Argentina developed earlier (before the Great Depression, c.1910-1920s) its manufacturing base, whereas the era of state 'developmentalism' in Mexico and Brazil started much later. Brazil and Mexico experienced an unprecedented 'exponential' growth in manufacturing per capita output between 1950 and 1975.[188] Chenery *et al.*, (1975) foresaw however, that those extraordinary high output growth rates would carry large structural imbalances in industrial employment and productivity in these countries.[189] Nevertheless, the outstanding employment rates (for Brazil and Mexico) were only matched by the ones achieved in Korea and Japan over the same period (e.g. Dollar and Sokoloff, 1994).

A paradox may appear at first sight when comparing table 4.5 with the global technology intensity classification (appendix 4.2.E). Several branches classified as 'low-tech' (e.g. food, beverages, & tobacco) displayed high labor productivities relative to 'medium high-tech' (e.g. electrical machinery). This feature may appear counterintuitive since it usually presumes that higher-technology intensive industries should be more productive then less-technology intensive.

This presumption has been the focus of analysis in several industry-case studies in countries with a restricted access to the international knowledge stock or technology transfer (see a review in Tybout, 2000). According to Diaz-Alejandro (1965) in developing countries, inter-industry labor productivity differentials can be explained by the type of activity conducted within the industry.[190] There are types of industrial branches that are 'process-centered' (or machine paced), and 'product-centered' (or labor paced activities). On the latter type, productivity is more dependent on the quality of *local* labor and other resources, and vice versa for process-centred activities. Industry-case studies have revealed that although the labor productivity differentials between advanced and less-advanced industrial countries tends to be larger in process-centered industries (e.g. chemicals, non-metallic minerals), labor productivity growth in product-centered activities (e.g. leather, textiles) in developing countries experience relatively high labor productivity growth (inter-sectoral labor productivity growth rates), and therefore, a smaller differential between countries (advanced and less-advanced).

This paradox occurs because the margin for improvement through 'learning by doing' in those activities is much wider than in machine paced activities. Particularly, a

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[188] See benchmark tables 4.1.B and 4.1.C in appendix A of this chapter.

[189] Similarly, Chenery *et al.*, (1975) arrived at very high estimates of compound growth rates of industrial per capita output (near to 7% per year) during this period.

[190] Diaz-Alejandro (1965) and Teitel (1981) analyzed a modified version of the Hirschman hypothesis for a sample of Latin American countries. The original notion in broad terms refers to the conjecture that manufacturing productivity differentials between highly-industrialized countries and developing countries is larger in labor-intensive industries.

large scope for high labor productivity growth (spillovers) is likely to appear in branches where the skills requirements of the workers is low (see for e.g. Pack 1988). For Latin America it has been documented that during this period 'light' industries displayed relatively high labor productivities particularly in those based on abundant local resources (see, Teitel 1981).[191]

Nonetheless, this general observation on high labor productivity rates in low-tech branches relative to medium-high technology branches has relevant implications for the ensuing empirical examination.[192] Firstly, because the apparent indistinct relation of technology intensity and labor productivity growth across the period may reveal the invariant effects of policy related to the 'initial conditions' of the existent comparative advantage that labor-intensive industries possessed at the start of the protectionist strategy. Secondly, for policy design reasons. Despite the relatively low labor productivity in branches regarded as more technology (medium-high) and capital intensive in early periods, the degree of support via import substitution was based on the widely held view (by Latin American policy makers) that the expansion of these (medium-high technology intensive) branches was the route to break with the existing labor specialization patterns and to become technologically independent.[193]

However, since various low-technology manufacturing branches were highly productive at the start of import substitution (c.1935/1939), it does not necessarily imply that the notion of the reallocation of labor toward technology-intensive sectors to raise labor aggregate productivity is untenable. As mentioned, the reallocation away from low-tech to medium high-tech industries was a deliberate policy effort to gain autonomy reducing the dependency from technology intensive imported goods. Although there is an intrinsic interaction between import substitution and the labor productivity dynamics (associated to pre-existent factor endowments), disentangling them statistically would have been only plausible with a sample selection control such as an *ad-hoc* counterfactual (e.g. productivity comparisons in a period of non-protected industries, i.e. autarky vs free trade). Thus, looking to maintain the measurement strategy of this chapter, the analysis

[191] Due to the nature of the present census data it is not plausible to account for the level of 'mechanization'. In order to accurately confirm the aforementioned feature, it would have required the inclusion of records of capital stock and the type of skills embodied within the industry/branch.

[192] Sandven et al., (2005) found that in OECD countries, taking both types of industries together (low and medium-low technology industries) they outweigh the corresponding value added per worker contribution of high-tech industries on aggregate labor productivity growth.

[193] As Prebisch (1964) contended, despite their high growth (labor-intensive), not all sectors possessed the same ability to inject dynamism to "propagate technical progress" in the long run. This was considered one of the most important preoccupations of the theorists of ECLAC. The creation of a capital goods industry was a priority because of the increasing dependency on these type of imports would imply that the balance of payments would impose a constraint to economic growth in the long run.

focuses exclusively on the statistical claim of the historiography that aggregate labor productivity growth during this period was indeed enhanced through labor reallocation.

The phenomenon of structural change entails that shift in the pattern of specialization of traditional into modern activities. Evidently, the labels 'traditional' and 'modern' coined in the dual-economy framework are not the most accurate to describe the complexity of the evolution of structure of the Latin American manufacturing. The ensuing examination puts forth a decomposition of labor productivity into its main components looking to provide a more accurate description of the process of labor reallocation.

4.5 Productivity decomposition methodology

The industrial productivity decomposition employed in the present study relies on a standard 'shift-share' analysis framework. This has been used in several studies to measure the contribution of structural change to aggregate productivity growth (e.g. McMillan, *et al.,* 2014).[194] The decomposition technique has been also applied for cases within manufacturing industries to disentangle their sources of productivity growth (e.g. Timmer and Szirmai, 2000; and Wang and Szirmai, 2008). Most of these studies have analyzed the impact of the shifts in capital and labor inputs on productivity growth (total factor productivity).[195] Due to the lack of comparable data on capital series for these countries during this period the analysis focuses exclusively on the effects of shifts of labor inputs on aggregate labor productivity growth.[196]

Decomposition of labor productivity

$$LP^T = \frac{Y^T}{L^T} = \sum_{T=1}^{N} \frac{Y_i^T L_i^T}{L_i^T L^T} = \sum_{i=1}^{n} LP_i^T S_i^T \qquad (1)$$

$$LP^T - LP^0 = \sum_{i=1}^{n} (LP_i^T - LP_i^0)\, S_i^0 + \sum_{i=1}^{n} (S_i^T - S_i^0) LP_i^0 + \sum_{i=1}^{n} (LP_i^T - LP_i^0)(S_i^T - S_i^0) \qquad (2)$$

LP^{T} is the aggregate labor productivity at year t;
LP^0 is the aggregate labor productivity at year 0;

[194] The method was first introduced by Fabricant (1942).

[195] This disaggregation has become a standard in structural change studies; however, one of the main drawbacks is that it cannot provide evidence of the effects of changes from the demand side.

[196] According to Syrquin (1984: 78), the 'complete' measurement should include the impact of shifts in both capital and labor on total factor productivity. Thus, the present shift-share measurement can be regarded as 'partial'.

LP^{T}_{i} is the labor productivity of branch i at year t;
LP^{0}_{i} is the labor productivity of branch i at year 0;
S^{T}_{i} is the employment share of branch i at year t;
S^{0}_{i} is the employment share of branch i at year 0.

The first term (from left to right) in the right side of equation (2) denotes the effect of productivity growth within industries (industrial branches). This term can be interpreted as the contribution to productivity growth resulting from learning by doing, capital intensity, hours worked in the sector (branch). The second term measures the effect of reallocation of labor between branches with differing levels of labor productivity (also known as 'static shift' effect). A positive sign in the total sum of this term is also seen as a 'structural bonus':[197]

$$\sum_{i=1}^{n}(S_i^T - S_i^0)LP_i^0 > 0 \qquad (3)$$

The third (last term), is an interaction effect of productivity growth and labor shifts (known as 'dynamic shift' effect). This reflects the effect of shifts towards branches with higher than average or to lower than average productivity growth. This last term will have a positive effect on productivity growth if labor shifts to branches where productivity is improving more rapidly than the average. Conversely, it will have a negative contribution if labor moves to branches where productivity is increasing less rapidly than average productivity, when this is the case (when its total sum is negative), the term can be seen as a 'structural burden' effect:

$$\sum_{i=1}^{n}(LP_i^T - LP_i^0)(S_i^T - S_i^0) < 0 \qquad (4)$$

This last term also captures Baumol's hypothesis derived from the 'unbalanced growth' model; since there are inherent differences between industries in their capabilities to raise labor productivity through technological progress, innovation, or capital deepening, labor may tend to move towards industries where productivity is growing slower (technologically stagnant industries). As a result, in the long-run, if this 'structural burden' persists it will generate a fall in the aggregate productivity growth rate.[198]

In general, a positive total sum of both shifts effects ('static effect' plus 'dynamic effect') would reflect a process of structural change that boosts aggregate (labor) productivity growth.

[197] See also in Peneder (2003).
[198] See in Baumol *et al.* (1989)

4.6 Results and discussion

The analysis applied the shift-share model (equation 2) discussed in the previous section to the eleven manufacturing branches in each of the three countries. Tables 4.6 to 4.8 report the results for each country on the contribution to productivity growth disaggregated by industrial branch. The column 'total' indicates the total contribution from intra-branch productivity growth (within effect) and the shifts between branches (static and dynamic).

Mexico

During the first period (1935-1950) of import substitution, industrial productivity growth in Mexico was driven predominantly by traditional branches (food, beverages; and textiles and wearing apparel). On the other hand, branches with relatively high-capital intensity (e.g. machinery or electrical apparatus) were unable to expand as 'national' industrial policies intended to promote. This salient feature appears when we look at the composition of the structural components of overall productivity growth (see table 4.6) which was dominated by a 'within' industry effect (91.2%). The contribution of labor reallocations related to a 'structural bonus' (static-shift effect), although positive had a very weak impact (0.4%).

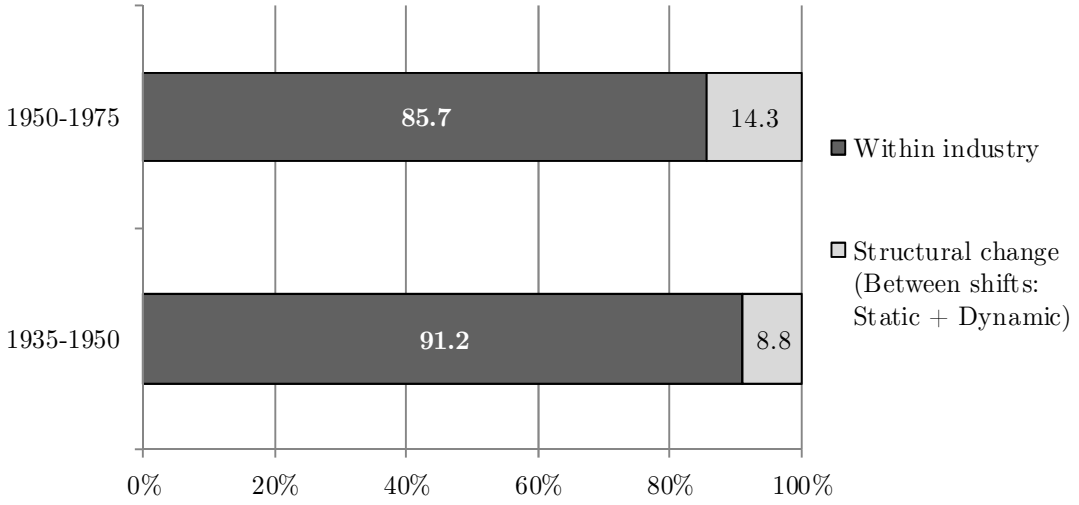
On the other hand, productivity growth due to reallocation to industries with high productivity growth reveals that 8.4% was derived from a dynamic shift effect. In the second period (1950-1975), Mexico's aggregate labor productivity growth continued to accelerate (8.3%). During this period, other industrial branches such as chemicals and fabricated metals contributed to productivity growth (1.8 and 1.0% respectively). Moreover, the contribution from labor reallocation from static shifts was higher than in the previous period but still small. Although, the 'structural bonus' effect on productivity growth increased to 1.3%, and the interaction effect (dynamic effect) added up to around 13%, overall productivity growth was explained by growth 'within' industries (85.7%).

Table 4.6: Shift-share decomposition of manufacturing labor productivity growth in Mexico, 1935-1975

	1935-1950				1950-1975			
Industry	Within	Static	Dynamic	Total	Within	Static	Dynamic	Total
Food, Beverages, and Tobacco	1.745	0.025	0.145	1.915	1.756	-0.037	-0.221	1.498
Textile, Textile Products, and Wearing Apparel	1.295	-0.062	-0.244	0.988	1.587	-0.096	-0.864	0.627
Leather, Leather and Footwear	0.228	-0.028	-0.170	0.030	0.209	0.010	0.245	0.465
Wood, Products of Wood, and Cork	0.242	0.001	0.008	0.251	0.236	-0.011	-0.067	0.159
Pulp, Paper, Printing and Publishing	0.277	-0.007	-0.033	0.237	0.381	0.010	0.100	0.491
Chemicals, Chemical Products, and Rubber	0.416	0.041	0.316	0.772	0.881	0.110	0.876	1.867
Non-metallic Mineral Products	0.233	0.005	0.021	0.259	0.401	0.004	0.039	0.445
Basic and Fabricated Metals	1.296	0.016	0.235	1.547	1.029	0.005	0.024	1.058
Electrical Machinery, Electrical Apparatus, and Prec. instrum.	0.057	0.012	0.041	0.109	0.122	0.050	0.360	0.532
Machinery and Transport Equipment	0.053	0.026	0.234	0.313	0.434	0.055	0.560	1.049
Other Manufacturing	0.054	-0.004	-0.009	0.041	0.086	0.003	0.034	0.124
Sum of industry productivity growth	5.894	0.025	0.543	6.461	7.123	0.104	1.087	8.314
Total contribution to growth of aggregate productivity	91.2%	0.4%	8.4%	100%	85.7%	1.3%	13.1%	100%

Note: Data adjusted with Mexico's branch-specific wholesale price indices. See appendix A.

Figure 4.6: Shift-share decomposition of aggregate labor productivity growth in Mexico's manufacturing, 1935-1975
(% contribution to aggregate labor productivity growth)



Note: Sum of last row in table 4.6, 'total contribution to growth of aggregate productivity'.

Figure 4.6 displays a summary of the decomposition of the structural components of aggregate productivity growth in these periods in Mexico. It indicates that although it played a relatively minor a role in boosting overall labor productivity, structural change (the sum of between-industry shifts) contributed in 8.8% from the 1935-1950 period and 14.3% from 1950 to 1975. These results suggest that there was a small but positive increase in the tendency of industrial labor moving into higher-productivity activities which promoted to some extent the rapid pace in aggregate labor productivity, particularly during the second period of analysis or the so-called *desarrollo estabilizador* (1950s-1960s).

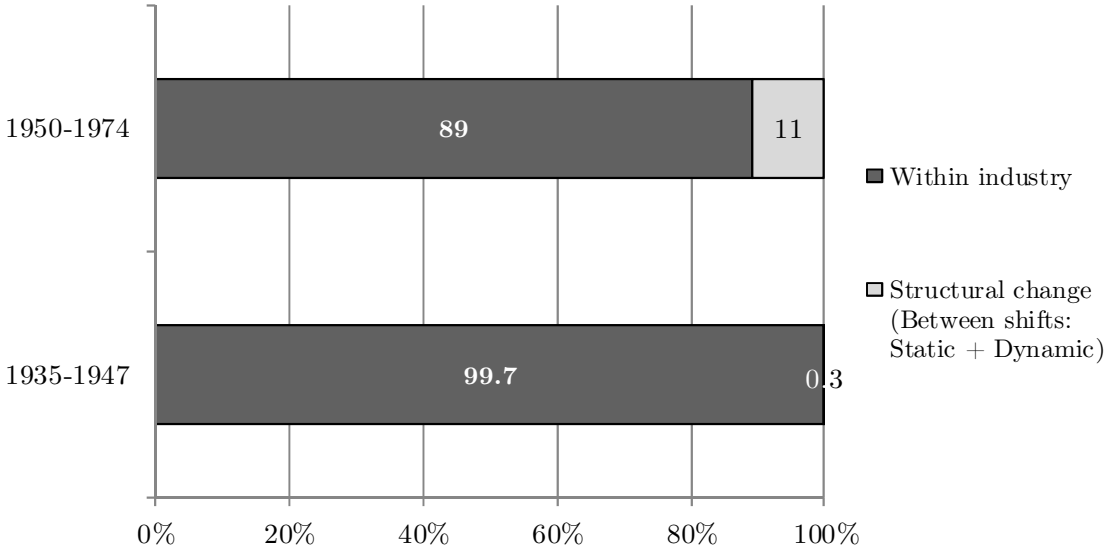
Argentina

Most of the discussion in the literature on Argentina's post-1930 relative economic decline has focused on the deterioration of the agricultural sector and the decline of the land-labor ratio with little emphasis on the dynamics of the industrial sector (manufacturing).[199]

Our new quantitative evidence based on industry shift-share estimates reports that although Argentine manufacturing was more diversified (in terms of employment shares) than Mexico (and Brazil), aggregate labor productivity growth was similarly driven by traditional branches (food and beverages, and textiles and wearing apparel).

[199] Recently, Debowicz and Segal (2014) explored this lacuna through data simulations (on broad sectors: agriculture, industry and services) using a computable general equilibrium model.

Figure 4.7: Shift-share decomposition of aggregate labor productivity growth in Argentina's manufacturing, 1935-1974
(% contribution to aggregate labor productivity growth)



Note: Sum of last row in table 4.7, 'total contribution to growth of aggregate productivity'.

For the period 1947-1974 other branches were involved in the acceleration of labor productivity; machinery, transport equipment, basic metals, and chemicals (see table 4.7). However, productivity gains from labor shifts were meager. For the first period (1935-1947), although the dynamic effect was positive (1.5%), this was nearly offset by a negative 'structural bonus' (-1.3%). The overriding interpretation of this is that aggregate productivity growth was driven by growth 'within' industries in Argentina (99.7%). During the second period (1947-1974), there was a slight change of labor moving out to more productive branches (gains from dynamic shifts accounted 10.9%).

Yet, as figure 4.7 summarizes, structural change did not play an important role in explaining aggregate productivity. Its contribution after 1947 in Argentina was higher than before but small (11%) in comparison with the impact of 'intra' industry contribution (89%).

Table 4.7: Shift-share decomposition of manufacturing labor productivity growth in Argentina, 1935-1974

	1935-1947				1950-1974			
Industry	Within	Static	Dynamic	Total	Within	Static	Dynamic	Total
Food, Beverages, and Tobacco	0.475	0.012	0.021	0.508	1.333	-0.042	-0.195	1.097
Textile, Textile Products, and Wearing Apparel	0.386	0.022	0.062	0.470	0.839	-0.073	-0.278	0.489
Leather, Leather and Footwear	0.052	0.018	0.027	0.097	0.135	-0.019	-0.054	0.063
Wood, Products of Wood, and Cork	0.061	0.029	0.038	0.129	0.256	-0.029	-0.118	0.109
Pulp, Paper, Printing and Publishing	0.087	-0.065	-0.061	-0.040	0.107	0.028	0.159	0.294
Chemicals, Chemical Products, and Rubber	0.100	0.031	0.070	0.200	0.753	0.053	0.456	1.262
Non-metallic Mineral Products	0.238	-0.065	-0.110	0.062	0.249	-0.002	-0.008	0.238
Basic and Fabricated Metals	0.128	0.015	0.028	0.171	0.678	0.025	0.197	0.900
Electrical Machinery, Electrical Apparatus, and Prec. instrum.	0.040	0.000	0.002	0.042	0.126	0.019	0.135	0.280
Machinery and Transport Equipment	0.105	0.008	0.009	0.121	0.575	0.050	0.377	1.002
Other Manufacturing	0.108	-0.027	-0.058	0.023	0.103	-0.009	-0.038	0.056
Sum of industry productivity growth	1.778	-0.022	0.027	1.783	5.155	0.002	0.733	5.890
Total contribution to growth of aggregate productivity	99.7%	-1.3%	1.5%	100%	88.4%	0.0%	10.9%	100%

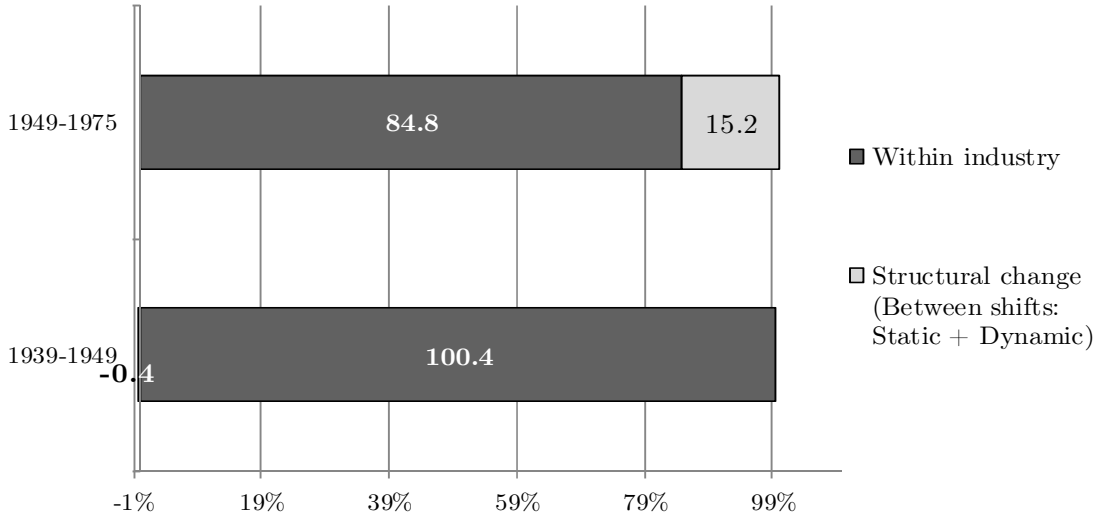
Note: Data was adjusted with Argentina's total wholesale price indices. See appendix A.

Brazil

Brazil's rapid growth after the Great Depression has been a well-documented feature in previous research. Studies have found that despite the fast pace of industrialization, the Brazilian economy continued relying on primary products, and its manufactured exports were mostly natural resource-based (Baer, 1994).

Our shift-share results on Brazilian manufacturing report that this feature may only be accurate for the 1939-1949 period in terms of labor productivity (see table 4.8). Thereafter, from 1949 to 1975, although productivity growth decelerated (sum of industry productivity growth), it slightly shifted to other more sophisticated branches such as machinery and chemicals. A noticeable feature for the first period (1939-1949) is that there was a 'structural burden' (negative dynamic effect) on aggregate productivity led by shrinking traditional sectors (-0.4%). This suggests that the Brazilian manufacturing sector may have suffered from a problem of labor misallocation, possibly arising from 'X-inefficiency' across firms, mainly those in traditional branches which could have accounted for the negative static and dynamic shift effects.[200]

Figure 4.8: Shift-share decomposition of aggregate labor productivity growth in Brazil's manufacturing, 1935-1975
(% contribution to aggregate labor productivity growth)



Note: Sum of last row in table 4.8, 'total contribution to growth of aggregate productivity'.

[200] On the other hand, Baer *et al.,* (1987) have documented that the large foreign investment inflows into Brazilian private manufacturing particularly into companies producing machinery, electric equipment, and pharmaceutical goods generated a more vertically-integrated manufacturing sector during the post-war years.

Table 4.8: Shift-share decomposition of manufacturing labor productivity growth in Brazil, 1939-1975

	1939-1949				1949-1975			
Industry	Within	Static	Dynamic	Total	Within	Static	Dynamic	Total
Food, Beverages, and Tobacco	1.055	-0.037	-0.131	0.887	0.146	-0.078	-0.045	0.023
Textile, Textile Products, and Wearing Apparel	0.994	-0.019	-0.088	0.887	0.140	-0.115	-0.067	-0.043
Leather, Leather and Footwear	0.162	-0.008	-0.019	0.135	0.088	-0.019	-0.038	0.032
Wood, Products of Wood, and Cork	0.189	0.001	0.002	0.192	0.038	0.003	0.002	0.044
Pulp, Paper, Printing and Publishing	0.219	0.003	0.011	0.233	0.064	-0.001	-0.001	0.062
Chemicals, Chemical Products, and Rubber	0.347	0.009	0.029	0.385	0.202	0.028	0.053	0.283
Non-metallic Mineral Products	0.181	0.021	0.072	0.274	0.073	-0.010	-0.010	0.053
Basic and Fabricated Metals	0.343	0.003	0.015	0.361	0.074	0.046	0.036	0.156
Electrical Machinery, Electrical Apparatus, and Prec. instrum.	0.020	0.018	0.018	0.055	0.013	0.046	0.039	0.098
Machinery and Transport Equipment	0.092	0.015	0.039	0.146	0.034	0.139	0.119	0.291
Other Manufacturing	0.042	0.006	0.025	0.073	0.015	0.017	0.014	0.046
Sum of industry productivity growth	3.644	0.012	-0.027	3.629	0.887	0.057	0.102	1.046
Total contribution to growth of aggregate productivity	100.4%	0.3%	-0.7%	100%	84.8%	5.4%	9.8%	100%

Note: Data was adjusted with Brazil's branch-specific wholesale price indices. See appendix A.

Figure 4.8 depicts yet again that aggregate productivity was dominated by growth within industries in both periods. From 1949 to 1975, a slight proportion of it was induced by structural change, contributing 15.2% to overall labor productivity growth in Brazil.

Is Rodrik wrong?

The evidence presented has indicated a very limited effect of structural change on aggregate productivity growth. Contrary to this, recent analyses by the economist Dani Rodrik have brought up a discussion on whether protectionist regimes can boost economic growth. In his book, *One Economics, Many Recipes* (2008) he states:

> "...Import-substituting industrialization (ISI) worked in Brazil, but not in Argentina" (p. 42) ...the model (ISI) was quite effective in stimulating growth in a large number of developing countries, for example in Brazil, Mexico, and Turkey" (p. 50).

The fragment cites as evidence estimates of aggregate TFP (Total Factor Productivity) growth rates from Bosworth and Collins (2003) where Brazil outperformed Argentina during the 1960-1973 period.[201] The overall message that Rodrik tries to put forward is that similar economic policies and institutions have worked for some countries but not for several others. Moreover, he claims that an 'unconventional' set of policies (such as industry protection) can ignite and accelerate growth initially with 'minimal' institutional change. However, Rodrik argues that over time it becomes more difficult to sustain growth without the reforms that promote a long-term 'sound' institutional underpinning to maintain a productive dynamism.[202]

Certainly, although Brazil and Argentina (and Mexico) had different initial institutional arrangements, their rapid growth from the 1930s until the 1970s was closely linked to their political economy model based on corporatism and industry protection. Following Rodrik's argument, it is likely that the lack of economic and institutional reform by the end of the mid-1960s or early-1970s may have contributed to the subsequent breakdown of the model during the Latin American crisis of the 1980s. Also, the combination of other factors (high debt-to-GDP ratios, overvalued exchange rates, 1973 oil shock, etc.) may have also contributed to the subsequent crisis.

However, could have been the lack of structural change the underlying cause of the 1980s crisis? McMillan *et al.* (2014) drawing on the findings of sectoral estimates by Timmer and de Vries (2009) argued that in fact, there was structural change during the period of protectionism in Latin America:

[201] TFP growth rates reported for that period in Brazil and Argentina are 2.3 and 0.6 respectively.
[202] *Idem*, p. 6.

> "...during the quarter century between 1950 and 1975, the contribution of structural change to overall productivity growth was positive and large, of roughly the same magnitude as the within component" (p. 31).

This notion is not incorrect but rather incomplete. As they show, during this period labor moved from agriculture to manufacturing and services contributing significantly to aggregate productivity growth. However, a view at a *higher* level of sectoral aggregation may mask the 'specific' effects of import substitution policies where manufacturing was the main targeted sector. The shift-share estimates from Timmer and de Vries (2009) referenced by McMillan and Rodrik (2011) employed a different dimension of structural change based on data from broad sectors across the economy (agriculture, manufacturing, and services).[203]

The estimates presented in this chapter are quite different to previous broad examinations since these are based exclusively on manufacturing censuses disaggregated at the 3-digit level. Yet, these estimates could be seen as complementary evidence of the latter. Our estimates accounted for the effect of structural change on 'total manufacturing' productivity growth but not on the 'total economy' aggregate productivity as the latter study is referred to.

It may not be implausible in attributing to various industrial policies in Latin America the 'success' of generating roughly 50% of 'bonus' on aggregate productivity growth from shifting the agricultural *labor surplus* into manufacturing (and services) as argued by previous authors. However, if the assessment of the effect of import substitution on structural change is viewed on the basis of how much of this bonus was gained from changing the structure of production inside the 'targeted' sector, then the shift-share examination broken down at the manufacturing level is more appropriate.

Our evidence presented shows a less optimistic picture compared to Rodrik and other research using a different data aggregation. As mentioned, the bonus (structural change effect on productivity growth) accounted at most roughly 15% for Brazil (period 1949-1975) and to a less extent in Mexico (14%) and Argentina (11%). Nonetheless, this meager contribution of structural change within manufacturing is not unusual. In comparative terms with other industrial sectors outside of Latin America, structural change in manufacturing also played a very limited role in the so-called East Asian growth miracle (post-1960s) which is usually portrayed as an example of successful industry 'interventions'.[204]

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[203] See 'GGDC 10-sector database' in www.ggdc.net

[204] 'Industry interventions' understood as selective industrial policies aiming to alter the structure of production towards sectors that offer greater prospects to accelerate overall economic growth (see Nolan and Pack, 2006).

For instance, Timmer and Szirmai (2000) estimated that the structural change component in India contributed only about 10% to 15% on manufacturing (labor) productivity growth, whereas in other Asian economies like South Korea, Indonesia, and Taiwan this component was nearly zero or negative.[205] Thus, what explanation can we draw in light on these similar findings?

As in Harberger's (1998) famous analogy on the shape of growth distributions, instead of expanding uniformly as yeast when baking bread in an oven, productivity growth in Latin America followed patterns in the shape of mushrooms. Resembling mushrooms in the forest bed, manufacturing labor productivity in this period 'popped out' sporadically only in specific branches. As argued by the growth literature a 'yeast-type' of productivity growth requires broad externalities which are related to the total stock of knowledge in the economy such as human capital. This ultimately could have been more important to boost growth uniformly rather than relying only on the structural change stemming from the dynamic effects of specific branches.

However, this does not mean that the present findings are a case against industrial policy in Latin America. On the contrary, although major aggregate labor productivity improvements were driven 'within' growth of individual industries, the magnitude of at least this type of growth has not been replicated in the region since. As McMillan *et al.,* (2014) indicate, patterns of structural change in Latin America not only have been absent after the 1980s, but since the 1990s (post-liberalization) have been even 'growth-reducing' for aggregate productivity growth.

Besides, as previous studies have shown the success of industrial policies in raising overall welfare in East Asian countries did not generate extraordinary TFP growth rates or caused major technological breakthroughs. Instead, their selected industry interventions raised also labor productivity 'within' industries together with high rates of capital accumulation which in the end accounted the most for overall output growth (per capita).[206]

As for Latin America, although it has been widely documented that import substitution had an anti-export bias that persisted until its later stages (1970s), Taylor (1998) has pointed out that the productivity divergence with their East Asian counterparts may have been not only related to the failure of creating a comparative advantage in the export sector; instead, the failure could be traced to the low capital-investment path that these economies experienced throughout this period relative to East Asia. Although more research is needed on whether Latin American manufacturing industries were operating at a sub-optimal level or with low capital intensity levels relative to other catch up economies

[205] Most of the increases of aggregate productivity growth in these countries were found driven by growth 'within' branches. See also an analysis on TFP growth comparison in Dollar and Sokoloff (1994).

[206] See for example Young (1995).

during this period, the nature of the data in the present estimations prevents us to go further on that issue.[207]

Nevertheless, it is necessary to highlight that most recent macroeconomic analyses on Latin America have usually blamed liberalization and the effects of globalization of the 1980s decade as the main drivers of the industrial productivity divergence relative the rest of the world. Our analysis has shown that the roots of industrial retardation predates the 1980s. The drivers of productivity divergence were engendered during the years of protectionism (between 1930 and 1975) characterized by the inability to diversify and shift the structure of production out of traditional activities towards the ones with higher value added which ultimately may have led to an industrial base that was highly vulnerable to the international competition under liberalization.

Yet, our estimates require caution in deriving policy implications. In addition to the data constraints, estimates are based on a standard shift-share analysis that omits other important factors that may also be considered as 'structural change'; changes on the demand side of the economy; the possibility of increasing returns to scale in targeted industries; and inter-industry knowledge spillovers derived from innovation and technological breakthroughs or from newly created backward/forward linkages of intermediate inputs.

4.7 Summary and conclusions

This chapter aimed to re-examine an historical feature that has been a matter of recent discussions of industrial policy in Latin America: the impact of structural change on productivity under protectionism (namely 'import substitution'). The main rationale of these policies was the potential generation of a 'structural bonus' (positive externality) arising from protecting a sector/branch with a 'latent' comparative advantage.

Notwithstanding the limitations of the empirical methodology and data, our results have set this discussion into a broad country-case historical context using unexplored records of disaggregated statistical information for Mexico, Argentina, and Brazil. Evidence from this data shows that under this policy regime, although employment and productivity in many industries grew in real terms at unprecedented high levels with relatively high tariffs, little was accomplished to enhance structural change in the manufacturing productivity of these three major countries.

Reallocation of labor within the sector did not provide an extra bonus to aggregate productivity growth in addition to growth 'within' individual branches. Most of these branches (food and beverages; textiles and wearing apparel) were in nature labor-intensive

[207] Existent studies for Brazil and Mexico on this issue are only for the period prior to the 1930s. See a review in Haber (2006).

and contributed the most to overall productivity growth. Needless to say, one of the broad accomplishments of import substitution was the development of a productive 'light' manufacturing; however, despite the government incentives in protecting other more relatively sophisticated sectors (machinery, transport equipment, and chemicals) with capital-intensive technologies, productivity growth remained 'stuck' into traditional industrial activities.[208]

Williamson (2011) has documented how most of Latin American countries were catching up in aggregate manufacturing with the 'industrial core' during this period. Yet, by disaggregating productivity growth in the manufacturing sector this chapter found that growth was driven by traditional industries (low-technology intensity) and very sparsely by sophisticated ones (medium-high technology intensity). Ultimately the persistence of this *unbalanced* pattern in manufacturing throughout the years (1935-1975) was likely the fallout of the meager export performance and a 'chronic' balance of payments problem experienced in the wake of the 1980s debt crises. As the economist Clark W. Reynolds (1978) once quoted for the case of Mexico's stable growth pattern: "the *stabilizing development* was actually destabilizing".

A further debate exists on why these countries failed to move from a manufacturing industry dependent on tariffs to a 'Schumpeterian-type' industry characterized by continually introducing cost-reducing processes and technologies as their East Asian counterparts accomplished during the same period. Most of the explanations have focused on the poor design of national policies regarding tariff protection in Latin America.[209]

However, the question that should be addressed from a political economy perspective is why if the prevalent structure of protection did not generate structural change by the 1950s (as shown in this chapter) this was not re-arranged or reversed.[210] Instead these policies persisted for the following two decades up until the debt crises in the 1980s indicating the existence of an endogenous tariff protection.

In other words, tariff policies did not target adequately those activities with a potential comparative advantage. Instead, these might have been influenced by the desire to aid declining sectors or/and protect the interests of large unproductive firms. As noted by Taylor (1998), Latin American policymakers confused "support for industrialization

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[208] Although there is evidence suggesting that there were other more successful 'non-tariff' policies such as the Brazilian BEFIEX (Special Fiscal Benefits for Exports) scheme which provided incentives for exports of domestic manufactures, many studies have shown that in spite of the diversification of Brazilian exports, many of these products did not meet international quality standards.

[209] Numerous studies have shown that the imports-GDP ratio in these countries did not fall as intended. Countries' vertical integration of production had a heavy reliance on machinery imports and foreign capital, generating as a result an unsustainable position in their balance of payments. See Hirschman (1968) and Bruton (1998) for a general overview, and Katz and Kosacoff (2003) for the particular case of Argentina.

[210] During the military regime around the year 1976 Argentina lifted its protectionist measures in manufacturing, much earlier compared to Mexico and Brazil.

with support for industrialists" generating costly distortions for the long run.[211] This argument is inexorably associated to the issue of institutional quality and how developing good economic institutions may be a prerequisite for an effective industrial policy.

Evidently, the region is large and now also comprises other major countries that in recent years have been more successful in diversifying their economies and gaining speed in the 'productivity race' such as Chile, and Uruguay. A future step in cliometric research would be to explore whether their current industrial success was shaped by the accumulation of capabilities from earlier industrial policies such as import substitution.

[211] A. Taylor, 'On the costs', p. 20.

Appendix A to Chapter 4: Gross value added and employment

In order to make cross-country comparisons I re-ordered the industrial branches that matched the international classification described above. Therefore, for the case of the Brazilian industrial censuses (1939-1975) we excluded the mining branches referring to extractives industries (industrias extractivas) of mineral and vegetable products (productos minerais and productos vegetais) and focused only on manufacturing branches (industriais de transformação) which represented roughly 95-96% of coverage of all industrial censuses (total employment).

Adjustments to 'value added' figures

Mexico: The information in Mexican industry censuses does not report estimates of value added. However, the censuses have enough information to arrive at an estimate that is similar to the concept of value added of the 1993 SNA (System of National Accounts) and have a level of compatibility with Argentina and Brazil. Mexican gross value added was constructed directly from the census figures as the total value of products (producción total) *minus* the cost of raw materials (materias primas utilizadas), purchased fuel and electricity (combustibles y electricidad consumida) and other production expenses (Otros gastos de producción). For Brazil and Argentina, value added figures in their censuses followed the definitions in accordance the standards of the SNA.[212]

Employment:

Mexico: Mexican industry censuses only include paid workers. The censuses covered by this study took the employment figures by branch referred as 'Personal ocupado'. The branches included were the ones disaggregated in the sub-sector 'industrias de la transformación', and thus, excluding extractive industries, agriculture, fisheries and forestry. Brazil: Data refers to column to total sum of 'Pessoal occupado' and the branch selection is the same as the one chosen for value added described above. Argentina: Employment figures are derived from the total sum of 'Empleados'.

[212] Official exchange rates of 1975: Following Officer (2011) exchange rates for 1975, in Mexico the 'Peso' was 12.50 per dollar, Brazil's 'Cruzeiro' in January of the same year was 8.13 per dollar and for Argentina, we used the year's monthly average of 78 pesos per dollar.

4.1.A: Comparative benchmark of levels of gross value added per person employed in Mexico, Argentina, and Brazil in 1935/39
(Constant US dollars of 1975)

Industry	Mexico (1935)	Argentina (1935)	Brazil (1939)
Food, Beverages, and Tobacco	167	575	169
Textile, Textile Products, and Wearing Apparel	124	398	60
Leather, Leather and Footwear	98	468	420
Wood, Products of Wood, and Cork	99	334	138
Pulp, Paper, Printing and Publishing	204	684	196
Chemicals, Chemical Products, and Rubber	193	588	214
Non-metallic Mineral Products	202	514	158
Basic and Fabricated Metals	128	392	61
Electrical Machinery, Electrical Apparatus, and Prec. Instr.	98	179	648
Machinery and Transport Equipment	89	456	295
Other Manufacturing	151	301	175
Total	142	471	135

Source: Text of Appendix A.

4.1.B: Comparative benchmarks of levels of gross value added per person employed in Mexico, Argentina, and Brazil in 1947/49/50
(Constant US dollars of 1975)

Industry	Mexico (1950)	Argentina (1947)	Brazil (1949)
Food, Beverages, and Tobacco	498	609	292
Textile, Textile Products, and Wearing Apparel	262	593	188
Leather, Leather and Footwear	301	476	668
Wood, Products of Wood, and Cork	271	309	161
Pulp, Paper, Printing and Publishing	411	526	269
Chemicals, Chemical Products, and Rubber	781	764	417
Non-metallic Mineral Products	343	547	179
Basic and Fabricated Metals	808	440	300
Electrical Machinery, Electrical Apparatus, and Prec. Instr.	433	441	333
Machinery and Transport Equipment	408	388	273
Other Manufacturing	266	379	219
Total	445	519	249

Source: Text of Appendix A.

4.1.C: Comparative benchmark of levels of gross value added per person employed in Mexico, Argentina, and Brazil in 1974/1975
(Constant US dollars of 1975)

Industry	Mexico (1975)	Argentina (1974)	Brazil (1975)
Food, Beverages, and Tobacco	1,001	861	1,077
Textile, Textile Products, and Wearing Apparel	759	713	699
Leather, Leather and Footwear	2,132	862	2,749
Wood, Products of Wood, and Cork	567	391	652
Pulp, Paper, Printing and Publishing	1,282	867	1,290
Chemicals, Chemical Products, and Rubber	2,033	1,023	2,810
Non-metallic Mineral Products	1,047	599	853
Basic and Fabricated Metals	1,338	964	1,251
Electrical Machinery, Electrical Apparatus, and Prec. Instr.	1,037	878	1,436
Machinery and Transport Equipment	1,322	826	1,191
Other Manufacturing	839	470	948
Total	1,204	883	1,196

Source: Text of Appendix A.

Appendix B to chapter 4: Prices

Wholesale prices: indices of the *aggregate* wholesale prices for the three countries were taken from the historical series of Mitchell (2008). The original data series were re-based to the year of 1975. To check for consistency, I compare for Mexico its trend with Mexico City's wholesale price index (Índice de precios al mayoreo) provided by INEGI (Instituto Nacional de Estadística Geografía e Informática) from 1930-1960 and the Montevideo-Oxford Latin America dataset (MoxLaD) for 1960-1975. For Brazil I compare it with the IBGE (Instituto Brasileiro de Geografía e Estatística) series IPA (índice de preços por atacado).

Branch-specific wholesale price indices

Brazil: Indices were derived from the series of de Bulhões (1948) and inflation rates were re-based to 1938 as reference year. Data was originally disaggregated into six branches (Food & beverages, Textiles, Chemicals, Metals, Fuel, and Miscellaneous). These series were used to adjust census data for 1939 and 1949/1950.

Mexico: Disaggregated indices were based on estimates by the Bank of Mexico in *Series Históricas de Precios*, compiled by INEGI in 2009's *Estadísticas Históricas de México*. Original series had 1978 as base year, thus, these were also re-based into the year 1975 for consistency.

Table 4.2.A: Wholesale price indices, Brazil 1938-1947

Years	Mitchell's Wholesale price index for Brazil	Disaggregated price indices by branch						
	Brazil total	Total wholesale price index Bulhões (1948)	Food and beverages	Textile products	Metal products	Chemical products	Fuel	Miscellaneous
1938	100	100	100	100	100	100	100	100
1939	104	102	102	101	105	106	119	101
1940	107	107	108	104	144	115	137	110
1941	133	125	139	113	143	129	153	124
1942	159	148	158	136	201	173	196	143
1943	181	173	175	166	216	192	229	164
1944	193	206	208	206	220	190	241	178
1945	226	239	252	242	207	183	253	190
1946	263	285	306	295	186	176	255	219
1947	319	283	337	265	171	188	253	228

Source: Mitchell 2008; and Bulhões (1948)

Table 4.2.B: Wholesale price indices for Mexico by manufacturing branch 1939-1975

Years	Food & Beverages	Textiles & Apparel	Chemical Products	Non-metallic Mineral Products	Basic & Fabricated Metals	Electrical Machinery & Electrical Apparatus	Machinery & Transport Equipment	Miscellaneous
1939	10.43	10.21	10.98	7.96	9.52	23.39	11.04	12.94
1940	10.79	10.83	11.64	8.16	10.00	23.39	11.26	14.99
1941	11.33	10.83	11.80	8.98	10.81	25.48	12.39	16.43
1942	12.05	11.67	13.61	10.61	12.26	23.91	13.29	19.51
1943	14.39	14.17	13.61	13.27	13.39	26.00	13.51	24.44
1944	16.73	16.04	15.90	15.10	14.03	26.35	13.74	27.52
1945	19.06	18.75	14.43	16.12	13.87	26.35	13.74	28.34
1946	22.30	20.42	12.79	19.59	15.81	26.00	13.96	29.98
1947	23.20	21.67	17.21	19.80	19.03	28.45	18.24	30.18
1948	25.72	22.71	29.67	23.27	22.42	34.38	22.75	31.62
1949	26.44	25.21	34.10	25.92	27.74	46.25	32.43	32.85
1950	26.80	28.33	29.34	29.80	29.68	51.13	35.14	35.73
1951	31.47	31.25	38.85	40.41	32.58	54.28	38.51	60.16
1952	34.35	33.33	37.87	39.18	34.68	56.02	39.86	44.97
1953	34.35	33.33	31.48	38.57	35.00	58.12	40.09	44.35
1954	36.69	35.63	35.25	44.90	37.74	70.33	48.65	47.23
1955	39.93	40.63	42.79	50.20	40.48	78.53	56.08	50.31
1956	41.19	42.29	42.13	50.20	45.16	80.80	59.46	51.75
1957	42.27	43.75	41.31	50.20	48.39	82.72	64.19	54.83
1958	44.06	45.42	42.79	49.59	50.16	83.42	68.69	55.65
1959	46.04	45.83	44.59	46.73	50.16	84.29	72.52	59.96
1960	47.84	46.46	42.95	50.41	49.68	84.99	73.20	66.74
1961	48.56	48.75	42.95	51.02	50.32	85.51	73.42	61.40
1962	48.92	51.88	42.95	48.57	50.32	83.77	74.55	60.37
1963	49.10	51.67	42.95	49.59	50.16	83.07	75.00	61.40
1964	49.82	51.88	42.95	52.45	51.13	83.77	76.80	63.45
1965	50.90	54.17	42.95	53.06	52.26	83.60	77.03	65.71
1966	51.08	55.63	42.95	51.43	52.10	80.98	81.53	66.74
1967	50.72	57.08	42.95	52.04	52.58	80.80	81.76	67.76
1968	52.88	57.29	42.95	51.43	54.03	80.80	81.76	68.99
1969	54.50	59.58	42.95	53.67	55.00	80.80	81.76	69.82
1970	56.29	61.88	42.30	56.53	59.19	81.85	81.98	71.46
1971	66.37	63.13	44.92	55.51	60.00	82.20	81.98	71.66
1972	66.91	66.25	47.54	58.78	60.00	82.02	79.95	75.36
1973	69.42	75.42	52.95	84.08	61.45	84.64	84.46	80.70
1974	89.57	88.13	90.98	97.96	83.23	91.97	86.94	95.69
1975	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Note: Original data labels of the categories were re-labelled from Spanish to English as follows: Food and beverages are 'Alimentos elaborados'; Textiles & apparel are 'No-alimentos de uso personal'; and Miscellaneous is 'otros'.
Source: Based on data from INEGI (2009).

Table 4.2.C. Wholesale price index of Mexico, Argentina, and Brazil (1975=100)

Year	Mexico	Argentina	Brazil
1934	6.06	0.02	
1935	6.06	0.02	
1936	6.39	0.02	
1937	7.60	0.03	0.05
1938	8.08	0.03	0.04
1939	8.00	0.03	0.05
1940	8.25	0.03	0.05
1941	8.89	0.03	0.06
1942	9.62	0.04	0.07
1943	11.64	0.04	0.08
1944	14.39	0.04	0.09
1945	15.76	0.05	0.10
1946	18.19	0.06	0.12
1947	19.16	0.06	0.14
1948	20.70	0.07	0.16
1949	22.64	0.08	0.18
1950	24.98	0.10	0.21
1951	30.80	0.15	0.25
1952	31.93	0.19	0.27
1953	31.45	0.22	0.31
1954	34.36	0.22	0.40
1955	39.05	0.24	0.45
1956	40.91	0.31	0.55
1957	42.68	0.38	0.61
1958	44.62	0.50	0.69
1959	45.11	1.17	0.95
1960	47.29	1.35	1.24
1961	47.70	1.46	1.72
1962	48.59	1.91	2.63
1963	48.83	2.46	4.56
1964	50.93	3.11	8.71
1965	51.90	3.85	13.24
1966	52.55	4.63	18.29
1967	54.08	5.78	22.82
1968	55.05	6.34	28.22
1969	56.51	6.74	33.97
1970	59.82	7.71	41.46
1971	62.09	10.72	50.17
1972	63.86	18.96	59.76
1973	73.89	28.50	68.47
1974	90.54	34.49	88.76
1975	100.00	100.00	100.00

Source: B. Mitchell, *International Historical Statistics.*

4.2.D Census aggregation into ISIC Classification rev. 3

Industry classification	ISIC	Description
Food, Beverages, and Tobacco	15-16	Manufacture of food products and beverages + Manufacture of tobacco products
Textile, Textile Products, and Wearing Apparel	17-18	Manufacture of textiles + Manufacture of wearing apparel; dressing and dyeing of fur
Leather, Leather and Footwear	19	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery and harness + Manufacture of footwear
Wood, Products of Wood, and Cork	20+30	Manufacture of wood and wood and cork products + Manufacture of furniture and fixtures + office furniture
Pulp, Paper, Printing and Publishing	21+22	Manufacture of paper and paper products + Publishing + Service activities related to printing
Chemicals, Chemical Products, and Rubber	23+24+25	Manufacture of coke oven products + Manufacture of refined petroleum products + Manufacture of basic chemicals + Manufacture of other chemical products + Manufacture of rubber and plastic products
Non-metallic Mineral Products	26	Manufacture of glass and glass products + Manufacture of non-metallic mineral products
Basic and Fabricated Metals	27+28	Manufacture of basic iron and steel + Manufacture of basic precious and non-ferrous metals + Casting of metals + Manufacture of structural metal products, and reservoirs and steam generators + Manufacture of other fabricated metal products; metalworking service activities
Electrical Machinery, Electrical Apparatus, and Precision Instruments	31+32+33	Manufacture of television and radio transmitters and apparatus for line telephony and line telegraphy + electric motors, generators and transformers + Manufacture of electricity distribution and control apparatus + Manufacture of insulated wire and cable + Manufacture of electric lamps and lighting equipment + Manufacture of medical appliances and instruments and appliances for measuring + optical instruments and photographic equipment + Manufacture of watches and clocks
Machinery and Transport Equipment	29+34+35 (352+359)	Manufacture of general purpose machinery + special purpose machinery + Manufacture of motor vehicles + Manufacture of parts and accessories for motor vehicles and their engines + Manufacture of railway and tramway locomotives and rolling stock
Other Manufacturing	-	Manufacture of jewellery and related articles; musical instruments; sporting and athletic goods; and manufacturing industries not elsewhere classified

4.2.E: Manufacturing industries classified according their global technological intensity

Low-technology	ISIC
Wood and furniture; Paper, printing, publishing	20-22
Textiles and clothing	17-19
Food, beverages, and tobacco	15-16
Recycling	36-37
Medium-low-technology	
Rubber and plastic products	25
Shipbuilding	351
Non-ferrous metals	36
Non-metallic mineral products	26
Fabricated metal products & ferrous metals	27-28
Petroleum refining	23
Medium-high-technology	
Machinery and equipment	29
Motor vehicles	34
Electrical machinery	31
Chemicals	24
Other transport equipment	352+359
High-technology	
Aircraft/Spacecraft	353
Pharmaceuticals	2423
Medical and precision instruments	33
Computing machinery	30

Source: Hatzichronoglou (1997).

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