

**UNIVERSIDADE FEDERAL DE ALFENAS**

**JOÃO VICTOR GUEDES NETO**

**INSTITUTIONS, INDUSTRIALIZATION AND INNOVATION: THE THREE IS OF  
ARGENTINA, BRAZIL AND MEXICO FROM 1950 TO 2010**

Varginha/MG

2015

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Dissertação apresentada como parte dos requisitos para obtenção do título de Mestre em Gestão Pública e Sociedade pela Universidade Federal de Alfenas, *campus* Varginha. Área de concentração: Gestão Pública e Sociedade.

Orientador: Michel Deliberali Marson.

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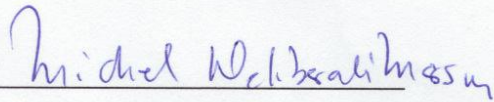
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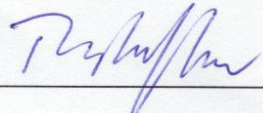
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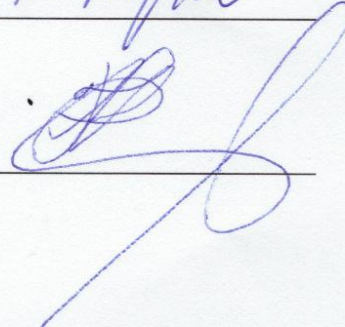
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Aos meus pais, João Victor e Maria Virginia,  
pelo amor incondicional e pelas maiores  
heranças que poderiam deixar: a educação e a  
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Each society functions with a set of economic and political rules created and enforced by the state and the citizens collectively. Economic institutions shape economic incentives: the incentives to become educated, to save and invest, to innovate and adopt new technologies, and so on. It is the political process that determines what economic institutions people live under, and it is the political institutions that determine how this process works. For example, it is the political institutions of a nation that determine the ability of citizens to control politicians and influence how they behave. This in turn determines whether politicians are agents of the citizens, albeit imperfect, or are able to abuse the power entrusted to them, or that they have usurped, to amass their own fortunes and to pursue their own agendas, one detrimental to those of the citizens.

(DARON ACEMOGLU; JAMES ROBINSON, 2013, p. 42).

## RESUMO

A escassez de recursos obriga a humanidade a enfrentar o problema de identificar formas eficientes para distribuí-los. Uma das formas de reduzir este problema é a possibilidade de aumentar a quantidade de bens disponíveis. A teoria do crescimento de Robert Solow descreve a composição do produto de uma economia como a soma das unidades de trabalho, estoque de capital e uma variação residual chamada mudança técnica. Este resíduo, a produtividade total dos fatores (PTF), é explicável por uma série de variáveis: mudança institucional, tecnologia disponível, políticas governamentais, etc. Esta pesquisa se dedicou a descobrir o papel das instituições no processo de inovação e industrialização em países emergentes selecionados entre 1950 e 2010. Devido às suas similaridades históricas e posicionamento geográfico, Argentina, Brasil e México foram escolhidos. As últimas seis décadas (dividas entre a era da industrialização pela substituição de importações, a Crise do Petróleo e a liberalização pós-Consenso de Washington) foram analisadas de forma a comparar como os agentes econômicos reagiram aos eventos de cada um destes períodos. A abordagem da Hélice Tripla, que leva em consideração as relações evolucionárias entre governos, firmas e universidades, foi usada para mapear fatos históricos que foram comparados com a PTF calculada dos países selecionados. Foi demonstrado que a estabilidade das instituições econômicas e políticas é um elemento chave para motivar empreendedores a inovar. Além disso, percebeu-se uma clara diferenciação entre os resultados gerados pelos modelos de política econômica adotados em cada período. A intervenção estatal foi benéfica para promover o crescimento industrial mas em diversas ocasiões seu protecionismo não ofereceu incentivos suficientes para motivar a inovação empreendedora. Muitas indústrias se perderam em meio a proteção estatal e não obtiveram competitividade suficiente na economia global. A abertura econômica, por outro lado, gerou a falência ou redução de uma série de empresas que não conseguiram se adequar à competição internacional mas, ao mesmo tempo, aumentou os esforços inovadores e, assim, a competitividade de setores de alta tecnologia das economias emergentes. Finalmente, foi notado que, mesmo que diversas políticas tenham sido criadas nesta direção, a interação entre firmas e universidades nestes países permanece muito incipiente.

Palavras-chave: Produtividade Total dos Fatores. Teoria da Hélice Tripla. Inovação na América Latina.



## ABSTRACT

Resource scarcity obliges humanity to face the problem of identifying efficient ways of distributing them. One way of reducing this problem lies on the possibility of increasing the amount of available goods. Robert Solow's growth theory describes the composition of an economy's output as the sum of units of labor, capital stock and a residual variation called technical change. This residual, the total factors productivity (TFP), is explainable by a series of variables: institutional change, available technology, government policies, etc. This research aimed at finding out the role of institutions in the process of innovation and industrialization in selected emerging countries from 1950 to 2010. Due to its similar historical backgrounds and geographic location, Argentina, Brazil and Mexico were chosen. The last six decades (encompassing the import-substitution industrialization era, the Oil Crisis and the post-Washington Consensus liberalization) were analyzed as a manner of comparing how economic agents reacted to the events of each period. The Triple Helix approach, which takes into consideration the evolutionary relations between governments, firms and universities, was used to map history facts that were compared to the calculated TFP of the given countries. It was demonstrated that the stability of economic and political institutions is a key element for motivating entrepreneurs to innovate. Furthermore, it was noticed a clear difference between the outcomes generated by the different models of economic policy adopted in each period. State intervention was helpful to promote industrial growth but in many occasions its protectionism could not offer enough incentives to motivate entrepreneurial innovation. Many industries faded into State protection and didn't gain enough competitiveness in the global economy. Opening the economy, on the other side, led to the bankruptcy or shrinkage of several firms that were not able to adapt themselves to the international competition but, at the same time, it boosted innovative efforts and, thus, the competitiveness of high technology sectors from emerging economies. Finally, it was noticed that, although many policies were enacted in this direction, the interaction between firms and universities in these countries is still very incipient.

Key words: Total Factors Productivity. Triple Helix Theory. Innovation in Latin America.

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## 1 INTRODUCTION

The impossibility of producing infinite resources obliges humanity to face the problem of identifying the best ways of dividing them. Different hypotheses have been presented across time. Mathematical equations, justice theories and moral debates were unable to reach a consensus on how to solve the problem of scarcity. As a common point could not be found, many economists dedicated their research efforts to mechanisms of increasing output. It would not solve the scarcity problem but at least it would reduce the problem of satisfying the existing demands.

Once again no consensus was found on how to increase output, but a great number of economists recognized the approach of Robert Solow (1956, 1957), a Nobel laureate in economics, capable of explaining at a reasonable level of reliability how countries managed to increase their productivity and, thus, the amount of produced goods. Briefly, he suggested that variations in an economy's output resulted from variations in labor engagement, capital stock and a residual factor named technical change – explained in diverse ways by him and other economists. Basically, the greater technical change was, the bigger the output would be.

A commonly debated research problem started being how to achieve technical change. Once this measure was calculated as a residual of the growth equation, it could be described or understood as an outcome of a large variety of economic phenomena. It will be argued in this paper that one of them lies in the economy's institutional background, or the rules of the game, which are capable of motivating or demotivating the search for and the use of new technologies.

This approach is not really new, deriving from Joseph Schumpeter (1934) who suggested that economic development was the outcome of entrepreneurial endeavors aimed at obtaining profit through innovations. The general idea was that new products or new production methods would alter the demand-supply cycle allowing the entrepreneur to sell its products at a greater profit margin until other firms managed to imitate or produce substitute goods.

It is noteworthy that although it is possible to correlate Solow's and Schumpeter's ideas in order to analyze innovation and entrepreneurship, both authors didn't necessarily agree with each other in many aspects. While Schumpeter (1934) treated innovation as a process of creative destruction where new methods or products substitute old ones, Solow

(1956, 1957) understood technical change as an incremental process that contributes, and not necessarily eliminates, to what has been done before. Some decades after his seminal works, Solow (1994) showed some agreement with Schumpeter's concept but, as mentioned, criticized the fact that incremental gains were not included in his theory.

Aggregating both theories, an important question must be done: if technical change is pursued by entrepreneurs looking for profit and the greater it is, the more an economy will grow, how does a certain country boost its entrepreneurial innovation? In a more recent approach, Acemoglu and Robinson (2013) argued that this process of constant innovation, or creative destruction, is favored by inclusive economic and political institutions, what means that in a certain country, entrepreneurs should be free to innovate relying on democratic governance, open-market economy and solid property rights.

Nonetheless, it would be too simple to define a common set of desirable institutions to be implemented in any country at any period of time and expect the same outcomes. Authors as Douglass North (1990) are very clear at pointing it out. Once each country, or region, evolved under different circumstances, adopting the same set of rules would lead to different paths as it happened in most Latin American countries that, after their independence, tried to adopt similar laws as the ones from the United States.

In this sense, Lundvall *et al.* (2009) published a book containing a collection of researches aimed at explaining successes and failures in the process of innovation in developing countries. It is clear that the nature of poor countries differs from rich economies. In general, education levels are lower, governance is not so well set or organized and financial resources are not enough for purchasing or inventing machinery, among other deficiencies.

This research aims at analyzing exactly what has been going on in selected emerging countries in regards of innovation as a way of identifying what has influenced technical change across the years. It is important as gaining a better understanding on these factors is helpful to allow policy-makers to be more effective when drafting and implementing new policies or reforms.

In order to that, Solow's technical change is defined as a measure of success in the pursuit of innovation. Then, it is compared to the evolution of the relationship between the government, firms and universities – defined as the proxy-institutions for the rules of the game. This serves as a way of understanding which historical events positively or negatively

influenced entrepreneurial action. At diverse moments, secondary data is used in order to complement all the analyses.

Argentina, Brazil and Mexico were chosen as the emerging countries to be studied because they all came from similar colonial backgrounds and are leading economies of the same region, Latin America. In the past six decades, more specifically from 1950 until 2010, they passed through similar economic regimes, as the import-substitution industrialization, a lost period after the Oil crisis and the post-Washington Consensus liberalization. Although in many calculations it is assumed that each period lasted two decades, most of this research is quite flexible in regards of periodicity.

With the clear objective of finding out the role of institutions in the process of innovation and industrialization in Argentina, Brazil and Mexico between 1950 and 2010 this research is divided in four chapters, including this (1) introduction; (2) Economics of Innovation; (3) Innovation and Growth in Latin America; and, finally, the (4) Conclusion.

The second chapter, Economics of Innovation, is dedicated to a profound literature review on aspects of economic growth and its applications in the studies about national innovation systems, entrepreneurial action and the Triple Helix theory. Besides the already mentioned neoclassical growth model, it encompasses writings from economists of different schools of thought, as post-Schumpeterians, neoinstitutionalists, and evolutionary and developmental economists. It is in this chapter that the research method is described, including calculation schemas and data sources.

In the next chapter the three Latin American countries are analyzed through the lens presented and discussed in the second chapter. It is divided into four subchapters: a historical overview of what happened in these countries until the II World War, the post-II World War period, the Oil Crisis years and the post-Washington Consensus era. Each of these three periods is presented by a short introduction, followed by a discussion on the data and historical events of each country, and concluded by some general remarks.

In the fourth, and last, chapter, all the research is summarized and the results are presented. As it will be discussed, the stability of economic and political institutions is a key element for motivating entrepreneurs. Furthermore, in each period different tools will result in different outcomes. State intervention will be helpful to promote industrial growth but in many occasions its protectionism won't offer enough incentives to motivate entrepreneurial innovation. As an outcome, many industries will fade into State protection and won't become



competitive in the global economy. Finally, it will be seen that, although many policies were enacted in this direction, the interaction between firms and universities in these countries is still very incipient.

## 2 ECONOMICS OF INNOVATION

### 2.1 ECONOMIC GROWTH

Economic growth is the phenomenon marked by the output's increase in a certain economy. It means that local firms are producing more or better products so that the overall value of them becomes greater within time. It has been widely pursued by different policy makers and economists who entered different research fields as developmental economics and economics of innovation. The latter, which will be further discussed during this work, has already existed for at least one century but gained a mainstream status in the last three decades when several researchers started discussing the concept of national innovation systems. The initial assumption is that through innovation entrepreneurs are able to insert in the market new products (or the same products through different methods) and obtain profit while other players are not able to imitate or surpass it. A continuous process of creative destruction leads not only to individual profit-makers but to increased gains in output and, thus, economic growth.

Barro and Sala i Martin (2003, p. 1) made an interesting supposition to address the importance of economic growth: in real life, the United States has grown at an average yearly rate of 1.8% from 1870 to 2000. It made the country achieve a real per capita gross domestic product (GDP) of US\$33,330 in 1996 dollars – the second-highest in the world. If its yearly growth had been of 0.8%, similar to the one experienced by India, Pakistan and the Philippines, the real per capita GDP of 2000 would have been US\$9,450 in 1996 dollars – ranked 45th out of 150 measured countries. On the other hand, with a yearly growth of 2.8%, the United States would have achieved a real per capita GDP of US\$127,000 in 1996 dollars – 3.8 times its real result. In their words,

[...] if we can learn about government policy options that have even small effects on long-term growth rates, we can contribute much more to improvements in standards of living than has been provided by the entire history of macroeconomic analysis of countercyclical policy and fine-tuning. Economic growth [...] is the part of macroeconomics that really matters. (BARRO; SALA I MARTIN, 2003, p. 6).

In this regards, Solow (1956, 1957) attempted to draft a theory capable of explaining how economic growth was achieved by nations. He did so making use of Keynesian

assumptions and advancements to the Harrod-Domar model. Basically, Solow (1956, p. 66) inferred that an economy's "output is produced with the help of two factors of production, capital and labor". Both factors would tend to grow following a certain balance, or equilibrium. He inferred that

[...] if the initial capital stock is below the equilibrium ratio, capital and output will grow at a faster pace than the labor force unit until the equilibrium ratio is approached. If the initial ratio is above the equilibrium value, capital and output will grow more slowly than the labor force. The growth of output is always intermediate between those of labor and capital. (SOLOW, 1956, p. 70-71).

Solow's (1956, p. 68) capital-labor ratio was denoted by  $r = \frac{K}{L}$  where  $K$  corresponds to capital stock and  $L$  to labor, or total employment. In brief, his statement suggests that the output will increase at an accelerated pace only if the economy gets into a catch-up process of capital augmentation until the availability of both capital stock and labor is balanced. This was the general basis for his Convergence Theory.

In the following year, Solow (1957, p. 312) added a new hypothesis to his growth theory described as "an elementary way of segregating variations in output per head due to technical change from those due to changes in the availability of capital per head". Mathematically, he started considering technical change (denoted as  $A$ ) as a statistical residual in his growth function initially composed by capital stock and labor.

It is noteworthy that, although clearly relevant to the economic sciences, the neoclassical model of growth is limited. As further discussed by Nelson (2006, p. 26-39) and Freeman and Soete (2008, p. 541-570), the AK assumption takes for granted theoretical assumptions, such as full employment and perfect competitiveness, that in practice might not be verified. Solow (1956, p. 65) was aware of it and started his seminal paper by affirming that "all theory depends on assumptions which are not quite true. [...] The art of successful theorizing is to make the inevitable simplifying assumptions in such a way that the final results are not very sensitive". The simplifications presented by Solow (1956) allowed the calculation of economic growth not solely as the sum of available capital stock and labor, but also by inserting a measure of technical change mathematically equivalent to the equation's residual. By that means, technical change, or the equation's residual, was given by an unexplained variation hereafter credited to different factors. This *measure of ignorance* was called total factors productivity (*TFP*) or, lately, Solow's residual. A purely mathematical approach would lead to vague results but its comparison to historical facts sheds light to the discussion on the causes of productivity growth and technical change.

Before going further on the neoclassical model, it is relevant to underline the explanation of TFP given by Helpman (2004, p. 22-23):

How much output growth is attributed by growth accounting to improvements in TFP and how much to the growth of inputs depends, however, on the ways in which the input measures are constructed. If, for example, labor input is measured in hours, unadjusted for education and experience, then in an economy with rising average years of schooling the contribution of schooling to the quality of the labor force will be attributed to the TFP growth. [...] More generally, all unmeasured improvements in the quality of inputs - improvements in technology, improvements in the organization of production and distribution, the reduction of distortions (harmful regulations or taxes), and improvements in government policies – will be attributed to TFP growth.

Miles and Scott (2005, p. 93-102) goes further and suggests several possibilities that may be included in the composition of an economy's TFP: institutions may matter, for example, in regards of the functioning of property rights, regulatory institutions, macroeconomic stabilization, social insurance, conflict management and political rights; rent-seeking and corruption may absorb factors that could be used in the entrepreneurial sector; and financial institutions may make a difference depending on how they will handle the allocation of resources from savers – funding successful or unsuccessful entrepreneurs. Comparing the advances of the TFP with the innovation policy of the selected countries throughout the sixty years since 1950 will help to understand how much these domestic initiatives contributed to the technical change process in Latin America.

It is important to highlight that while most of the available literature on innovation is dedicated to rich countries, there is still a vast field to be explored in emerging and poor economies. Innovation matters as much to develop countries as to developing ones. Low incomes in the periphery have usually resulted from low average productivity and, as a cycle, have led to a limited capacity for developing or adopting new technologies to increase productivity. In this sense, successful initiatives to replace the poverty trap by an innovative trend might lead a poor country to a new path of wealth creation and economic development (ALTENBURG, 2009).

It explains why using the neoclassical model of economic growth is important even though it is just a simplification of the economic reality of these countries. The measures of productivity (2.1.1) and technical change (2.1.2), when compared to history events, will be used to identify how successful (or not) each policy or regime was.

$$(2.1.1) \quad \frac{Y}{L}$$

Several textbooks present this model in slightly different manners. Hereafter, Blanchard's (2013, p. 265-266) method will be followed due to its simplicity, academic recognition and accordance to the present research. Denoting output as  $Y$ , identifying variations as  $\Delta^1$ ,  $\beta$  as the share of labor in the output and  $\alpha$  as  $(1-\beta)$  or the share of capital in the output, Blanchard (2013, p. 265-266) infers that

$$(2.1.2) \quad \Delta Y = \alpha \Delta K + \beta \Delta L + TFP$$

In order to calculate the  $TFP$  (2.1.2) for each given period, data from the Penn World Table (HESTON *et al*, 2012) will be used. It provides the amount of workers and average amount of work hours ( $L$ ), capital stock ( $K$ ) and the Gross National Product ( $Y$ ) for every selected country in an annual basis making use of 2005 prices in U.S. Dollars. Furthermore, it provides the yearly capital- and labor- elasticity, or, respectively, the shares of capital ( $\alpha$ ) and labor ( $\beta$ ) in the output, for each of the studied countries. The calculated data is presented on the Appendix.

## 2.2 INNOVATION AND TECHNOLOGY

Rosenberg (2006, p. 49) stresses the fact that only a small portion of economic (and productivity) growth is explained by increases in the capital stock and the amount of labor. The unexplained part is identified as technical change. As it was already affirmed, this variable does not serve as a final word on innovation efficiency, but as an additional tool to verify historical trends.

As previously noted, the importance of Solow's findings also embraces the field of convergence. Growth tends to be bigger in countries where the ratio between capital stock and labor is not balanced. It implies a catch-up process that takes place through the spontaneous or induced transference of technology to developing regions. Several examples evidenced this fact throughout history. In the first quarter of the XIX century, British engineers and mechanics, summed to large investments in reverse engineering and technical education, were

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<sup>1</sup> The formula  $\Delta V_t = \frac{V_t - V_{t-1}}{V_{t-1}}$  will be used to calculate variations, where  $V$  denotes a given variable and  $t$  the current period.

the key elements in the achievement of a highly efficient machinery production industry in Prussia. In the second half of XIX, the possibility of exploiting cheap natural resources, energy and accessible land motivated foreign entrepreneurs to move to the United States letting North America's economy surpass Great Britain's (FREEMAN; SOETE, 2008, p. 507, 509-510).

Studying economic history plays a strong role in understanding catch-up processes and, essentially, why some countries succeed in innovating while others do not. Differences between countries are vast and deep changes may occur across time. Institutions, resources availability, culture and policies are some of the aspects that may influence the speed of economic growth and social change (ROSENBERG, 2006, p. 25). Coke, for example, was a central innovation in the Industrial Revolution. In Great Britain, it was used in more than 90% of the country's blast furnace in 1810. Fifty years later, only 10% of the American production used this material. The literature shows that this fact was caused by the lack of incentives to innovate in this field in the United States. Wood was vastly available and coal reserves were far from the biggest cities of the country. Following this, the use of coke only became profitable (and popular) after the Civil War, the invention of the hot blast and the migration to the west (ROSENBERG, 2006, p. 47-48).

This relationship between profit and innovation was always clear. Although a correlation of science and entrepreneurial activity might point out to several technological innovations pushed by scientific discoveries, the Industrial Revolution is full of examples of new products and methods discovered by profit-driven trial and error experiences (ROSENBERG, 2006, p. 32-34). Nonetheless, it is important to understand that entrepreneurs and scientists were not the only agents in the quest of innovation. Leydesdorff (2006, p. 46) affirmed that "under the condition of constitutional stability in the various nation-states after 1870, national systems of innovation could gradually be developed among the axes of economic exchange and organized knowledge production and control". Prussia's efforts in driving technical change through education and machinery imports served as an influential example to nations that wished to step ahead in the struggle for industrial excellence.

The intensification of national innovation systems promoted some changes in the average stereotype of innovators. During the XIX century, there existed the heroic figure of scientist-entrepreneurs such as Thomas Edison, John Deere and John Wesley Hyatt. At the same time they were led endeavors in creating new methods or products, they profited from either selling their patents or products. In the XX century the new standard became the

entrepreneurial research and development (R&D) departments or laboratories. In this process of change, big companies as Kodak, General Electric and Du Pont started developing their own innovations as part of their businesses. In the first decade of this century, even the U.S. Navy sponsored its own military industrial complex (FREEMAN; SOETE, 2008, p. 342-343). The trend of government spending in military research became even clearer in the II World War. It was through the Manhattan Project and its results in Hiroshima that the power of the Big Science was evidenced to the entire planet (FREEMAN; SOETE, 2008, p. 511-512).

Rosenberg (2006, p. 396) highlights that it was also during the two World Wars that developing countries such as India, Mexico and Brazil started accelerating their innovation efforts. The lack of availability of industrialized goods, the growing economic instability and other correlated factors led several countries to an import-substitution regime where foreign technology and imported capital were used to boost productivity and start supplying their own industrial demand.

In this sense, technology transfer is still an efficient mechanism of innovation and productivity gains. Once the R&D process is skipped, efficiently using foreign technology might be a quicker and cheaper path to economic development. Still, the degree of international involvement of a certain country regards its capacity to access a given piece technology and to insert itself in the processes of knowledge creation and diffusion. Once the R&D capabilities of developing countries are limited, their international involvement is essential not to lose track of the worldwide technological change. Among the mechanisms to facilitate this involvement are

[...] the movement of qualified workers and/or researchers, the promotion of knowledge interactions with expatriates (diaspora), the promotion of international technological joint ventures or joint research projects, scholarships for graduate students to study abroad, international programs of inter-governmental cooperation, and so on. (MARIN; ARZA, 2009, p. 280-281).

Catching-up the developed world is not an easy task. Most of Marin and Arza's mechanisms of technology transfer did not exist or were not well-developed during the import-substitution era in Latin America. Furthermore, a multinational corporation will not necessarily have research and development departments in every country it operates. As Hilpert (1991, p. 7-8) affirmed, "techno-industrial innovation, though a common aim of Western states seeking to solve their socio-economic problems, requires specific initial conditions and these normally include the requirement for an active state". Added to that, the

economic crises faced by the world in the XX century proved that the current international division of labor was not permanent.

In the Western industrialized countries, the 1970s and the 1980s, have been characterized by the effects of economic crisis and industrial decline in many industrial sectors. [...] Before, the international division of labor was characterized predominantly by the Western industrialized countries being the producers of industrial products and by the countries of the Third World supplying raw materials or agricultural products. Today more and more industrial products are manufactured in former Third World countries. These countries' experience [...] indicates the fundamental change in the international division of labor. Mass production based on low production costs, cheap labor and very low requirements for the qualification of labor were the ways in which these countries first emerged in world industrial markets. Step by step some of these countries engaged in more sophisticated products, such as microelectronics, software and chemical products from Brazil, India, Korea, Singapore or Taiwan. (HILPERT, 1991, p. 5)

Agreeing with the difficulties existent in a catch up process, Freeman and Soete (2008, p. 614) affirm that the assimilation of foreign technology is complex as it depends on the country's and local firms' absorption capacity. The American case of coke and blast furnaces exemplifies it. That's one of the reasons why some countries performed better in the catch-up process than others. East Asia drastically outperformed Latin America in the XX century. Radical changes such as the land reform and the universal schooling permitted East Asia to engage in a structural and technical transformation that was not seen in most countries of Latin America. In the 1980s, the contrast between the advancements in education in South Korea and Brazil was remarkable. The Japanese case is even more striking. During the 1950s and 1960s, the country's growth was attributed to imitation and technology transfers. In the 1970s, the Japanese relative expenses in industrial R&D surpassed the United States'. In the 1980s, the same happened with the ratio between the total civil R&D and the GNP, and the country became one of the most competitive in several highly technological sectors, such as electronics (FREEMAN; SOETE, 2008, p. 516-521).

It is noteworthy that government intervention is not the only tool for acquiring foreign technologies. Multinational corporations often function as technological diffusers. There are several mechanisms whereby they are able to influence technical change in developing countries: the movement of high-skilled workers to subsidiaries as they will be able to use their previous experience to adapt practices and diffuse knowledge; the observation effect, which allows multinational corporations to demonstrate certain technologies and, through a deeper awareness, accelerate its use by the domestic firms; the purposeful transfer of technology to domestic firms in order to increase the quality of local stakeholders such as



buyers and suppliers; and competition effects, obligating local firms to improve their techniques in order to keep their market presence (MARIN; ARZA, 2009, p. 286-287).

After all, an important question to be answered is why innovating is important to promote growth. Is it only a matter of increasing productivity and thus economic growth? The Schumpeterian argument says that once innovating is costly and risky, the delay in imitating it is a key element in profit making (NELSON, 2006, p. 57, p. 93). Indeed, introducing new products or new techniques in the market means higher productivity, but it is also about better products (ROSENBERG, 2006, p. 18). Once a market economy is based on competition, the agents who are able to meet (or generate) a given demand better than its rivals will manage to sell at higher prices and, consequentially, obtain satisfactory profits. The more profit-makers succeed in a country, the more its economy's will grow.

It is true that public policies and regimes are able to create a good atmosphere for innovations. Still, it is market-driven competition that encourages this phenomenon. According to Hayek (1945, p. 519), "the knowledge of the circumstances of which we must make use never exists in concentrated or integrated form, but solely as the dispersed bits of incomplete and frequently contradictory knowledge which all the separate individuals possess". The more plural an economy is, the higher are the chances that new methods or products will be successfully introduced in the market. Diversity and plurality, on the other hand, also means that some innovators will fail. It is the possibility of obtaining profit that compensates the risk of failing in the struggle for the right supply (NELSON, 2006, p. 60).

In this sense, some preconditions are necessary in order to create an appropriate environment for innovations. Macroeconomic policies are influential in different ways. Monetary policies may provoke an exporting behavior encouraging companies to innovate in order to compete in international markets. On the other hand, some policies can also be harmful to a certain innovation system: protecting the local industry with tariff barriers might deter firms' innovative spirit (NELSON, 2006, p. 446). Large internal markets or access to external ones represent an additional advantage to firms which aim at a large public (HILPERT, 1991, p. 21). Finally, intellectual property regulations will influence how companies behave. Whereas in some cases imitation might be helpful, in others the preservation of innovators' rights might be an additional incentive to higher spending in R&D (NELSON, 2006, p. 114).

Altenburg (2009, p. 43-44) argues that "neo-institutionalist perspectives are needed to better understand how [...] [market] institutions interact with national innovation systems and

how these should be shaped to enhance technological learning”. His list of required institutions includes, among others, competition policies and institutions as “financial sector governance, regulation of firm entry and exist, labor market regulation, and rules for corporate control’.

It was with a similar understanding that Sakoh (1984) described Japan’s economic developing throughout the last decades. According to his analysis, during the 1950s, 1960s and early 1970s, the Japanese government has managed to sustain a limited expenditure with low taxes and under small deficits. Once economic growth emerged, the government used its increased budget to reduce taxes every year. As a matter of comparison, in the early 1980s the tax revenue ratio over the GPD in France, West Germany, England, the USA and Japan was, respectively, 42%, 37%, 36%, 31% and 26%. These taxation levels and the positive fiscal results helped Japan to renounce from the international inflationary trend and achieve yearly deflation rates. Once a macroeconomic stability was sustained by the government, a higher propensity for business development was generated. In the 1960s, for example, nearly 75% of the amount of capital formation came from the private sector. The same happened in regards of research and development spending. Whereas in France, England, the USA and West Germany the government share of gross R&D expenditures was, respectively, 58%, 48%, 48% and 44% in the late 1970s, in Japan it equaled 28%. Public ownership of manufacturing companies was also limited. In the 1980s, while European nations operated major industries in sectors as automobiles, aircrafts, iron and steel, the Japanese government was directly involved only with cigarettes. In other sectors, where the government was active, monopolies didn’t exist. The transportation sector exemplifies it as public and private firms used to compete.

Going back to the initial statement on public policies and regimes to generate a good atmosphere to investments, the Japanese government didn’t fall into a passive laissez-faire behavior, but kept itself active in building solid institutions to permit a plural economic environment. Its activeness was seen on the monetary policy, which aimed at maintaining an artificially low and stable interest rate shortly after the II World War in order to stimulate private banks to serve as an ample source of credit for industrial initiatives. Furthermore, the government directed its low expenditure to the country’s infrastructure, investing in roads, harbors, airports and basic industries (as hydroelectric power). It has also established other programs to support private initiatives such as the Fiscal Investment and Loan Program. Still, only 15% to 10% of its funds were directed to the Export-Import Bank and to the Japan

Development Bank – main responsible for the linkage between the State and the private sector<sup>2</sup> (SAKOH, 1984).

Another gain from plurality is that the use of a specific innovation by a given sector may be extended to different ones. Once a given technology is used by different sectors (or at least known by them), it generates more productivity in different areas and might be improved by different agents. The original innovation, thus, results in more innovations (ROSENBERG, 2006, p. 190).

The literature on innovation presents an extensive debate on which companies are better fit to innovate. Freeman and Soete (2008, p. 351) argues that the successful firm will be the one which is able to monitor advancements and perceive opportunities first, that efficiently invests in R&D and whose management is able to link technical possibilities to market demands. In the 1970s, most of the innovations in the OECD area were introduced by firms with more than 5000 employees. The majority of the small firms didn't develop any specific R&D program. In the 1980s and 1990s, innovation kept concentrated in big firms, but the amount of R&D efforts in smaller ones has grown (FREEMAN; SOETE, 2008, p. 395-396). Furthermore, “dynamic complementarities often exist between large and small enterprises, particularly in the role of small and medium enterprises as suppliers and subcontractors to large firms in integrated production systems” (ASHEIM, 2004, p. 25). Whereas big firms are able to make bigger investments in R&D, small businesses are efficient in adapting techniques and renewing industries. In the mechanical industry, for example, low-cost methods might be developed by SMEs or individual inventors. The same would hardly happen in the chemistry industry due to the R&D high costs (FREEMAN; SOETE, 2008, p. 400).

Firms of different sizes are not the only agents in innovation systems. A Triple Helix composed by universities, industries and the government is proposed by Leydesdorff (2006, p. 48, 65):

Governance can be considered as the variable that instantiates and organizes systems in the geographical dimension of the model, while industry is the main carrier of economic production and exchange. Thirdly, academe can play a leading role in the organization of the knowledge production function. [...] The layers can be expected to feed back onto each other, thus changing

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<sup>2</sup> A solely market-driven regime is far from consensual among researchers of the fields of innovation and development. Mazzucato (2013), for example, argues that an entrepreneurial State was necessary for many innovations introduced by firms as the leading Apple Computer. A further discussion on the matter will be found on her book “The Entrepreneurial State: Debunking Public vs. Private Sector Myths”.

the institutional roles, the selection environments, and potentially the evolutionary functions of the various stakeholders in each subsequent round.

A similar approach is presented by Nelson (2006, p. 430-431). He refers to national innovation systems as a broad concept. Word by word, innovation is regarded as the use of new processes or products by firms even if these are not new in the global, or national, scenario. Systems are the spontaneous interactions of diverse players, including firms, universities, laboratories, researchers and governments. Finally, national is understood as a broad term, including (even if paradoxically) transnational firms and initiatives.

Lundvall *et al.* (2009, p. 2-3) also discuss the differences between a narrow and a broad concept of national innovation systems. While a narrow analysis would take into consideration only science systems and technology policies, a broader approach focus on aspects such as “social institutions, macroeconomic regulation, financial systems, education and communication infrastructures, and market conditions as far as these have impact on the learning and competence-building process”. In this sense, although it is fairly common to find research containing data on R&D efforts and patents, these measures are not the only ones to be considered when analyzing a certain innovation system. Approaches such as the Triple Helix (as previously noted), a better understanding of the educational dynamic or the willingness of firms to cooperate with scientific institutions are also media of research (LUNDVALL *et al.*, 2009, p. 10-12).

Asheim (2004, p. 21) adds up affirming that

[...] the systems approach to innovation is based on the interactive innovation model, which implies that innovation is viewed as a complex, interactive, non-linear learning process inside firms and between firms and their environments. [...] This view involves a critique of the linear, sequential model of innovation, which focuses exclusively on more radical, technological innovations. The interactivity of innovation process refers to the internal collaboration between different departments of a company as well as to external co-operation with other firms (especially with customers and suppliers), knowledge providers, finance, training and public administration. Co-operation between local actors may in particular improve knowledge creation, informational exchange and learning which lead to innovation.

Making use of a narrow concept to national innovation systems is not ideal when analyzing countries in the South. Basic needs such as well-developed infrastructures and intellectual property are non-existent. Local knowledge is often substituted by international standards and desires. The uneven distribution of constitutive and instrumental freedoms deteriorates their situation even more. It is thus necessary to direct the scientific approach not to understand the functioning of the South's high-tech and science-based innovations but to

the building of their national innovation systems. It includes economic growth and, potentially, social disparities. The use of innovations requires knowledge that is not available to everyone. It means increasing the polarization between the ones who have their productivity increased and the ones who lose their jobs. That's where policy may make a difference. Granting a sustainable welfare system and stable macroeconomic and financial institutions – usually forgotten or relegated by governments from developing economies – make a difference in the process of innovating. Analyzing national innovation systems in developing countries requires a broader approach which includes not only science and technology, but basic economic institutions. (LUNDVALL *et al.*, 2002, p. 225-227)

Hereafter, national innovation systems will be understood as the Triple Helix's evolutionary relationship between the government, firms and universities of a given country – including not only specific policies and partnerships but also general economic aspects as in the example of Japan's catch-up process. As a methodological tool, focusing on the interaction of these three agents will allow a more concrete comparative analysis of steps that may have retarded or accelerated innovation and economic growth in certain economies.

There are different ways of understanding the role of each of these three players in a national innovation system. Firms are seen by Nelson (2006, p. 442) as the most relevant agent in the innovation process. He affirms that the level of investments in R&D will depend on the incentives to innovate in a given sector. A very competitive sector will demand companies to constantly research on new products and methods. Less competitive sectors and stagnant economies won't encourage aggressive entrepreneurial initiatives.

Different strategies are used by firms when trying to innovate. Industrial R&D through internal laboratories is helpful to provide a stronger link between the specificities of a firm and its market. In other words, new technologies will be introduced according not only to the sector's needs but the company's needs (NELSON, 2006, p. 106). Learning by doing may complement or substitute R&D efforts. The constant use of imported technologies, for example, allows a given firm to improve its usage and better adapt to its reality (NELSON, 2006, p. 62-63; ROSENBERG, 2006, p. 186-187). Multinational companies are able to use both methods. Whereas most of their investments in R&D are done in their origin country, international branches are responsible for adapting methods and products in order to fit their new markets (FREEMAN; SOETE, 2008, p. 528-529).

The case of China illustrates how the government's influence over the Triple Helix may promote firms' growth and constant innovation. According to Liu (2009, p. 119-120)

[...] there are several key factors which have led to [...] a powerful government in China. Firstly, thousands of years of Chinese history and culture have created a government that is very influential in many aspects of Chinese people's lives. Secondly, China was formerly a socialist country with a powerful system in place controlling the economy. This regulation system has changed, with several decades of market-oriented reforms; however, the basic power structure has not changed that much, thus remaining a government-controlled economy. Thirdly, China is still a developing country. During the early stages of catching-up, the country's business system was relatively weak. The government therefore mobilized its limited resources, focusing on key industries and the development of a system of public research institutes and state-owned enterprises that have become the core of the system of innovation.

Since the end of the II World War, the Chinese government has adopted different measures to promote growth and innovation. From 1949 to the 1980s, most of its innovation efforts were directed to assimilate foreign technology coming from the former Soviet Union, Germany and Japan, among other countries. It was done through an intensive investment in State-owned industrial research institutes. Incremental innovations were stimulated in order to replace new imports. As part of these efforts the government launched in 1956 its National Science and Technology Long-Term Plan aimed at boosting R&D investments in atomic energy, electronics, semi-conductors, automation, computer technology and rocket technology. Specific projects resulted in innovations such as the development of atomic (1964) and hydrogen bombs (1967), and the launching of satellites (1970) (LIU, 2009, p. 121-122).

Although many advances were achieved, the State's overwhelming intervention was also a burden for some sectors in China. Due to the socialist ideology, enterprises' incentives for innovating were limited. Efficiency and profit were secondary; employment stability and social equality were primary. Reverse engineering and incremental innovations did happen, but radical changes were rare. When compared to Korea, which initiated its growth strategy almost in the same period, China still lagged behind even decades later (LIU, 2009, p. 124).

Since the 1980s this scenario started to change. Research institutes and universities gained more autonomy to invest in science and technology. Multinational corporations and private firms started existing and engaging in independent R&D initiatives. Liu (2009, p. 123) argues that "this wave of privatization and competition has given enterprises strong incentives to invest in product development and innovation".

Foreign Direct Investment has been playing a strong role in China's recent growth. Especially since 1998, the number of multinational firms in China has steadily increased. Still, in most sectors their share of expenditure in R&D is relatively low. Until the 1980s,

government research institutes were the main agencies realizing the national science and technology goals. Since 2000, enterprises surpassed the total expenditure in R&D in China. Nonetheless, universities and research institutes are still key players in the sector. Their manner of interacting with the government has been changing though. Since the 1980s, several reforms made the government funding system more flexible, diversifying the sources of funding; strengthening incentives for innovations with economic returns; and encouraging spin-offs in the high-tech industry. As an example, in 2004 the amount of entrepreneurial sponsorship in universities was about 31,3 percent of their total research funds (LIU, 2009, p. 125-136).

Although the relationship between universities and firms has approximated their research orientation, there are still some key differences. It is possible to divide innovation into two main fields: science and technology. Science regards understanding a given phenomenon. Technology is a set of practices. Industrial R&D departments are usually related to technological innovations while universities are more dedicated to scientific research (NELSON, 2006, p, 97). Freeman and Soete (2008, p. 347) tried to summarize the debate on the relationship between science and technology dividing it into two approaches: science-push and demand-pull. While scientists usually prefer a science-push approach where technology comes from innovations in science, economists tend to prefer a demand-pull approach affirming that inventions are led by a specific needs. According to Rosenberg (2006, p. 224-231), once technological progress is achieved by trial and error processes, science is led to the path of explaining these phenomena and, thus, allowing further developments. High technology sectors such as spaceflight and long distance telephony exemplify it.

Universities are able to contribute in several ways to a national innovation system. High-quality educational institutions generate skilled labor to firms and their R&D departments. Research in universities produces academic papers and a deeper understanding of science that may be used to improve certain technologies. Furthermore, scientists and academic engineers have been providing consultancy services to several companies. The Massachusetts Institute of Technology is an example of academic institution with strong ties with firms (NELSON, 2006, p. 77, 124-125).

On the other side, there are many ways on how the government can interact with firms and universities. In most countries, education is provided or at least regulated by the State. Other initiatives, such as the Science and Technology Policy Council in Finland, direct a stronger effort to the structural interactions of the Triple Helix (ASHEIM, 2004, p. 22). An

alternative initiative was held by the American government through the National Science Foundation. It is the main source of State funding for academic research in the United States. The key difference between the American and the Finnish models lies on the decentralization of the research in the United States. Besides its science foundation, other federal institutions such as the National Institutes of Health, the Defense Department, the Atomic Energy Commission and the Energy Department are important funders of science and technology in this country (NELSON, 2006, p. 130).

The importance of universities in emerging economies has been growing. In Latin America, the tertiary gross enrollment ratio has jumped from 6 per cent in 1970 to 31 per cent in 2006. It was still far below the North American and Western European ratio of 70 per cent, but since 2004 has surpassed the world average (27 per cent in 2006). When analyzing the role of universities in research and development, it is noticed that whereas the gross expenditure is still below the average when compared to richer countries (e.g., the gross expenditure as a percentage of GDP in 2005 equaled 3,86% in Sweden, 2,45% in Denmark, 2,51% in Germany and only 0,92% in Brazil), the share of gross expenditure in R&D held by universities is higher in emerging countries (e.g., 20,5% in Sweden, 26,3% in Denmark and 39,0% in Brazil). It may evidence either a catch-up effort in making use of formal education to generate manpower, and science and technology, or the lack of investments in research and development from firms' and independent labs (BRUNDENIUS *et al.*, 2009).

Data shows that the second option may be true. An innovative behavior was found in 32% of the Brazilian firms and 28% of the Mexican firms. In Sweden and Denmark these ratios are, respectively, 52% and 47%. Argentina presents itself as a positive outlier in Latin America with a ratio of 42,6%. One of the causes of that average behavior is the low level of the manpower's education. In the European Union, 49,0% of the researchers are working in business firms. In the USA, this ratio goes to 80,5%. In Mexico, Brazil and Argentina it is, respectively, 28,8%, 26,3% and 12,5% (BRUNDENIUS *et al.*, 2009). Reinforcing the importance of a well-functioning Triple Helix, Brundenius *et al.* (2009, p. 325) suggest that "the role of higher education needs to be assessed in the wider context of the national innovation system and [...] higher education policy needs to be coordinated with a wider set of innovation policies."



### 3 METHODOLOGY

Solow (1956, 1957) discussed the convergence process where developing nations increase their productivity ratio in order to catch up rich economies. It takes place by augmenting stocks of capital and technology. During this process, the developing country benefits from the foreign availability of modern techniques and capital migration. Once the catch up process is completed, the new industrialized country will either have to start generating its own technology or stagnate.

Schumpeterian and post-Schumpeterian researchers affirm that technical change does not restrict its effects to productivity gains. Once new products and methods are inserted in a market economy, the innovator (or entrepreneur) obtains higher profits until other firms manage to imitate it or to launch other innovations capable of substituting the original technology. Countries with a greater potential for innovating tend to generate and attract more wealth and, thus, are led through a path of economic development.

Two problems may arise during this process. The first one regards the achievement of the same productivity ratio of rich economies. Recent history has been scarce in providing examples of countries that managed to catch up. The second problem lies on the fact that a well-structured scenario that encourages innovation demands a continuous effort from government, firms and universities in the long term. It is essential that the catching up country dedicates all of its resources to create a favorable atmosphere for competition and R&D gains.

That is why it is important to understand the evolutionary process where national innovation systems are developed. Comparative studies allow a better understanding of which practices resulted in greater gains or losses. This research proposes an analysis over the recent history of the three biggest economies of Latin America: Argentina, Brazil and Mexico. *It aims at finding out the role of institutions in the process of innovation and industrialization in the before mentioned countries in the second half of the XX century and the early years of the XXI century.* Secondly, it also points out to the evolution of public bodies dedicated to stimulating research and development, and identifying key differences among the economic regimes adopted by these three countries in this period. Furthermore, it offers a contribution to the understanding of technical change in emerging economies.

Considering the importance of the post-II World War events such as the import-substitution process, 1950 is set as the starting year for the analysis. Due to consolidated data

availability, 2010 is set as its ending year. It is possible to identify three main periods during these six decades: the import-substitution era, as previously stated, in the 1950s and 1960s; the oil crisis in the 1970s and 1980s; and the post-Washington Consensus era in the 1990s and 2000s. The comparative analysis will be made based on these three periods.

Calculating the total factors productivity will be helpful to compare economic trends and the accumulation of technical changes during these periods. Formulas 2.1.1, 2.1.2 and 2.1.3 will be used as the main parameters. Capital stock, the output (GDP) and the shares of labor and capital in the output will be taken from the Penn World Table (HESTON *et al*, 2012). The measure of labor will be calculated by multiplying the number of engaged workers by the average amount of working hours in a given year. Both data will also be taken from Heston *et al* (2012).

A deeper review on the available literature and the economic history of each country will be the main parameters to understand how these countries' innovation systems evolved across time – influencing the calculated productivity ratio and variations on the Solow's residual. As previously stated, the Triple Helix composed by the relationship between government, firms and universities will be the central tool for analyzing the innovation environment.

## 4 INNOVATION AND GROWTH IN LATIN AMERICA

### 4.1 PRE-1950 INDUSTRIALIZATION

Neo-institutionalists treat institutions as the rules of the game, or the constraints that shape human society. The concept is quite broad but it is directly related to (and summarized by) politics – named after the constant conflict whereby winners are able to forge new institutions. Obviously, in practice it is not so simple to change them. In the nineteenth century most Latin American countries tried to adopt a constitution similar to the one from the United States. Although these governments were clearly motivated to import the American institutions, societal and economic backgrounds were very distinct. These efforts were unsuccessful and led to different paths (NORTH, 1990, p. 101; ACEMOGLU; ROBINSON, 2013, p. 79-83).

Among the reasons why this attempt failed lied the lack of capabilities to enforce the new legislation in Latin America. Political institutions were very different. In the United States, the colonial process led to inclusive institutions with well-distributed power. In Latin America, the *conquistadors'* origins led to extractive institutions where political power was chained to economic elites. It helps to explain two phenomena of Argentina, Brazil and Mexico: their slow industrialization process and the simultaneous embracement of *laissez faire* and protectionism by their governments (ACEMOGLU; ROBINSON, 2013, p. 79-83; HABER, 2008, p. 539).

Latin America's early industrialization took place in the mid-nineteenth century but rapidly accelerated in the 1890s. In this period, silver – the standard currency used by most Latin American countries – devaluated, reducing the region's purchase power. Furthermore, in the same period international costs of transportation were drastically reduced with the insertion of steel-hulled steamships in the market. These were incentives strong enough to generate a nascent industry of consumer nondurable goods such as beer, cigarettes, soap, matches, hats, paper, footwear and cotton cloth at least in the most developed countries of the region: Argentina, Brazil, Chile and Mexico. Once the exchange rate was very favorable for exporting, the primary goods' sector became even more profitable and started receiving investments from industrialized economies to develop not only their production but also the

local infrastructure, such as railroads linking production sites to ports. The protective exchange rate, the expanding transport networks and the export-led economic growth created the initial preconditions for a nascent industrialist culture in Latin America<sup>3</sup>. Once it became strong enough, the new sector started gaining political power. As soon as they could, industrialists initiated a lobbying effort to create tariffs over rival imported goods and to eliminate tariffs over capital and intermediary goods needed by their industries. The sector became increasingly stronger. In Brazil, for example, tariffs over textile imports increased from 22,4% in 1895 to 49,7% in 1906. Once the State increased its role in the development (and protection) of the nascent industry, industrialists who had closer relations to politicians were able to find even better opportunities – such as specific tariffs or even funding for expansions. It led to high levels of power and economic concentration (HARBER, 2008, p. 539-541, 550, 553; CLEMENS; WILLIAMSON, 2002; COATSWORTH; WILLIAMSON, 2002).

During the World War I the inflow of rival goods to Latin America was reduced as the industrialized economies had to focus most of their resources in the conflict. Although it could benefit the region's nascent industry, it also represented some harm as foreign investments and the import of capital and intermediary goods were also drastically reduced. It caused an initial slowdown in Latin America's industrial development. Once the domestic production of capital goods was minimal, this slowdown meant stagnation for several sectors in the 1910s. In the 1920s, after the end of the war, the industrial growth was retaken and diversified. Several local repair shops started producing machinery. Other machinery manufacturers such as General Electric, RCA, IBM, Ericsson, Philips and Standard Electric established subsidiaries in Latin America. It is true that this phenomenon didn't substitute the import of capital goods. On the contrary, this kind of international commerce even grew. But it evidenced the intensification of the region's industrialization process (HABER, 2008, p. 553-562)<sup>4</sup>.

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<sup>3</sup> Williamson (2011) argued that the transportation revolution didn't play a strong role in the changes occurred in Latin America as sea freight prices weren't drastically reduced as it happened in other regions. Still, the fact that it facilitated exporting primary goods, importing capital goods and widening internal markets (through railroads, for example) makes this event an important variable when analyzing the period.

<sup>4</sup> The argument that the availability of capital goods in Latin America in the late XIX and early XIX centuries was entirely dependent on foreign players is not consensual. Lago *et al* (1979) argues that in the late XVI century it was possible to find locally produced furnaces and tools in São Paulo. In 1810 the Portuguese crown funded in the same state a large-scale iron industry named Fábrica Real de Ferro Ipanema. Private endeavors became more common in the second half of this century as local entrepreneurs, usually importers, started using their acquired know-how to locally produce what they used to import. To some extent, these private endeavors might be compared to the reverse engineering efforts of the Prussian authorities.

The relationship between industrialists and the government led to an increasingly protectionist regime. Besides tariffs, multiple exchange rate systems, quantitative restriction to imports, state-owned development banks and enterprises created an “inward-looking, technologically backward, and inefficient” industrial development (HABER, 2008, p. 562). Once the Great Depression impacted the United States and the world economy, Latin American exports were dramatically contracted. In Mexico, for example, the export earnings of 1932 were only one third of 1928. As exports of primary goods were the main source of international currencies, it caused a shock in the manufacturing sector. The direct response of most governments was the abandonment of the gold standard and the establishment of a system of freely floating exchange rates. It led to a process of currency devaluation in most Latin American countries during the 1930s and, thus, an increase in their competitiveness in the global market (while protecting local manufacturers). In Brazil, the manufacturing sector grew 82% from 1928 to 1939. In Mexico, it doubled from 1925 to 1939. This new scenario led to an accelerated industrialization process: in 1939, 16,5% of the Latin American GDP was accounted by the manufacturing sector (HABER, 2008, p. 562-570).

During the World War II the world economy was hit again. Latin American exports were dramatically reduced and the availability of international currencies for importing capital and intermediary goods drastically shrank. Differently than before, the local capacity for manufacturing these goods had increased and could supply, at least partially, the domestic demand. Once it meant a possibility of consolidation for local industries without an aggressive international competition, it was also another event to make Latin American industrialists more accustomed to protectionism (HABER, 2008, p. 570-572).

The relationship between economic events and entrepreneurial endeavors is enormous. Some researchers as Marson (2014) directed their studies to map these relations. It is the case of two Italian-Brazilian entrepreneurs named Mário Dedini (1893-1970) and Américo Emílio Romi (1895-1959). The first was born in Italy and migrated to Brazil when he was 17 years old. The second was born in Brazil, moved to Italy as a kid and went back to his country at the age of 28. Both of them gained technical skills in mechanics in Northern Italy and became well-paid professionals in São Paulo, Brazil. Both of them became entrepreneurs in the 1920s: Mário Dedini started his carpentry and blacksmithing workshop in 1920; Américo Romi founded a car workshop in 1929 (MARSON, 2014).

It is important to notice that the technical skills acquired in Northern Italy were not the only knowledge used to start these businesses. Both of the firms were directly related to

Mário's and Américo's professional experience in Brazil. Their businesses were totally immersed in the local reality. That's why Dedini's firm managed to grow and, by the end of the decade, became a small industry dedicated to repairing and creating machinery and tools to sugar mills – one of the most relevant economic sectors in São Paulo at that period (MARSON, 2014).

Nine years later, Romi created his company and, foreseeing the economic crisis, imported a great amount of vehicle parts becoming the biggest car workshop in the same state. In 1934, Romi expanded his business to operate with farm machinery – a similar market to the one selected by Dedini. In 1937 his company had 75 employees in comparison to 2 when it was founded. In 1939 it was the biggest farm machinery manufacturer in the country – an exporter comparable to firms in the United States and Europe (MARSON, 2014).

Dedini also benefited from the 1930s' growth. Since the Great Depression and the coffee crisis, farmers have diversified their production benefiting the sugarcane sector. Dedini's prices were already better than the ones from imported goods due to the currency devaluation. Once the government decided to stimulate the sector through the *Instituto do Açúcar e do Alcool* (IAA), his business took off. In the 1940s their expansion continued. The imports interruption resulted from the World War II motivated Dedini to diversify his portfolio to sugar and alcohol (derived from sugarcane) mills while Romi boosted his investments in heavier machinery such as lathes (MARSON, 2014).

In 1946, Romi used to export circa 40 lathes per month to Argentina. In the 1960s, Romi's firm was the second biggest producer of lathes in the world, exporting its products to Europe, Japan and the United States. The same growth happened with Dedini's businesses as he also benefited from the IAA. His diversification transformed his firm into a heavy producer of machinery and general equipment to distilleries and sugar mills. After merging with another company and adding partners to his business, by the end of the 1940s his industry was capable of producing whole sugar mills and supplying all the machinery and equipments demanded by this Brazilian sector (MARSON, 2014).

It is undeniable that the leading Latin America economies were able to advance during the unstable years of the late XIX and early XX centuries. Two World Wars and a large-scale depression created several difficulties to industrialized countries and, although it represented some temporary losses to the emerging world, it also brought new opportunities. On the other hand, this nascent industrialization process was guided by devaluated exchange rates and protective tariffs that would hold off local entrepreneurs from foreign competitor. Whereas it

allowed the creation of industries in several sectors (including capital goods), most of them lacked quality and prices, functioning at low levels of productivity with a highly dependence on government policies. It means that there is no evidence that the early industrialization brought any change to the already extractive institutions of Latin America. On the contrary, it is possible that they have perpetuated it by creating a new political and economic elite.

#### 4.2 POST-II WORLD WAR

Protectionism was not created in Latin America. It was a common mechanism of catch-up for less developed countries. In the middle and second half of the nineteenth century there was a wave of import-substitution policies in Europe and the United States<sup>5</sup>. The role of government during this period was mainly to create a favorable environment to permit the development of the nascent industry without the prohibitive competition coming from already developed countries. Once the United States and Western Europe managed to catch-up the United Kingdom, import-substitution policies ceased being their main source of economic growth. In the nineteenth century rural elites were still playing a strong role in Latin America. It means that economic change through industrialization existed but was not the main interest of the government. In the first half of the twentieth century this reality changed. Local entrepreneurs and migrants managed to become more influential and national leaders such as Juan Domingo Perón (Argentina), Getúlio Vargas (Brazil) and Lázaro Cárdenas (Mexico) governed aiming at the developing industrial sector (BAER, 1972; HABER, 2008).

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<sup>5</sup> Chang (2002) discussed the topic at a deeper length. At his book, "Kicking away the ladder: development strategy in historical perspective", he presents data, for example, on tariffs and economic intervention in the industrialization process of the North.

Table 1- Percentage distribution of Gross Domestic Product according to principal sectors in selected Latin American countries.

<b>Argentina</b>			
	<b>1927-1929</b>	<b>1950</b>	<b>1963-1965</b>
<b>Agriculture</b>	27,4	19	17,1
<b>Industry</b>	23,6	29	33,7
<b>Brazil</b>			
	<b>1939</b>	<b>1950</b>	<b>1968</b>
<b>Agriculture</b>	25,8	31	17,9
<b>Industry</b>	19,4	17	28,0
<b>Mexico</b>			
	<b>1930</b>	<b>1950</b>	<b>1960</b>
<b>Agriculture</b>	25,9	21	18,9
<b>Industry</b>	16,7	18	27,7

Source: Adapted from BAER (1972, p. 99) and GRUNWALD (1970, p. 834).

In the postwar, most of the Latin American governments kept increasing their protectionist efforts. Import controls, multiple exchange rates and constant devaluations were widely adopted by major economies such as Argentina, Brazil and Mexico. In this sense, exports played an important role in these countries as they were used to supply the demand for international currencies, necessary for the import of capital goods. That's why Latin American governments did their best to create new opportunities for commodity exporters: whereas in 1951 the United States were responsible for buying 47% of the Latin American goods, in the early 1960s this share has shrank to 35%, while Europe and intra-regional imports accounted for, respectively, 38% and 15% (ABREU, 2008).

This diversification was not part of a systematic protectionist effort held by the government in order to boost economic growth. On the contrary, it was an *ad hoc* measure responding to a series of exogenous factors such as the need to defend its elites and the harsh competition for foreign investments. In regards of international loans, the amount received by Latin America by the World Bank in the 1960s was of 21,5% of the bank's total, a lower share than the capital inflows prior to 1929 (ABREU, 2008; MACARIO, 1964).

It was during the 1950s and 1960s that the previously mentioned *ad hoc* measures started being transformed into purposeful policies to boost industrialization. The macroeconomic results were quite favorable. It is true that in many cases governments were demanded to answer to exogenous events such as the competition for foreign investments against a recovering Europe or the economic instability caused by the 1950-1953 Korean War but many initiatives were quite successful in regards of international relations and trade.



Mainly pushed by the United Nation's Economic Commission for Latin America and the Caribbean (ECLAC or, in Spanish, CEPAL), the stronger integration between Latin American economies exemplifies it (MACARIO, 1964).

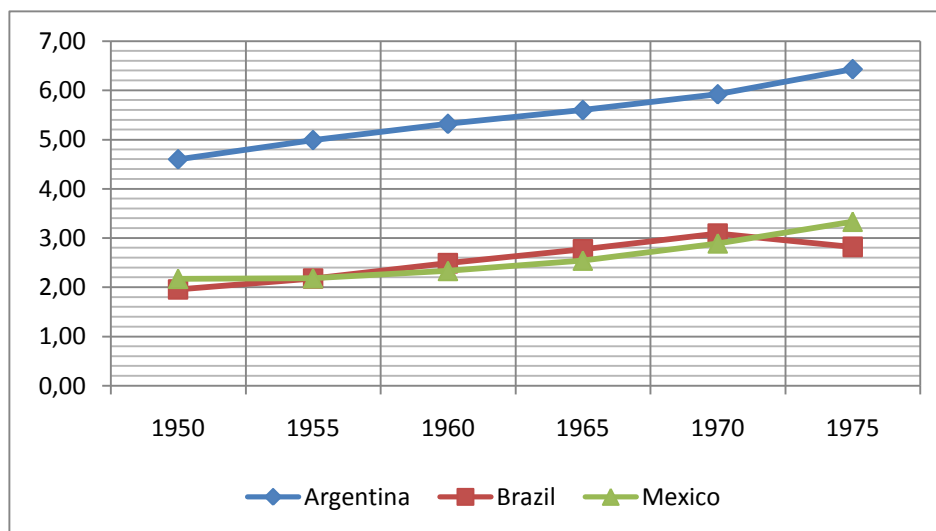
On the other hand, many problems derived from the import substitution model. Macario (1964) points out to the favoritism and corruption that played an important role in the definition of several policies in this period. Furtado (1965, p. 174) goes even further in the same topic by affirming that "there exist an inconsistency between the interests of those groups which control the process of capital formation and the interests of the community as a whole". Discussing negative consequences of this duality, Tavares (1964) criticizes the fact that this model was worsening Latin America's structural problem once the gap between the capitalist and subsistence sectors was getting even wider. Although it generated wealthy and macroeconomic gains, the import substitution industrialization was marked by extractive political and economic institutions.

In the 1960s and 1970s the Latin American integration was boosted by regional trade agreements such as the Latin American Free Trade Association, the Central American Common Market, the Andean Common Market and the Caribbean Free Trade Area. Although the growth of 10 to 20 percent in the share of intra-trade was credited to these initiatives, most of them were buried by the 1980s (ABREU, 2008).

During these years, inward-looking governments adopted new strategies such as the pick-the-winner mechanism of subsidies. Both domestic companies and multinational subsidiaries were selected and helped according to their potential for substituting imports or expanding exports – including a great share of manufactured goods which jumped from 9 percent in 1960 to 21 percent in 1973. This data and the numbers presented on Table 1 evidence the successfulness of these policies. Although some manufacturers such as the Italian-Brazilian Dedini and Romi were extremely competitive, criticism lies on the fact that a considerable portion of the Latin American industry lacked quality due to the absence of international competition (ABREU, 2008; MACARIO, 1964; MARSON, 2014).

#### 4.2.1 Argentina

Argentina was definitely the country where the most educated people of Latin America used to live. In 1950, an average Argentine citizen have studied for 4,6 years. At the same time, Mexico's average years was 2,17 and Brazil's 1,96. Although smaller, this difference remained considerably big in 1975. Whereas Argentina's average equaled 6,43 years, Mexico's and Brazil's were, respectively, 3,33 and 2,82 years. Oddly, Argentina didn't manage to advance as much the others. Its growth was of 39,78% when compared to 43,87% and 53,45% in Brazil and Mexico even though Argentines used to be in school at least the double of years of average Brazilians (BARRO; LEE, 2012). Graphic 1 evidences these disparities.



Graphic 1- Educational attainment measured by average years of total schooling in Argentina, Brazil and Mexico, 1950-1975.

Source: Calculated with data from Barro and Lee (2010).

In order to understand why education was so strong in Argentina, it is necessary to go back in history to 1847 when Domingo Faustino Sarmiento, the country's president between 1868 and 1874, visited the United States and got to know more about their inclusive educational system. At this period, the American system was extremely decentralized and efficient as the local populations were responsible for supervising and electing boards of education in every district. When elected president 1868, Sarmiento tried to develop a similar model. He opened more than 800 schools increasing the number of students in Argentina from 30.000 to 110.000. Through hiring foreigner teachers from the United States and

Europe, and making massive investments in the sector, Sarmiento created an educational system capable of boosting the amount of basic (as writing and reading) and technical (as agriculture and industrial) knowledge in the whole country (PUIGGRÓS, 2006).

During the twentieth century, the Argentinean education kept advancing. In 1955, 2,7 million people were enrolled in educational institutions in the country. The system was quite advanced and inclusive. Most of the middle class children and a considerable amount of workers' kids managed to achieve secondary schooling. In 1955, 467.199 students were enrolled in this kind of education, where a portion of 37,64% studied technical courses (TORRE; PASTORIZA, 2002).

It was due to its large investments in education that Argentina managed to be the hometown of renowned scholars as the 1947 Nobel laureate Bernardo Alberto Houssay. It is true that his witty was great enough to allow the admission at the Pharmacy School of the Universidad de Buenos Aires when he was only 14 years old and then at the Medical School when he was 17. Still, it was not a coincidence that his scientific prominence took place exactly in this country. The difference in the average years of education between Argentina, Brazil and Mexico evidences why the first Nobel Prize of Latin America was born and educated there. Further than that, Bernardo Alberto achieved his prize in a golden period for the Argentinean economy. Between 1935 and 1950 the country's manufacturing share increased around 15 percent, a greater level than developed countries as the Netherlands and Sweden. A comparison of the composition of the domestic product (*Table 1*) evidences that Argentina managed to be the most industrialized country from Latin America in the first half of the twentieth century (GRUNWALD, 1970).

Dr. Houssay became an important figure of the Argentinean educational evolution also because he was the first director of the *Consejo Nacional de Investigaciones Científicas y Técnicas* (CONICET), created in 1958 to coordinate and foster scientific research in the country. In the same period, other initiatives evidenced the government's effort in this area: in 1950 the creation of *Comisión Nacional de Energía Atómica*; in 1954 the *Instituto de Investigaciones Científicas y Técnicas de las Fuerzas Armadas*; in 1956 the *Instituto Nacional de Tecnología Agropecuaria*; and in 1957 the *Instituto Nacional de Tecnología Industrial*. In the following years, all these efforts were rewarded by achievements such as the Nobel prizes in Chemistry to Luis Federico Leloir (1970) and, once again, Medicine to César Milstein (1984).

It is at least curious that all these efforts in education were not enough to place Argentina's technical change in a privileged position in comparison to Brazil and Mexico. As seen on the calculated data (Appendix), the variations in the levels of total factor productivity were usually lower in Argentina in the two decades after the II World War. Considering the yearly average, Argentina's, Brazil's and Mexico's TFP grew, respectively, -0,391%, 3,604% and 3,827% in the 1950s and 1,956%, 3,480% and 2,804% in the 1960s. It suggests that, in this period, education was not the main factor which influenced technical change in the region.

As discussed in chapter 2, the Triple Helix approach suggests that innovation comes from the interaction of three agents: government, firms and universities. As far as it has been showed, universities – represented by the educational system – were quite advanced in Argentina after the II World War. The government, on one side, was quite supportive as it had been investing in the sector for several decades. On the other side, the government lacked the stability achieved by Japan in the second half of the twentieth century. While the Japanese government promoted macroeconomic stability through low taxes and reduced expenditures, Argentina's political institutions were a powder keg. Elected in 1946 and re-elected in 1951, Juan Domingo Perón suffered a major assassination attempt in June, 1955. The event, planned and executed by the armed forces, resulted in the killing of more than 300 civilians. In September the army managed to oust him. Arturo Frondizi was vested president in 1958 and ousted, once again by the army, in 1962. In 1963 Arturo Umberto Illia was elected president. In 1966 a new military coup unseated him. From 1966 to 1973, General Juan Carlos Organía exerted the *de facto* presidency until *Peronismo* was legalized and its leaders managed to achieve the power once again (GERCHUNOFF; LLACH, 2004; ROMERO, 2002).

With such an extreme political scenario, transaction costs were extremely high and the economy too unstable to attract foreign investments and stimulate local entrepreneurs to develop their businesses. It is true that industrialization succeeded as firms producing intermediate (such as chemicals and petrochemicals) and durable consumer goods (such as cars) became major players in the import-substitution era. Nevertheless, the government's political instability didn't let the most educated Latin American country advance as much as it could have (VESSURI, 1990).

Once it played a key role in Argentina's economy, it is important to clarify which concept of political instability is being used in this work. Grindle (2004) discussed the problem of bad governance for countries trying to overcome underdevelopment. Weak

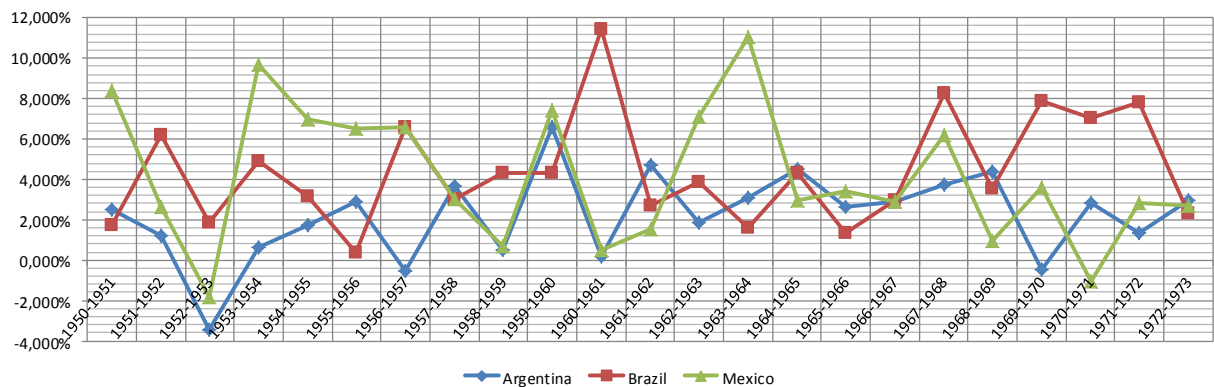
institutions, badly managed public organizations, untrained and unmotivated civil servants, illegitimate governments, leadership undermined by political discord, and deeply divided and ill equipped civil societies are some of the terms used to define these regimes. The common point of most of them is that good policies and intentions are not effective when the government is not fully able to implement them. In this sense, political instability will be used as a concept for the periods when the central government is not able to implement or manage policies due to any problem caused by its lack of governance.

Table 2- Proportion of net increases of employment absorbed by economic sectors in Argentina, Brazil and Mexico, 1950-1960.

	Agriculture	Manufacturing	Construction	Services
<b>Argentina</b>	n.a.	5	4	71
<b>Brazil</b>	25	8	14	38
<b>Mexico</b>	35	17	7	29

Source: GRUNWALD (1970).

Two decades earlier Grunwald (1970) contributed to the analysis of Argentina’s failure adding up a few arguments to the ones lately presented by Vessuri (1990). According to Grunwald’s (1970) analysis, illustrated by Table 2, while a great increase was seen in most of the Brazilian and Mexican sectors in the 1950s, the only segment of Argentina’s economy that presented a satisfactory growth in employment rates was the one of services– which had extremely low gains in productivity *per capita*: whereas the product per worker in the manufacturing sector jumped from US\$2.009 in 1950 to US\$2.795 in 1960, it went from US\$1.306 to US\$1.321 in the services segment (1960 Dollars).



Graphic 2 - Labor productivity’s variation in Argentina, Brazil and Mexico, 1950-1973  
 Source: Calculated with data from Heston *et al* (2012).

Using Heston *et al* (2012) data to calculate the variations in the labor productivity in the 1950s and 1960s it becomes evident how much political instability and the diminished

growth in employment in the manufacturing sector harmed Argentina's economy especially in the 1950s. Aggregating the data presented on Graphic 2 per decade and calculating the average yearly growth, the results for Argentina, Brazil and Mexico in the 1950s are, respectively, 1,019 percent, 3,571 percent and 4,740%. In the 1960s, Argentina managed to catch up – or at least get close – to Brazil and Mexico: 3,455 percent, 4,434 percent and 4,407 percent.

#### 4.2.2 Brazil

Since the 1940s, the Brazilian government adopted a very active attitude towards its industrial development. Its main idea was to create the needed structure to allow the flourishing of a diversified manufacturing sector. During his terms Getúlio Vargas, a populist president whose governments occurred in 1930-1945 and 1951-1954, created several companies, including three major State-owned firms to explore and process ferrous materials and oil: in 1942 the mining *Companhia Vale do Rio Doce* (CVRD); in 1941 the ferrous metallurgic *Companhia Siderúrgica Nacional* (CSN); and in 1953 an oil company named *Petrobras*.

It is true that these companies managed to succeed and played key roles in the country's development. Nowadays, all the three companies still exist as major players in their sectors: CVRD and CSN as private companies and *Petrobras* as a joint-stock company controlled by the government. Still, most of the others entrepreneurial initiatives of the Brazilian government failed to achieve a reasonable level of efficiency. It was the case of companies in sectors as transportation (especially railways and shipping), chemical products and post offices (ABREU, 2007).

Besides acting as an entrepreneur, the Brazilian government was also very supportive to national firms. It maintained protective exchange rates and created, in 1952, the *Banco Nacional de Desenvolvimento Econômico* (nowadays *Banco Nacional de Desenvolvimento Econômico e Social*) to sponsor the development of the local industry. At the same time, the government kept its support to the agriculture sector buying the production's surplus to keep the commodities at an elevated price (BUENO; FARO, 2004).

During his term as president, Juscelino Kubitschek (1956-1961) strengthened all the mechanisms of protection for the local industry and agriculture while kept developing alternatives to benefit the population. The purchasing power was maintained and, although several reforms were made, civil servants' jobs were preserved. Bueno and Faro (2004) affirm that whereas new bureaucracies were created in order to boost the State's efficiency, the old ones weren't extinguished. A "parallel administration" was used to implement the proposed policies (such as the planning and building of a new capital, Brasília) while keeping the old ones was a measure to avoid political disputes.

Table 3- Goals and achievements of the 1957-1961 administration in Brazil.

	<b>Goal</b>	<b>Achievement</b>	<b>%</b>
<b>Electricity (1.000 Kw)</b>	2.000	1.650	82
<b>Coal (1.000 tons)</b>	1.000	230	23
<b>Oil – production (1.000 barrels/day)</b>	96	75	76
<b>Oil – refining (1.000 barrels/day)</b>	200	52	26
<b>Railways (1.000 km)</b>	3	1	32
<b>Highways – building (1.000 km)</b>	13	17	138
<b>Highways – paving (1.000 km)</b>	5	-	-
<b>Steel (1.000 tons)</b>	1.100	650	60
<b>Cement (1.000 tons)</b>	1.400	870	62
<b>Cars and trucks (1.000 units)</b>	170	133	78
<b>Nationalization (cars) (%)</b>	90	75	-
<b>Nationalization (trucks) (%)</b>	95	74	-

Source: ORENSTEIN and SOCHACZEWSKI (1989, p. 180).

It is true that during this period all the investments and expenses of the government helped the economy to flourish. The advancements are quite clear as evidenced on Table 3. As an example, by 1961 75 percent of the car parts commercialized in the country were produced in Brazil. At the same year, Brazil's GDP grew 14,073%. As evidenced on Table 4, Brazil's average growth was greater than Mexico's and Argentina's. During the 1950s, Brazil managed to achieve an annual average growth of 6,879 percent while Argentina and Mexico achieved, respectively, 2,517 and 6,056 percent.

Table 4 also evidences another peculiarity of the Brazilian growth during the 1950s. By decomposing its GDP's variation through Solow's approach into changes in labor, capital stock and total factor productivity, it is possible to notice an equilibrated growth where all these three items ranged between 3,194 and 3,604 percent. The same doesn't happen in

Argentina, where a negative TFP was possibly caused by all the political instability that took place during the period. In Mexico, as it will be discussed at a later moment, TFP played an important role doubling the contributions attributed to variations in labor.

Table 4 - GDP's, labor's, capital stock's and TFP's variations calculated as annual averages between 1950 and 1959.

	$\Delta Y$	$\Delta L$	$\Delta K$	$\Delta TFP$
<b>Argentina</b>	2,517%	1,511%	4,354%	-0,391%
<b>Brazil</b>	6,879%	3,194%	3,374%	3,604%
<b>Mexico</b>	6,056%	1,257%	2,966%	3,827%

Source: Calculated with data from Heston *et al.* (2012).

The downside of all this evolution was on the country's fiscal balance. During Juscelino Kubitschek's years some attempts were initiated in order to avoid an inflationary boom. Once his political agenda was closely related to the interest of different groups, any cause of restrictive policy would damage his reputation. In this scenario, most of the trials to balance the government's finance were too small to cause any real effect. In the early 1960s, the incomes of the government were enough for only 50 percent of its expenses (ABREU, 2007; ORENSTEIN; SOCHACZEWSKI, 1989; BUENO; FARO, 2004).

In regards of education, Graphic 1 shows that the Brazilian situation was catastrophic. In 1950, only 13,9 percent of the population completed primary schooling. It meant that the average years of schooling in the country was 1,96 years. In the same year, 28 percent of the Argentinean population completed primary schooling and had an average of 4,60 years of schooling (BARRO; LEE, 2010).

Nonetheless, it doesn't mean that there were no government efforts in this regard. In 1792, for example, the local government created the first school of engineering of the Americas, the *Real Academia de Artilharia, Fortificação e Desenho* (nowadays, *Instituto Militar de Engenharia*). One of the spin-offs of this school was the *Instituto Tecnológico de Aeronáutica* (ITA), created in 1950 by the armed forces to educate aeronautic engineers. In 1969, ITA generated its own spin-off: Embraer, an aerospace conglomerate initiated by public and private funds which is now one of the world largest companies in this sector.

Aside other military initiatives, the Brazilian government directed different efforts at the establishment of educational institutions. In 1889, Dom Pedro II, the country's last emperor, announced a few months before the end of his reign a plan of creating two universities, one in the south and the other in the north, in order to generate two centers of



scientific and literary production. In practice, universities were only established in Brazil in the first decades of the twentieth century, when state governments funded the *Universidade de Manaus* (1909), the *Universidade de São Paulo* (1911) and the *Universidade do Paraná* (1912) (FÁVERO, 2006).

Sampaio (1991) suggests that most of research and development efforts were not done in universities until the 1930s. According to her study, most of the pioneering initiatives took place in State-funded institutes such as the *Instituto Agrônomo de Campinas* and the *Instituto Soroterápico de Manguinhos* (nowadays *Instituto Oswaldo Cruz*). Although several trials were initiated, only a few of them managed to survive and produce new technologies. It happened especially in sectors with high demand from either the government or the entrepreneurs, respectively health care and agriculture. During this period, as it happened with Mário Dedini and Américo Romi, a great portion of the skilled workers that served the local firms and started their own businesses was composed by migrants who were educated in their origin countries as Italy.

It is true that there existed different bodies dedicated to education and technology in the 1950s. Furthermore, some of them, as already mentioned, were created in this decade. Still, education, research and development were not key issues in the agenda of this period. Some debates used to take place especially after the creation of the *Centro Brasileiro de Pesquisas Educacionais*, a center for the development of education controlled by the *Instituto Nacional de Estudos Pedagógicos* – which is still active in the Ministry of Education nowadays (CUNHA, 2002; CUNHA, 2004). In this sense, innovation during the 1950s was basically brought through imports of machinery and foreign direct investments and furtherly adapted according to the knowledge of skilled workers or the needs of local markets.

In January 1961, a new president would inherit a country with an enormous annual growth and, at the same time, an inflationary trend and a big debt. Jânio Quadros, the new president, managed to be elected with the highest number of votes in the Brazilian history. Still, his stabilization plans and his ability to handle the different players of the economy weren't good enough to allow a term longer than 6 months. In August of the same year, Quadros resigned and initiated a political crisis that would last 1964 when the armed forces ousted João Goulart, Quadros' vice president. As Fonseca (2004) points out, besides all the political instability, the economic directives of Goulart were very unclear and, during his short administration, the Ministry of Economics was headed by five different ministers.

It is possible to notice that all this political instability had a clear effect in the economy. During Kubitschek's term (1956-1961), the country's GDP grew at an average yearly rate of 9,194 percent. From 1961 to 1964 this rate decreased to 5,261 percent. The total factor productivity's average variation decreased from 5,174 (1956-1961) to 2,049 percent (1961-1964) – less than a half of the previous period. As it happened in Argentina, this measure of technical change was drastically affected by political instability. It matches Miles and Scott's (2005) argument that institutions influence TFP. When the political and economic environment is not stable, economic agents don't feel safe enough to invest.

Marshal Castelo Branco became head of State in March, 1964, and launched a stabilization plan that aimed at ceasing the inflationary trend which had reached a rate close to 100 percent in the first semester of that year. His plan was quite wide and included promoting a better fiscal balance, investing in key areas, reforming the financial system and increasing the interaction with foreign players. By the end of his term, the real minimum wage was about 9 percent lower than in 1964; the ratio between the government's deficit and the GNP had fallen from 4,2 percent in 1964 to 1,1 percent in 1967; the foreign direct investments almost tripled from 1964 to 1965; imports were reduced to the lowest level since 1950 and the exports reached the highest index in the country's history; and, finally, inflation was reduced to an annual rate around 20 percent in 1969 (RESENDE, 1989).

It is true that in order to achieve this partial stability the government had to pass through an orthodox period of restrictive policies. It explains the positive variations of 3,964 percent in the GDP and 0,456 percent in the TFP between 1965 and 1966. Still, these reforms were part of the process that let Brazil recover its stability and credibility, and reach yearly growth rates above 10 percent in most years between 1967 and 1973 (RESENDE, 1989; LAGO, 1989).

During these seven years, two presidents were in charge of the government. Still, only one minister was held accountable for the economics during the whole period: Antonio Delfim Netto. His main proposal was similar to the one from the past government but different methods were chosen in order to do so. In order to achieve high levels of economic development and to control the inflation, the government expanded the supply of credit especially to consumers, to increase their purchase power and to generate the possibility of building and buying houses, and to the agriculture, to increase the volume of exports. Bureaucracy was drastically reduced, allowing the diversification of the economy and the inflow of foreign investments. A solid policy of subsidies to the industry was enacted and the

*Banco Nacional de Desenvolvimento Econômico* started lending a heavy amount of resources to the public sector (LAGO, 1989).

During this period (1967-1973), the economy grew at an average of 10,956 percent per year. Its capital stock had an average annual variation of 7,596 percent and the total factor productivity 5,022 percent. Those numbers are fairly similar to the ones achieved by Juscelino Kubitschek and only diverge in regards of capital stock, as Kubitschek's average was 5,174 percent per annum. It was mainly caused by the considerable growth of the investments in the industries of machinery and durable goods led by the inflow of technology through multinational corporations and the government's efforts that led to the creation of institutions for the promotion of Science & Technology such as the *Financiadora de Estudos e Projetos*, *Fundo Nacional de Desenvolvimento Científico e Tecnológico*, *Instituto Nacional de Propriedade Industrial*, *Instituto de Pesquisas Espaciais*, *Instituto Nacional de Metrologia, Normalização e Qualidade Industrial* and the *Empresa Brasileira de Pesquisa Agropecuária* (PACHECO; CORDER, 2009).

#### 4.2.3 Mexico

As in Argentina and Brazil, the Mexican industrialization process started in the nineteenth century and in the first half of the twentieth century was reasonably intense. In the thirty years between 1910 and 1940, Mexico City tripled its population, Monterrey more than doubled and Guadalajara doubled. It is true that by 1940 most of the people kept living in rural areas, but the urban population grew by 58 percent. Illiteracy decreased from 78 to 58 percent and the number of rural schoolteachers reached 20.000 (from practically nil in 1910) (MORENO-BRID; ROS, 2009).

Although poverty was being reduced, the economy wasn't able to grow at the same pace of the world economy. Some factors might explain the downfall of the Mexican growth, which was reasonably big during the regime of General Porfirio Díaz (1884-1911): the period of instability and violence that followed the Mexican Revolution, pro-cyclical fiscal and monetary policies from 1926 and 1932, and the external shocks derived from the Great Depression (MORENO-BRID; ROS, 2009).

It is interesting to notice that whereas Brazil and specially Argentina passed through intense periods of political instability after 1950 resulting in military dictatorships, the contrary happened in Mexico. A military autocracy existed between 1884 and 1911, when a revolution ousted the *Porfiriato* and the *Partido Revolucionario Institucional* (at that time, *Partido Revolucionario Nacional*) managed to win twelve consecutive presidential elections and remain in power until the year 2000.

A few years after the stabilization of the new regime, General Manuel Avila Camacho became president in 1940 defining industrialization and social equality as his main goals. Avila Camacho was surely benefiting from the opportunities brought by the II World War. Whereas most Latin American countries invested in import substitution policies due to the weakness of an external market during this period, the proximity with the United States – a leading industrialized country which had to direct a great amount of its resources to the war – opened a possibility of supplying manufactured goods even if at elevated prices. During this period the share of manufacturing exports rose from 7 to 40 percent in 1945, an amount higher than any level achieved in the 1950s, 1960s and 1970s. As the war was coming to an end and the industrial sector was becoming more important, a protectionist policy was started in 1944 through a system of direct import controls aimed at protecting domestic manufacturers from foreign competition (MORENO-BRID;ROS, 2009). Besides benefiting entrepreneurs, his government was also responsible for the expansion of workers' rights with the creation, for example, of the *Instituto Mexicano del Seguro Social*, dedicated to offer health care and social security to Mexican laborers.

From this period on, the process of import substitution industrialization was intensified. By the early 1960s, most nondurable consumer and light intermediate goods consumed in the country were already produced by domestic industry. In this decade, new policies directed the entrepreneurs to the production of durable consumer, heavy intermediate and capital goods. It included different protectionist policies which included a heavy scheme of license requirements for new imports which rose from 17,7 of the imported products in 1950 to 68,3 percent in 1970. On the other side, exports were heavily stimulated. In the 1950s and 1960s, agriculture was subsidized to produce food both for the local and foreign markets. The *Compañía Nacional de Subsistencias Populares* was created by the government in 1961 to acquire agricultural surplus from private farmers. In 1963, the government created the *Fondo para la Exportación de Productos Manufacturados* aimed at sponsoring manufacturing exporters making use of the revenues from import tariffs (MORENO-BRID; ROS, 2009).

The importance assigned by Mexican presidents to economic development is remarkable. As presented on Table 5, the share of public expenditure directed to economic issues rose from 38 percent in 1935-1940 to 55 percent in 1965-1970. Beside expenses related to licensing requirements and public sponsorship of exporting initiatives, the Mexican industrial policy also encompassed fiscal benefits. In 1941 selected manufacturing industries received 5-year tax exemptions. In 1946 the benefit was extended by the *Ley de Fomento de Industrias de Transformación*. In 1955 the legislation was reformed and expanded, requiring companies to establish maximum prices, quality control and worker training. In 1961 a new reform allowed the use of depreciation charges to renew of machinery and profit reinvestments (MORENO-BRID and ROS, 2009).

Table 5 - Composition of federal budgetary expenditure (percentages).

	<b>Economic</b>	<b>Social</b>	<b>Administrative</b>
<b>1935-1940 (Cárdenas)</b>	38	18	44
<b>1941-1946 (Avila Camacho)</b>	39	17	44
<b>1947-1952 (Alemán Valdes)</b>	52	13	35
<b>1953-1958 (Ruiz Cortines)</b>	53	14	33
<b>1959-1964 (López Mateos)</b>	39	19	42
<b>1965-1970 (Díaz Ordaz)</b>	55	32	13

Source: Adapted from MORENO-BRID and ROS (2009, p. 99).

Although the data for the last two presidents shown on Table 5 is quite divergent, both of them had one thing in common: Antonio Ortiz Mena, the secretary of finances (in Spanish, *Secretario de Hacienda y Crédito Público de México*). As it happened in Brazil with Antonio Delfim Netto, he is accounted for the golden ages of the Mexican economy, identified as the *Desarrollo Estabilizador* (1958-1970). In this period, the economy grew at a yearly average of 6,488 percent composed by 5,227 percent of advancements in the capital stock and 2,495 percent in the total factor productivity. Whereas TFP's growth was only a half of the variation in the capital stock, it explains 38,459 percent of the GDP's evolution<sup>6</sup>.

Life quality reasonably improved during this period. In 1960 only 1,75 percent of the population had a television. In 1970 this number was equal to 5,85percent. The same happened with telephones (1,41 to 2,96 percent), automobiles (1,29 to 2,41 percent) and houses with electricity or gas (18 to 44 percent). At the same time, the government managed to keep prices stable avoiding the high levels of inflation that occurred in most of the Latin

<sup>6</sup>Calculated as  $\frac{\Delta TFP}{\Delta Y}$ .

American countries. It was due to the above-average results of the payments balance, a non-deficitary effort and a strong banking system. In regards of the latter, the share of private banking institutions rose from 23 percent in 1956 to 63 percent of the whole sector in 1961. Excluding 1960, yearly inflation was below 5 percent during the whole administration of Ortiz Mena (MORENO-BRID and ROS, 2009).

Table 6 - GDP's, labor's, capital stock's and TFP's variations calculated as annual averages between 1960 and 1969.

	$\Delta Y$	$\Delta L$	$\Delta K$	$\Delta TFP$
<b>Argentina</b>	4,541%	1,035%	4,190%	1,956%
<b>Brazil</b>	7,190%	2,640%	5,028%	3,480%
<b>Mexico</b>	6,917%	2,408%	5,407%	2,804%

Source: Calculated with data from Heston *et al.* (2012).

Table 6 shows that Mexico's growth during the 1960s was fairly similar to Brazil's with small differences only in regards of variations in capital stock and total factor productivity. Although the growth in capital stock was higher in Mexico than in Brazil, a qualitative aspect of this data must be highlighted. It was mentioned that by the 1960s, the production of nondurable consumer and light intermediate goods was well-developed in Mexico. Although its government tried to stimulate entrepreneurs to adhere to the production of capital goods, by 1970 more than 90 percent of its machine tools were supplied from abroad. This rate is disastrous when compared to other semi-industrial countries as Brazil whose imports in the sector were not above 20 percent and, in addition, exported 27 percent of its production (MORENO-BRID; ROS, 2009; ROS, 1993).

Table 7 - Average years of total schooling in Argentina, Brazil and Mexico, 1950-1970.

	<b>1950</b>	<b>1970</b>	<b>Variation (%)</b>
<b>Argentina</b>	4,60	5,92	28,695
<b>Brazil</b>	1,96	3,09	57,653
<b>Mexico</b>	2,17	2,89	33,179

Source: Calculated with data from Barro and Lee (2010).

There are alternative explanations for this fact. The proximity to the United States and the easy to import capital goods is one of them. As the supply of machinery was reasonably accessible at low prices, it would be a hard job to enter this market. Additionally, the Mexican educational system was underdeveloped – as in Brazil. In the beginning of the colonization the Spanish crown founded the *Real y Pontificia Universidade de Mexico* (1539). It was quite advanced for that time as in the sixteenth century it used to offer advanced studies in Physics

and Mathematics. The university was shut down right after the Mexican Independence War in 1833. Almost one century later, the *Universidad Nacional Autónoma de México* was created in 1910. This university and El Colegio de México – founded in 1939 by the president Lázaro Cárdenas – are high level universities nowadays but were not enough to transform Mexico in a leading developer of science and technology. As it happened in Argentina and Brazil, an intensification of the R&D agenda took place during the import substitution with the creation of different incentive bodies as the *Academia Mexicana de Ciencias* (1959), *Centro de Investigación y de Estudios Avanzados* (1960), *Academia de la Investigación Científica* (1969) and the *Consejo Nacional de Ciencia y Tecnología* (1971). As Table 6 shows, after two decades the average years of total schooling in Mexico had advanced in a similar pace to Argentina and far below Brazil, ending up with the worst index among the three Latin American leading economies.

#### 4.2.4 Some remarks

Although being in the same region, having similar cultural backgrounds and being colonized in fairly similar models, Argentina, Brazil and Mexico entered the 1950s in different conditions. Argentina benefited from an advanced educational system with a high propensity to innovate but its politics looked like a powder keg. The Brazilian educational system was extremely poor and it was passing through a politically instable period but, differently than Argentina, its governments were still able to implement solid economic policies<sup>7</sup>. Mexico also had weak results in regards of education but since the late 1929s had achieved a stable government that would last – with an unchanged leading party – for seven decades.

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<sup>7</sup> Rapoport and Laufer (2000) describe the military coups that took place in Argentina and Brazil in the 1960s. Although their aim is to show the influence of the American government in these processes, the narrative is very efficient in presenting similarities and differences in both processes. It is important to this research that the Argentine political crisis was much more severe and longer than the one in Brazil, causing greater harm to its economy.

Table 8 - Variations in the labor productivity and explanatory power of the TFP calculated as annual averages between 1950 and 1959, and 1960 and 1969.

	1950-1959 (%)		1960-1969 (%)	
	$\Delta Y/\Delta L$	$\Delta TFP/\Delta Y$	$\Delta Y/\Delta L$	$\Delta TFP/\Delta Y$
<b>Argentina</b>	1,019	-15,542	3,455	43,073
<b>Brazil</b>	3,571	52,397	4,434	48,403
<b>Mexico</b>	4,740	63,198	4,407	40,535

Source: Calculated with data from Heston *et al* (2012).

The three countries adopted similar policies to achieve its industrialization through an import substitution process. As neo-institutionalists argue, it would have been difficult to achieve similar results if the initial conditions were different. In this sense, they were half right and half wrong. Brazil and Mexico followed really similar trends in most aspects. Both of them grew at an average pace above 6 percent per annum between 1950 and 1970. Both of them increased their capital stock, respectively, at an average 3,374 and 2,966 percent per annum in the 1950s and managed to accelerate it in the 1960s achieving an average yearly growth above 5 percent. The influence of the TFP, or technical change, in the 1950s was very high: 51,397 and 63,198 percent. Once industrialization advanced, the pace in the 1960s had slowed down to 48,403 and 40,535 percent. Yearly advances in labor productivity were also high: in the 1950s, 3,571 and 4,740 percent; in the 1960s, 4,434 and 4,407 percent. On the hand, while Mexico managed to achieve a quite stable environment with low inflation rates and had its industrial production focused on nondurable consumer and light intermediate goods, Brazil's inflation was very high and unstable, but it managed to join the team of countries which were able to produce and export capital goods.

Some key differences in the backgrounds of Brazil and Mexico may be used to explain these different outcomes. The proximity with the United States made imports of capital goods cheaper to Mexico, making it harder for local producers to compete – even though different subsidies were being offered by the government. Once it was more expensive to Brazilians to import this kind of products, the local industry benefited from the knowhow brought by the skilled migrant workforce to develop its own machinery.

In regards of politics, Mexico's stability let its government adopt stabilization policies more easily than it would occur in Brazil where different political actors were constantly fighting for special benefits. It is true that *the two Antonios*, the Mexican Ortiz Mena and the Brazilian Delfim Netto spent a long time in charge of their countries' finances and were



responsible for stabilizing the economy (at least partially in Brazil). Still, during Delfim Netto's term many violent riots took place all over Brazil. In Mexico the scenario was calmer and easier to handle by the authorities.

Argentina is the negative outlier of this trio. It was the most educated and industrialized country in Latin America in 1950. As Table 1 shows, 29 percent of its GDP was composed by industry's outcome in 1950. In the same year, Brazil's and Argentina's industries responded only for 17 and 18 percent, respectively. Whereas this parcel grew only 16,206 percent until 1963-195, the same sector advanced 64,705 and 53,889 percent in Brazil and Mexico. In comparison to the already mentioned influence of TFP in the GDP in Brazil and Mexico during the 1950s, Argentina's level was negative in 15,542 percent, evidencing a decrease in the level of technical change. In the 1960s Argentina managed to leave its crisis and advance. Still, it was not able to achieve the high levels of growth and capital accumulation reached by Brazil and Mexico.

A reasonable explanation for the Argentinean failure lies on the political conflicts that took place since the election of the president Juan Domingo Perón in 1946. Among different trials, three presidents were ousted between 1955 and 1966. The situation was so critical that in 1955 more than 300 civilians ended up being killed after an assassination attempt against Perón. The fact that the most educated people in Latin America were not able to produce a considerable amount of innovations in this period might be credited to this lack of political stability and, consequentially, the high transaction costs to any business endeavor. As it was earlier discussed, a certain level of stability and optimism in regards of profit-making are essential factors to stimulate an innovative behavior.

Finally, it is important to highlight that there is not much evidence of successful research and development efforts in these three countries although several public bodies were created to stimulate science and technology. The interaction between universities and firms was minimal and most of the innovations were brought by multinational corporations or through the import of capital goods which were adapted to supply goods according to the local demand and to be used according to the skills of the local workforce. Nevertheless, as it will be further discussed, the bodies created in Argentina, Brazil and Mexico during this period were essential to the development of new technologies in the upcoming decades.

### 4.3 OIL CRISIS

The period initiated in the 1970s would drastically change the economic behavior of most Latin American countries. It is undeniable that the import substitution industrialization lacked stability as it was highly dependent on international currencies and protectionism. An external crisis could present a major harm its sustainability and, consequentially, to the economic stability of the region. That is what happened when the Arab members of the Organization of Petroleum Exporting Countries declared an embargo against the United States due to conflicts initiated by the Yom Kippur War. It triggered a series of events that would result in a lost period and strong pressures for a regime change in regards of economic policy.

Talking about data, Ocampo and Vos (2008, p. 11) studied the evolution of 106 developing economies across time and their capabilities of catching up with developed nations. Their study found out that almost a half of these countries experienced sustained expansion – or, “four consecutive five-year moving average periods with growth of over 2 per cent per capita” – between in the 1960s and 1970s. In the 1980s, only 20 out of 106 countries managed to achieve it, mostly in Asia, and were retaken by most of the developing world in the 1990s but in levels far below the ones achieved during the golden years.

This data presents the 1980s as a lost decade. Still, it would be incorrect to underestimate the political and economic events of the 1970s when trying to understand why the world economy – and especially the developing world – stopped growing. In short, the two oil shocks that took place during the 1970s have raised several adversities to the developed world.

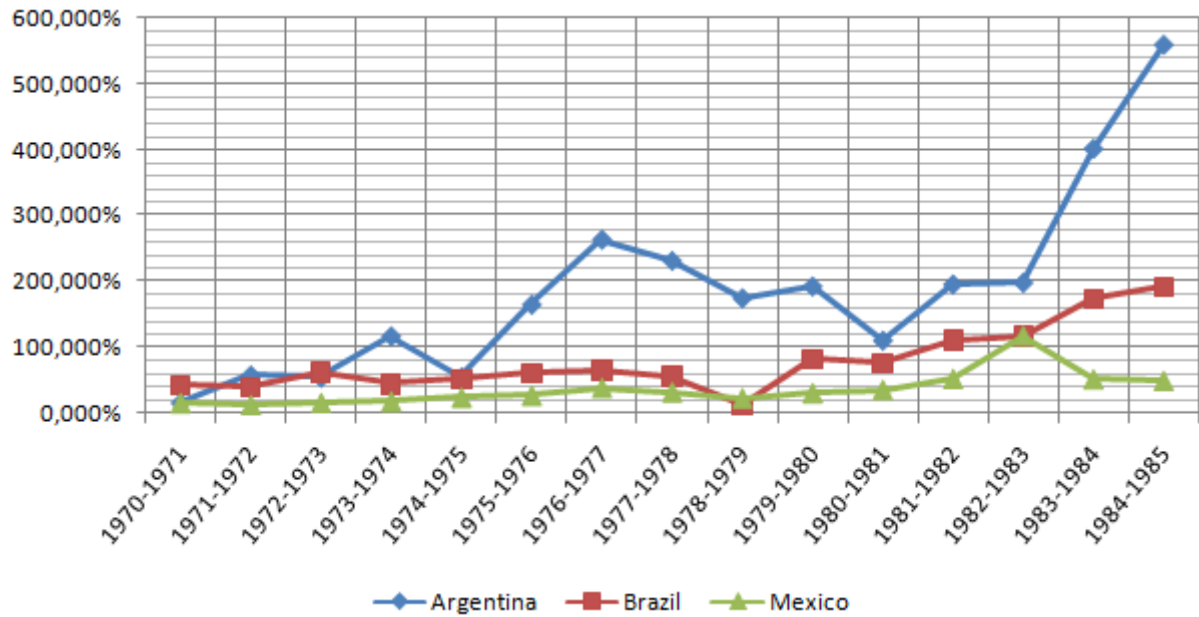
Two international crises occurred in the 1970s: in 1973-74 oil prices were multiplied by four; in 1978-1979 by three. Whereas it was a reason for euphoria to oil exporters such as Ecuador and Venezuela, oil importers had to adopt economic measures to sustain their economic stability and growth. That was the case of Argentina, Brazil and Mexico where import-substitution efforts were intensified by a combination of tariff increases, lists of prohibited imports, national similarity rules and import deposits. Loaning money was still a key measure for adding-up to the Latin American reserves of foreign currency. During the 1970s, when the developed world was collapsing, the share of foreign direct investments in the inflows to Latin America was drastically reduced due to the increasing foreign debt – although it was getting more and more expensive due to the restrictive macroeconomic

policies adopted by the United States and Europe. Mexico's foreign debt doubled between 1971 and 1976 reaching US\$27,9 billion. By 1981 it had risen to US\$81 billion (ABREU, 2008).

On one hand, crises suffered by industrialized nations work as a natural protection for the industry of developing countries as it was already discussed for the economic events of the two World Wars. On the other hand, a great parcel of the developing world based its import substitution industrialization on funds from the rich economies in the form of loans, exports or foreign direct investments. Once the United States and Europe were running out of money, at some point it would affect the inflow of investments to Latin America.

That is what happened. The United States increased their real interest rates from -1,8 percent in 1979 to 3,6 percent in 1981 and 8,2 percent in 1984. The rate paid by developing countries was even higher. The average risk premium based on the London Interbank Offered Rate (LIBOR) rose from 2,5 percent in 1979 to 22,0 percent in 1981 – an increase of 780 percent in two years. It meant not only that the developing world would have serious problems to loan money, but also that it was extremely difficult to use new loans to pay the previous ones. Furthermore, if loaning was one of the sources of foreign currencies to afford the sponsored industrialization through imports of capital goods, the second one was based on exporting primary products. On the same period, a second shock took place and real non-oil commodities dropped in more than 30 percent during this decade. It meant that the developing world would either find alternative ways of financing their projects or the import substitution era would come to an end (OCAMPO; VOS, 2008).

Domestic credit started being seen as one of the few alternatives to keep stimulating local industries. As Table 8 shows, it increased at enormous rates during the 1970s and early 1980s. In 1982, the following year of the one when LIBOR reached an average risk premium of 22,0 percent, domestic credit increased in Argentina, Brazil and Mexico at, respectively, 198,368, 117,355 and 117,066 percent. It is true that Argentina is the country where domestic credit expanded the most in relative numbers during these two decades. Still, the phenomenon was seen in all these three economies.



Graphic 3- Yearly growth of the domestic credit in Argentina, Brazil and Mexico, 1970-1985.

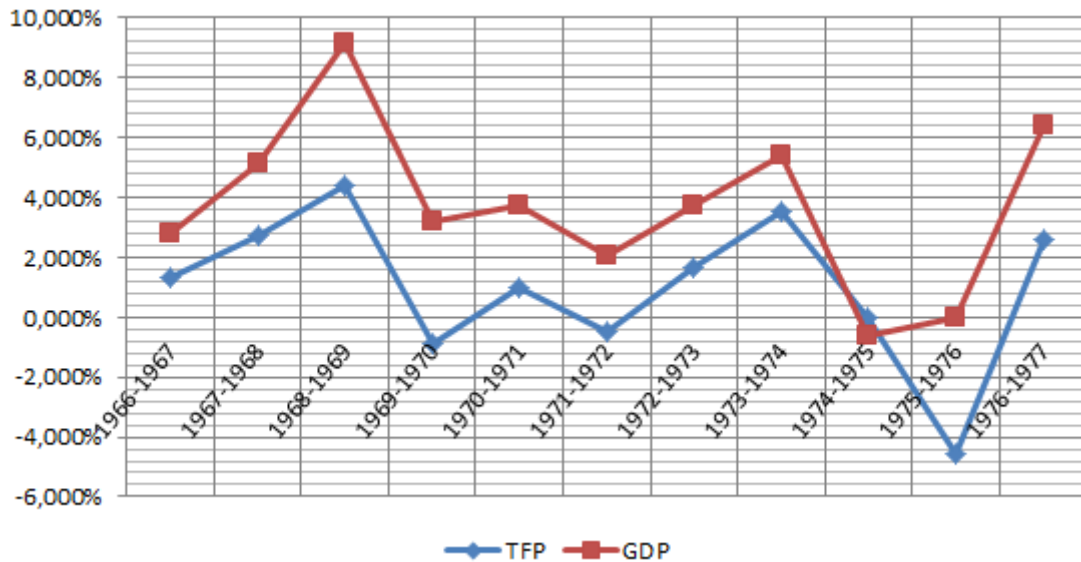
Source: Calculated with data from World Bank (2015).

This trend was surely part of the financial liberalization that occurred in most Latin American countries after the oil crisis. The banking system was in a deeply process of expansion and its competition led most of its key players to offer cheaper credit through reducing their spread. In Argentina, for example, it went from 49 percent in 1978 to 23 percent in 1981. Once this expansion occurred in a very short time, it lacked sustainability and, at some point, many Latin American governments had to intervene to save important banks from bankruptcy (BROCK; SUAREZ, 2000). As it will be further discussed, these 20 years were a transitional period from the import substitution industrialization to the post-Washington Consensus era.

#### 4.3.1 Argentina

During the second of half of the 1960s the economic situation of Argentina started going to a stability path. Still, the political problems kept being a thorn in the government's side when planning any kind of policy or reform. That is what happened when the Minister of Finances, Adalberto Krieger Vasena, had his reputation damaged by an episode called *Cordobazo* in May, 1969, when major protests and strikes forced his renounce and the fall of President Juan Carlos Onganía. Four years later, it was undeniable that *Peronismo* was still

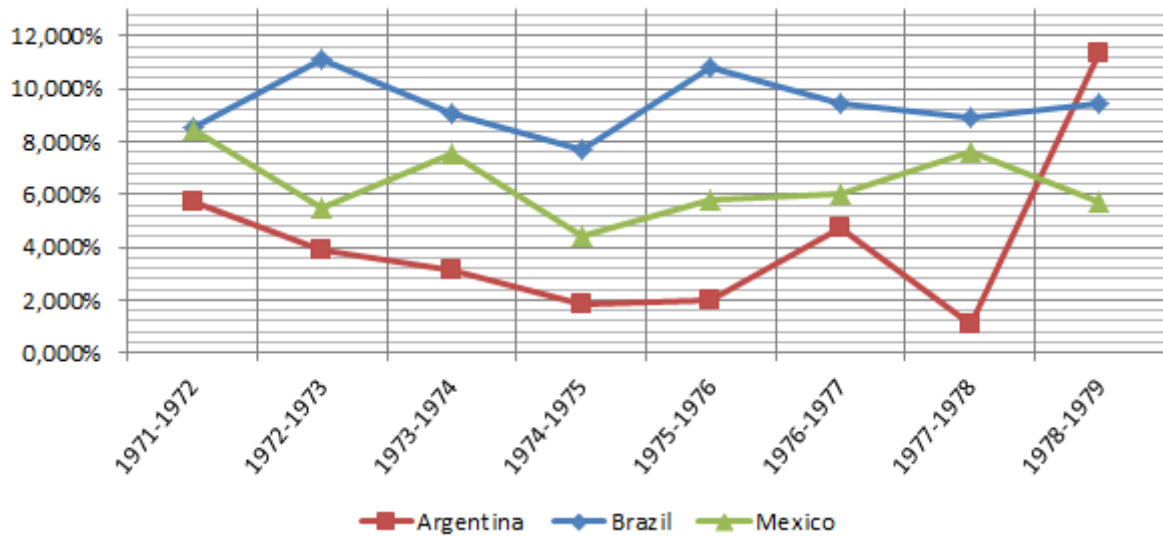
alive and extremely strong and pressed President Alejandro Agustín Lanusse to call for elections allowing the participation of the *Peronistas*.



Graphic 4 - Yearly variations on the Argentinean TFP and GDP, 1966-1977.

Source: Calculated with data from Heston *et al.* (2012).

The facts that followed this election were even more tragic than the past decades. Due to restrictions in the legislation, Juan Domingo Perón was not allowed to run for president. Nonetheless, Héctor Cámpora, his nominee, ran and won the elections with a half of the votes. Once his political strength was not enough to manage a post-dictatorship and economically unstable country, Cámpora renounced after 50 days and new elections were called. This time, Perón was able to run and got elected with 62 percent of the votes. In July, 1974, nine months after taking the presidency, he died and left the office to his vice president and widow, María Estela de Perón. *Isabelita*, as she was known, was not able to manage the country's instability and was ousted by a new military coup in 1976 (GERCHUNOFF and LLACH, 2004).



Graphic 5 - Yearly variations on the energy consumption per capita in Argentina, Brazil and Mexico, 1971-1979.

Source: Calculated with data from International Energy Agency (2014).

The link of these political events with the economic aspects of the Argentinean total factor productivity is evident as shown on Graphic 4. Besides the stabilization process guided by Krieger Vasena, the transitional years of President Lanusse and the following year of *Isabelita's* fall, Argentina had slow or negative trends of growth both in its gross domestic product and total factor productivity. Making use of Kraft and Kraft's (1978) assumption of correlation between variations in energy consumption and economic activity, Graphic 5 confirms the slowdown of the Argentinean industrialization during these years of political crisis. Although the variation was always positive, this growth lower than Brazil's and Mexico's and was becoming smaller every year.

It is true that some economic activity took place during this short period of *Peronismo*. The *Ley de Protección al Trabajo y a la Producción Nacional* was enacted by Perón to keep up with the protectionist model of restricting imports and fostering exports from small and medium businesses. Nonetheless, all the political instability and the short live of his term weren't enough to provoke a real change in the economic scenario (GERCHUNOFF; LLACH, 2004).

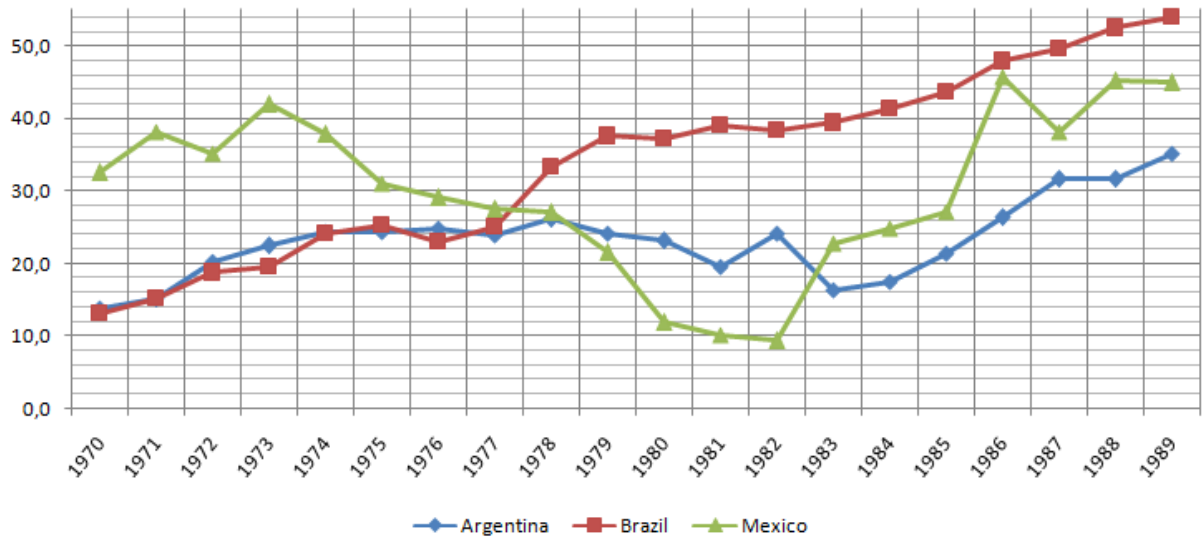
In 1976, the beginning of the new military government, José Alfredo Martínez de Hoz was nominated Minister of Finances. A widely known monetarist influenced by the ongoing Chilean reforms, Martínez de Hoz adopted a contractionary agenda including the liberalization of prices, the alleviation of trade barriers and a salary freeze aimed at reducing the consumption to refrain the inflationary trend. Indeed he managed to stabilize the economy

and welcomed a great inflow of foreign money originated from both direct investments and loans. As a result of these policies, credit expanded and Argentina's economic growth was higher than Brazil's and Mexico's in the period 1976-1977. Respectively, their GDP varied in 6,384, 4,930 and 3,443 percent (GERCHUNOFF; LLACH, 2004; HESTON *et al.*, 2012; ROMERO, 2002).

In 1977 a new liberal reform took place. The government decided to liberalize the financial sector allowing more competition and coupling up the capability to lend to the capability to attract deposits. Between 1977 and 1980, the number of banks jumped from 119 to 219. From 1976 to 1980, the amount of time deposits rose from 5,9 to 16,5 percent of the GDP. It also explains, as shown on Graphic 3, why the Argentine domestic credit increased almost 300 percent in 1976-1977. As a direct result, energy consumption per capita rose 20,489 percent from 1976 to 1980 evidencing a considerable increase in the industrial activity (GERCHUNOFF; LLACH, 2004; WORLD BANK, 2015; INTERNATIONAL ENERGY AGENCY, 2014).

As already mentioned, in the early 1980s LIBOR's risk premium drastically rose. The Argentine government and local firms started being unable to renew their international loans. Furthermore, the increase in the American interest rate motivated a capital flight from most developing and unstable countries to the United States. In March 1980 four important banks went bankrupt, including the largest one in the country. Data for electric power consumption per capita confirms the decrease of the industrial activity: from 1980 to 1981, it shrank 3,650 percent. So does the GNP (-5,417 percent) and the TFP (-8,242 percent) (GERCHUNOFF; LLACH, 2004; ROMERO, 2002; HESTON *et al.*, 2012; INTERNATIONAL ENERGY AGENCY, 2014).

The same protective trend initiated in the United States also took place in most developed nations including increased interest rates and controlled flows of currency emissions. Foreign loans became even more expensive and, in order to save local loaners, the Argentine government started nationalizing international debts. Although it helped a number of firms, the government's economic sustainability was worsened. Adding the facts that in 1982 Argentina had to face a war against the United Kingdom due to the Falkland Islands (or *Malvinas*) and Mexico declared its moratorium, the system's structure started to ruin. From 1981 to 1982, energy consumption, GDP and TFP varied, respectively, 0,996, -3,161 and -5,498 percent. In 1983 the military dictatorship fell (GERCHUNOFF; LLACH, 2004; ROMERO, 2002; HESTON *et al.*, 2012; INTERNATIONAL ENERGY AGENCY, 2014).



Graphic 6 - Exports of manufactured products as percentage of total exports, 1970-1989.

Source: Economic Commission for Latin America and the Caribbean (2015).

Although the military regime ended up in a crisis as big as the one achieved by the previous regime, some sectors did advance during both periods. It was the case of the automobile industry, benefited from foreign direct investments, or the manufacturing sector in general. Graphic 6 clearly shows that the share of manufacturing products in the total amount of exports kept advancing until 1982 (besides downfalls in 1977, 1980 and 1981). In the early 1970s Argentina's numbers were better than those from Brazil. In the early 1980s, when Mexico declared its moratorium, Argentina's share was the double of the Mexican one. As reported by Romero (2002), it was due to the spectacular growth of family conglomerates, as Macri, Pérez Compan, Bulgheroni and Fortabat, and local branches of multinational corporations as Bunge y Born and Techint. These initiatives, among others, were specially benefited by the policies adopted by Martínez de Hoz, including a wide range of public private partnerships, including from infrastructure to a new atomic nuclear reactor, and the partial privatization of several public companies, as in the sector of telecommunications.

In 1983 Raúl Ricardo Alfonsín competed for the Argentine presidency against the *Peronista* Ítalo Luder and managed to win. His government was dedicated to reestablish social cohesion and stability and included efforts in the creation of a new federal constitution, a peace treaty with Chile and strengthening of the state provision of higher education. He indeed managed to reach many social achievements in regards of political stability. On the other hand, his economic policies were not successful to avoid the recession that had taken control over Latin America. Worse than that, Argentina's GDP was the only among the



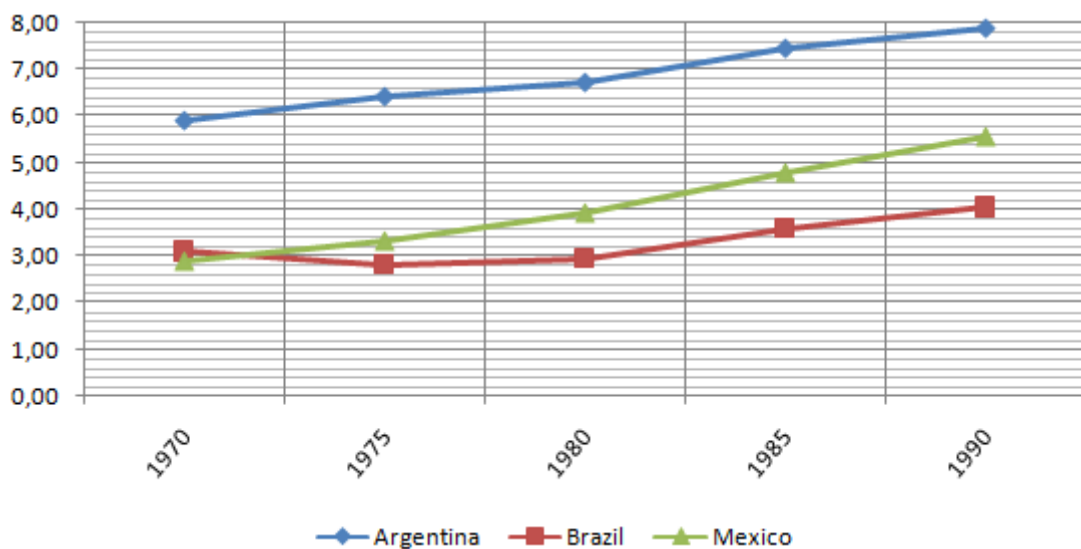
biggest economies in the region to achieve a negative yearly average during the decade (GERCHUNOFF and LLACH, 2004).

Table 9 - GDP's, labor's, capital stock's and TFP's variations calculated as annual averages between 1980 and 1989.

	$\Delta Y$	$\Delta L$	$\Delta K$	$\Delta TFP$
<b>Argentina</b>	-0,725%	1,285%	1,821%	-2,273%
<b>Brazil</b>	3,025%	2,420%	4,890%	-0,502%
<b>Mexico</b>	2,203%	3,562%	3,797%	-1,492%

Source: Calculated with data from Heston *et al* (2012).

In regards of economics, the two terms of Alfonsín were composed by three different stages. The first one, right after his election, was marked by the lack of a clear plan. Once there were no expectations of winning against the *Peronistas*, his party had only focused on the political aspects of the country. When elected, the only plan was to retake what had been done two decades earlier when his party was in the charge of the Argentine government. Inserted in a region in clear recession, he didn't manage to be successful. In 1985 the new minister Juan Vital Sourrouille started a heterodox plan based on the assumption that Argentina's inflation was inertial or, in other words, the inflation's cause was inflation itself. For one year his policies, that included freezing most prices, achieved fairly positive results. In 1986, trying to adopt flexible measures to generate growth, the government lost control over the economy and a new inflationary recession took place until the end of the decade (GERCHUNOFF; LLACH, 2004).



Graphic 7 - Educational attainment measured by average years of total schooling in Argentina, Brazil and Mexico, 1970-1990.

Source: Calculated with data from Barro and Lee (2010).

During these turbulent years, education kept advancing in Argentina and the country maintained its lead in the ranking of average years of total schooling in Latin America. Although Argentina wasn't advancing as fast as the developed economies from the north anymore, its scientific discoveries were still being recognized all over the world. In 1970, Luis Federico Leloir, a physician born in France but educated at the *Universidad de Buenos Aires*, was awarded the Nobel Prize of Chemistry for his discovery of the metabolic pathways in lactose. In 1984, the biochemist César Milstein received the Nobel Prize in Medicine – the second awarded to an Argentinean scientist – due to his research that resulted in the development of the hybridoma technique for the production of monoclonal antibodies.

It is noteworthy that even though Argentina was passing through an intense industrialization process and its workforce was highly educated, most of its discoveries lied in the field of science, not in technology. The interaction between universities and firms was extremely timid and frowned upon. Schugurensky and Naidorf (2004) noted that university researchers preferred to keep their autonomy and refused to adhere to the utilitarian logic. Furthermore, a left-nationalist view rejected any interaction with industrialists and international investors. Besides ideology, the great amount of funding available to universities and to the CONICET is an explanatory evidence for such phenomenon. Once funding was taken for granted by the researchers, links with the market were unnecessary and could represent less stability than the one granted by the government.

It doesn't mean that education didn't contribute to industrialization process. Whereas technological discoveries were not so common in universities, it was the highly skilled workforce provided by them that allowed – and attracted – the development of local industries and the installment of multinational corporations. In this sense, the migration of skilled laborers were an option but not a necessity.

In 1984, after his election, president Alfonsín tried to change this reality by establishing the *Area de Transferencia de Tecnología* at the CONICET. In 1985, this council created the *Oficina de Transferencia de Tecnología* and, in 1986, the *Comisión Asesora de Desarrollo Tecnológico*, a commission composed by researchers, civil servants and entrepreneurs in order to approximate firms and universities. In 1987 the Universidad de Buenos Aires adhered to this logic and created the *Dirección de Convenios y Transferencias* (SCHUGURENSKY; NAIDORF, 2004; ALBORNOZ; GORDON, 2011). Although these measures direct Argentina to the composition of a well integrated national innovation system, it is difficult to identify expressive technological gains until the end of the 1980s.

### 4.3.2 Brazil

During these two decades the Brazilian government enjoyed a reasonable level of stability. Besides violent protests and an equally violent repression from the military regime, the 1970s were marked by an average yearly growth of 8,841 percent. In the 1980s, when the credit crisis hit Latin America, Brazil still managed to grow more than the other leading economies in the region. Respectively, during the 1980s, Argentina, Brazil and Mexico grew at an average yearly rate of -0,725, 3,025 and 2,203 percent (Table 9).

Table 10 - GDP's, labor's, capital stock's and TFP's variations calculated as annual averages between 1970 and 1979.

	$\Delta Y$	$\Delta L$	$\Delta K$	$\Delta TFP$
<b>Argentina</b>	2,776%	0,974%	3,955%	0,337%
<b>Brazil</b>	8,841%	3,492%	8,960%	2,900%
<b>Mexico</b>	6,449%	5,171%	5,936%	0,843%

Source: Calculated with data from Heston *et al* (2012).

Before going into details, it is important to highlight some downsides of the successful economic policies initiated in the first half of the century and maintained during these two decades. First of all, protectionism was a key element in the development of the national industry. It meant granting special conditions to local industrialists and certain multinational corporations in order to boost their businesses and, thus, to increase the country's productivity. On the one hand, it allowed the achievement of impressive growth rates as the yearly average mentioned in the previous paragraph. On the other hand, it required reducing the amount of imported goods available to the Brazilian people, reducing their life quality, and creating a bubble of inefficiency as local industries didn't have to compete against foreign firms. Furthermore, the *pick-the-winner* policy aimed at benefiting selected industries through import licenses or cheap credit reduced the incentives to innovate as competition in these sectors – or against specific companies – became inexistent or unbalanced. Finally, import barriers to protect the local industry also led to an increased price to acquire capital goods. Whereas it helped the development of a strong sector of machinery production during the protectionist era, it also restricted advancements in other sectors and caused a competitiveness deficit at a later moment (ABREU, 2007).

It is noteworthy that whereas the government had an enormous flexibility to approve new reforms as most partisan actors were controlled or domesticated by the regime, it was

still highly dependent on the happiness of key organized interests and the population as a whole. It means that decreasing levels of economic growth would deteriorate the regime's political strength and, thus, empower a pro-democracy alternative. That is why General Ernesto Geisel, the Brazilian president from 1974 to 1979, adopted economic policies aimed at the short term during his mandate. According to Carneiro (1989) four important decisions marked the beginning of his government: alleviation of the prices' control; formalization of the monetary adjustment; intervention in the financial group Halles; and a review on the wage law.

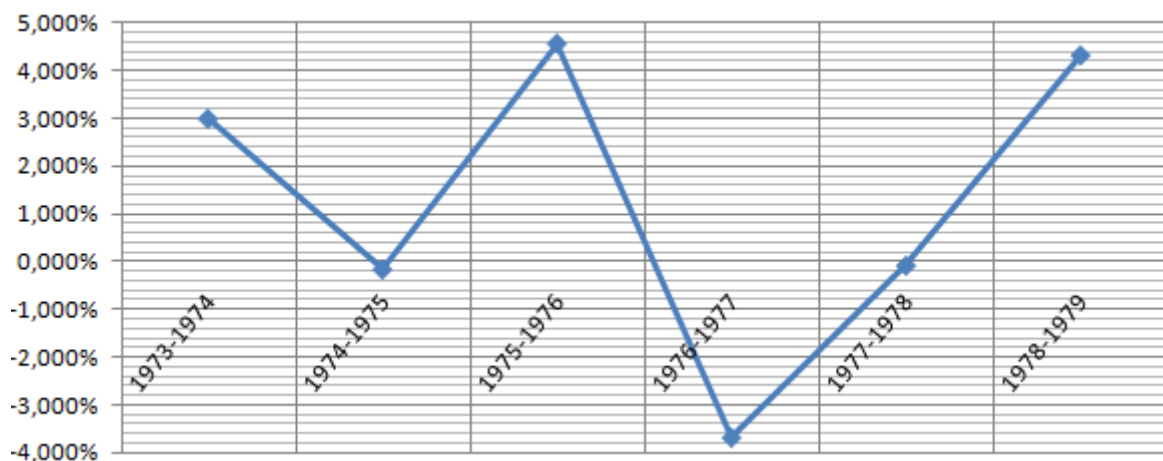
The first of them was a trial to induce a corrective inflation aimed at stabilizing the economy without coercive controls over prices. In many sectors, prices were set free. In others, the control was modernized in order to reduce State intervention over the economy. Although it granted more freedom to entrepreneurs, it resulted in unstable monthly variations in the level of inflation and high uncertainty in regards of financial management. The government's answer was the adjustment of monetary indexation through fixed rules. It included a restrictive policy of increased rates on government bonds (*Letras do Tesouro Nacional*) that would function as contractions on the purchase power. On the other hand, measures as the expansion of credit through the State-owned Banco do Brasil, an intervention to reduce the losses of Halles' bankruptcy, the fourth biggest bank in the country, and the adjustment of wage indexation went in the opposite direction, granting more monetary flow in the economy. As it was already argued, it is clear that Geisel's policies were mainly aimed at short term political outcomes than at long term economic gains (CARNEIRO, 1989).

Inflation became reasonably controlled in 1974. Between May and December its monthly average was 1,4 percent. Adversely, these mixed policies and the oil shocks affected the economy's growth. In 1973-1974, it achieved a variation of 8,150 percent. In 1974-1975, it decreased to 5,170. It is true that these levels were high if compared to the ones achieved nowadays. Still, from 1967 to 1973, the Brazilian economy grew at an average yearly rate of 10,965 percent. In response, the *Secretaria de Planejamento* pressed President Geisel to retake an investment policy by expanding credit to the private sector. In 1975, loans increased in 55 percent and money supply in 36 percent. The economy reached its peak growing 10,260 percent in 1975-1976 (CARNEIRO, 1989; HESTON *et al.*, 2012).

The effects of an increased availability of credit are visible in the data related to economic activity. Graphic 5 shows that energy consumption was boosted exactly in this period of expansion. On Graphic 6 it is possible to notice that it was in this period that the

share of manufacturing exports in Brazil surpassed the one in Argentina and Mexico. It also evidences the importance given by the government to the balance of payments. In this regards, it is important to discuss a point of view presented by Carneiro (1989). Whereas he affirms that Geisel tried to relegate the external crisis, a list of government measures shows his concern in shielding the country from both the oil and credit crises. This list includes investments in expanding oil drilling and alternative sources of energy as ethanol and nuclear power<sup>8</sup>, and extensive credit to increase the production of tradable manufacturing goods focusing on an equilibrated balance of payments.

On the other hand, it is also clear that this *stop-and-go* model of alternating restriction and expansion wasn't capable of controlling inflation in the long term. Furthermore, its impact in the economy used to happen at a very quick pace. Graphic 8 shows the total factor productivity's high volatility during Ernesto Geisel's administration. The variation between 1975-1976 and 1976-1977 equaled 8,234 percent. In this sense, a visible difference separates Argentina and Brazil: while the first suffered from an intensive process of political instability and regime change, the second was affected by the inflationary trend and a constant change of economic policies where credit and protectionism used to boost technical change. Among their similarities, instability and lack of predictability were major factors to hinder innovation.



Graphic 8 - Variations in Brazil's total factor productivity during Ernesto Geisel's administration.

Source: Calculated with data from Heston *et al.* (2012).

General João Figueiredo took office in 1979 after the second oil crisis and in the imminence of the credit crisis. The “stop movement” initiated to curb the inflationary trend

<sup>8</sup> In June 1975 the Brazilian government signed an agreement with Germany for investments in nuclear reactors. In November of the same year, the government launched the Programa Nacional do Álcool aiming at substituting gasoline by ethanol as the main fuel for automobiles produced in the country. Two years earlier it was already clear the government's motivation of investing in the energy sector. For a detailed overview of the State planning initiated in 1973 is found on *Conjuntura Econômica* (1973).

was unsuccessful and the country initiated the decade with a recessive result of -4,250 percent of variation in the GNP in 1980-1981. Technical change, denoted as the total factor productivity was even worse: -9,039 percent. As a response, Figueiredo tried to alleviate the crisis by maintaining Geisel's goal of equilibrating the balance of payments and the inflation. In order to that, he tried to contain the internal demand and stimulate exports (CARNEIRO; MODIANO, 1989; HESTON *et al.*, 2012).

These measures were successful in regards of international commerce. In 1980 the balance of trade had a deficit of US\$2,8 billion. In 1981 it achieved a surplus of US\$1,2 billion. The economy stagnated but the TFP kept decreasing at a -4,099 percent rate (1981-1982). Predicting the worsening of the situation, the Brazilian government asked the International Monetary Fund (IMF) for support. In exchange of helping the renegotiation of the Brazilian debt, the Fund demanded several contractionist measures, including cuts in the public expenditure, reducing imports and increasing exports, and policies aimed at controlling interest, exchange and wage rates. Figueiredo managed to achieve most of the initial goals set by the Fund but the high levels of inflation made the bank cancel its support package after three months. The economic situation was deteriorated. The share of manufacturing goods in the total exports fell for the first time since 1968; the TFP shrank 4,776 percent and the GDP decreased 2,930 percent (CARNEIRO; MODIANO, 1989; HESTON *et al.*, 2012; ECONOMIC COMMISSION FOR LATIN AMERICA AND THE CARIBBEAN, 2015).

In the first semester of 1984 exports to the United States increased, agriculture prices went up and the multiplier effect of the money inflow reinvigorated the Brazilian economy. A new package was dealt with the IMF and, due to the favorable economic environment and the new legislation, laborers achieved real gains with the increase of wages in the second semester. In 1983-1984, an increase in 8,754 percent in energy consumption per capita evidences the economic activity resumption. In the same period, the Brazilian GDP expanded in 5,400 percent and inflation kept a similar pace of the previous year: 223,9 percent (CARNEIRO; MODIANO, 1989; HESTON *et al.*, 2012; INTERNATIONAL ENERGY AGENCY, 2014).

Figueiredo's years were also marked by the end of the military regime. Free presidential elections were not called but new parties were created and the Congress voted for a civilian president. A former prime minister before the dictatorial regime, Tancredo Neves won the election in 1985. Due to a disease, Neves died and his vice-president, José Sarney, took office. Until late 1980s, Sarney tried three different heterodox plans to control the

inflation: *Plano Cruzado*, *Plano Bresser* and *Plano Verão*. None of them were successful and Sarney left the presidency in 1989 with a monthly inflation rate around 80 percent and a timid average variation of the total factor productivity of 0,849 percent (GREMAUD *et al.*, 2007; HESTON *et al.*, 2012).

As Canêdo-Pinheiro (2013) highlights, during this period the attention given to economic factors was far greater than the one for education or, in general, capacity building for innovation. On the contrary, the average years of schooling decreased in the 1970s and sustained a similar growth of the one achieved by Mexico during the 1980s. According to Ferreira and Veloso (2013), until 1980 only Haiti's index of education was worse than Brazil's in Latin America. As it is seen on Graphic 7, in 1990 Brazil was still the least educated country among the three leading economies of the region.

It is explained by the low levels of investment in education. In 1950, public expenditure with education was about 1,4 percent of the GNP. In 1980 it wasn't above 2,4 percent. Furthermore, a big share of this expenditure was dedicated to higher education which was directed to a small parcel of the population. It even impacted wage distribution during the 1960s and 1970s as the high demand for skilled workforce increased the salaries for educated people creating wider social inequalities (FERREIRA; VELOSO, 2013).

Although funding was extremely low, it is untrue that the military government didn't do anything to improve the country's educational standards. Besides the creation of several research bodies in the late 1960s, in 1971 the Ministry of Education launched a reform aimed at adapting the educational system to the demands of a newly industrialized country. It included a decentralized mechanism of schooling provision heavily stimulated by the World Bank including new bodies as the *Centro de Integração Empresa-Escola*, the *Movimento Brasileiro de Alfabetização* and the *Programa de Desenvolvimento do Ensino Médio*, and adjustments in the content of secondary schooling which substituted subjects on humanities by technical and vocational classes. During the late 1970s and the 1980s the model was expanded. In rural areas, the government established the *Projetos de Desenvolvimento Rural Integrados*, aimed at providing basic education and vocational skills in impoverished regions of the country's northeast. In Rio de Janeiro, Minas Gerais and Paraná, the renewal of vocational schools resulted in the creation of 3 *Centros Federais de Educação Tecnológica* – State-owned institutions dedicated to professional education in strategic fields (FONSECA, 2009).

As it happened in the same period in Argentina or even Brazil during the two post-war decades, the majority of the skilled workforce was used mainly to operate machinery instead of developing new ones. Most of the innovation was brought by multinational corporations and the firms directed to domestic markets usually lagged behind in regards of technology. Innovation in the national industry was mainly restricted to the companies that competed in the international environment (SILVA, 1994). In this case, direct links with universities were rare. Indirectly, it was the educated personnel provided by higher education institutions that was responsible for learning recent advancements from foreign firms, adapting them to the Brazilian capabilities and generating innovations.

Furthermore, specific initiatives of research and development are found when analyzing the behavior of public companies. In January 1974, *Fundação Getúlio Vargas* (1974) launched the 28<sup>th</sup> volume of its journal *Conjuntura Econômica* including ten studies on science and technology. They were motivated by the *Plano Básico de Desenvolvimento Científico e Tecnológico*, created in July 1973, which aimed at funding research in strategic areas. The studies were focused in fields where Brazil had renowned innovative efforts as mining, nuclear energy, oil drilling, steelmaking, aerospace and physics – all of them controlled or dominated by State actors. Although in most of these sectors Brazil was or became highly competitive, the efforts and gains were too concentrated to cause drastic structural changes.

#### 4.3.3 Mexico

As it was earlier mentioned, different Mexican governments aimed at reducing social inequalities besides industrializing the country. Although much advancement was achieved, economic disparities were still frequent. In 1970 Luis Echeverría Álvarez was elected president setting as his goal sharing the benefits of economic growth among a greater amount of people: the *Desarrollo Estabilizador* would become the *Desarrollo Compartido*. In order to that, one of his efforts was directed at increasing public investment in the agriculture as a way of boosting its productivity and, thus, remuneration. It was done through guaranteed prices for a list of products and the launching of *Programa Integral de Desarrollo Rural*, a policy designed to support rural communities in technical and financial aspects of infrastructure projects (MORENO-BRID; ROS, 2009).



In regards of taxation, president Echeverría Álvarez enacted a reform aimed at increase the State's income through specific taxations on wealthy citizens. He expanded the list of taxable items as sources of accumulation in the income tax, raised the tax over interest on financial assets, created a wealth tax and eliminated financial anonymity mechanisms that could allow any kind of evasion. In 1972 political pressure from the private sector forced the government to refrain its reform and the only remaining change in the tax reform was a new taxation over luxury goods and an increase in sales taxes (MORENO-BRID; ROS, 2009).

Other key economic elements pursued by previous governments continued in the industrial agenda: stimulating the domestic production of capital goods and exporting manufactured goods. New subsidies were created through the *Fondo para el Fomento de las Exportaciones de Productos Manufacturados*, the *Fondo de Equipamiento Industrial* and the *Instituto Mexicano de Comercio Exterior*. Tax and tariff benefits were offered by the *Certificados de Devolución de Impuestos* and the *Certificados de Promoción Fiscal*. Lastly, a new regulation imposed a general 49 percent restriction on foreign ownership over new enterprises (MORENO-BRID; ROS, 2009).

Besides managing to reduce social inequalities (Gini coefficient decreased from 0,54 to 0,49), Echeverría Álvarez's administration was also marked by fiscal imbalances. Between 1970 and 1976, the general government final expenditure has increased 73,804. In the same period, the economy's output rose 43,118 percent – almost a half of the government's expenses. The primary fiscal debt went from 0,5 to 6,4 percent of the GDP between 1971 and 1975. Foreign debt, which was US\$7,1 billion in 1971, jumped to US\$24 billion in 1976. Inflation started being a problem once again, the balance of payments was being deteriorated and private investment was shrinking. An internal crisis was initiated exactly when the world was going into one of its most severe economic downfalls of the century (HESTON *et al.*, 2012; MORENO-BRID; ROS, 2009; WORLD BANK, 2015; BUFFIE, 1990).

Besides an average yearly growth of almost 6 percent in capital stock, technical change during the first half of the 1970s was nil. In the last months of Echeverría's government, talks with the International Monetary Fund were initiated. José Lopez Portillo y Pacheco started his term as Mexico's president under an economic crisis that would soon be fought making use of the traditional IMF's orthodox policies: trade liberalization and fiscal and monetary austerity. In his first year, fiscal debt decreased from 9,9 to 6,7 percent of the GDP, inflation from 27,2 to 20,7 percent per annum and the current account deficit was lowered by over US\$2 billion. In 1976-1977 the GDP achieved its lowest growth since 1960-

1961 but the economy was getting ready to retake its growing path (BUFFIE; KRAUSE, 1989; HESTON *et al.*, 2012).

In the same year new oil wells were found in Mexico. Oil reserves jumped from 6,3 billion barrels in 1976 to 16 billion in 1977 and 40 billion in 1978. The euphoria generated by the new oil output made Lopez Portillo abandon his austerity plan and reproduce the same mistakes initiated by Echeverría Álvarez. From 1977 to 1981 the general government final consumption expenditure had risen 44,878 percent while the economy's output rose 39,252 percent. Capital stock reached growth booms of 9,352 and 8,005 percent, respectively, in 1980-1981 and 1979-1980. Still, technical change was extremely low and strong evidences point out to symptoms of Dutch disease. As Table 11 shows, solid investments in the oil sector from both the public and the private sectors caused a severe downfall in the development of the manufacturing sector. It explains the negative trend in the share of manufacturing products in the total amount of exports that went from 41,9 percent in 1973 to 9,4 percent in 1981 (HESTON *et al.*, 2012; BUFFIE; KRAUSE, 1989; WORLD BANK, 2015; MORENO-BRID; ROS, 2009; INTERNATIONAL ENERGY AGENCY, 2014).

Table 11 - Composition of total public and private investment in Mexico, 1970-1980.

	<b>1970-1977</b>	<b>1978</b>	<b>1979</b>	<b>1980</b>
<b>Agriculture</b>	7,3	8,4	7,5	7,2
<b>Mining</b>	2,2	1,6	2,9	3,1
<b>Oil</b>	11,2	20,7	24,7	25,6
<b>Manufacturing</b>	38,9	20,7	24,7	25,6
<b>Electricity</b>	8,1	10,1	9,5	9,8
<b>Commerce and services</b>	33,3	38,4	36,9	35,3

Source: Buffie and Krause (1989).

At the same time currency inflows were extremely high due to oil exports, Mexico became very attractive to international banks. Private and public actors contracted a huge debt that tripled until the early 1980s. In 1982 Mexico's total debt was US\$87,6 billion. Understanding that the country was not going to be able to follow the payment schedule, López Portillo nationalized the banking system in November 1982 imposing a de facto moratorium. After the enormous incomes provided by the new oil reserves, he left the government with the first recessive result since 1953 (HESTON *et al.*, 2012; BUFFIE; KRAUSE, 1989).

In December 1982 Miguel de la Madrid Hurtado became the new Mexican president under a critical crisis. As López Portillo did in the beginning of his government, De La Madrid set a deal with the International Monetary Fund aiming to recovery the country's economy with an austerity plan that included cutting the public budget and enacting restrictive monetary and fiscal policies. Table 9 shows that, as it happened to Argentina and Brazil, the 1980s was a lost decade to Mexico. Yearly growth average was 2,203 percent while technical change decreased at an average pace of 1,492 percent per year. Equally negative, labor productivity's yearly average was -1,332 percent. Interestingly, the manufacturing sector regained its status in the export sector: from a 9,4 percent share in 1982 it reached 45,1 in 1988, De La Madrid's last year as president (HESTON *et al.*, 2012; BUFFIE; KRAUSE, 1989; WORLD BANK, 2015).

During De La Madrid's administration, public expenditure remained under restrict control. Whereas the last two governments saw their expenses raising 73,804 and 44,878 percent, from 1983 to 1988 it rose only 9,213 percent. This number is compatible with the one-digit growth achieved by the GDP in the same period: 5,676 percent. Besides a more equilibrated expenditure, the country was benefited by its oil surplus. Whereas Brazil used to have an oil import bill on around US\$9 billion, Mexico collected US\$16 billion per year through oil exports in 1983 and 1984. This factor was a facilitator in the achievement of an equilibrated trade balance (HESTON *et al.*, 2012; MORENO-BRID; ROS, 2009).

This situation remained relatively stable until 1986 when the collapse of the oil market reduced the sector's revenue by a half. In 1985-1986 Mexico's economy faced another depression. Its GDP shrank 3,754 percent led by a strong downfall of the total factor productivity of -6,380 percent. It is true that Mexico was already towards a path of pro-market austerity but this new crisis accelerated the liberalization movement that would became the main trend of the emerging world in the 1990s (HESTON *et al.*, 2012; MORENO-BRID; ROS, 2009).

These twenty years were marked by two shifts in the administration model followed by the Mexican government. Besides changes in the aspects of economic policy, Casas and Dettmer (2007) present a detailed analysis over the country's science and technology policy. As it was earlier discussed, in the previous period Mexican authorities tried to rebuild their higher education system and created new bodies to coordinate research and development efforts aiming at the support of industrial activity. In 1970s, guided by the *Desarrollo Compartido*, Echeverría Álvarez created the *Consejo Nacional de Ciencia y Tecnología*

(CONACYT) to reverse the technological backwardness. A profound educational reform was initiated in the universities creating a greater integration and adapting their courses' curricula according to regional necessities. Following the same movement as it happened in Brazil, vocational and technological schooling received a stronger attention. In order to increase the availability of educated workers, the number of *Institutos Tecnológicos Regionales* was multiplied from 19 to 48 while other institutions, as the *Instituto Politécnico Nacional* and the *Universidad Autónoma Metropolitana*, were founded (VIELLE, 1976). Although these reforms managed to provide skilled workforce to Mexico's firms, the linkage between enterprises and universities in the development of innovations was very rare.

In the 1980s a new shift was forced by the economic downfall. Once funding was restricted, a more pragmatic agenda was built in the direction of demand and supply. The most relevant reform was initiated with the creation of the *Sistema Nacional de Investigadores* as part of the CONACYT. Its clear objective lied in fostering individual efficiency in research efforts. Financial benefits and research funds were granted to scholars capable of publishing papers in internationally recognized journals. Whereas it increased intellectual productivity in universities, no changes took place in the development of innovations in firms (COLÍN; FARIÁS, 2007).

#### 4.3.4 Some remarks

During the 1970s developing economies faced external shocks that broke their growth trend. In general, it was not the oil crisis itself that harmed Latin America but the effects it had over rich countries and, in a second moment, the credit crisis it generated. As previously mentioned, the average risk premium on the London Interbank Offered Rate jumped from 2,5 percent in 1979 to 22,0 percent in 1981. Once developing countries were highly indebted and extremely dependent on external funding, the new reality imposed a different attitude toward public spending and industrial policy.

This general standard doesn't mean that all the countries in the region faced exactly the same problems or responded in the same way. The analysis over Argentina, Brazil and Mexico shows that each of these economies were inserted into different political and

economic realities and, thus, responded in different ways - although some similarities are still found.

Argentina, for example, was marked by political instabilities. It was a similar scenario of the one that took place in the previous decades since the ascension of *Peronismo*. In the 1970s democratic elections were called, a president resigned after 50 days, Juan Perón was elected and died after a few months, his widow was nominated president and lost the government due to a new military coup. Technical change answered for only 12,153 percent of the GDP's variation in this decade. It is less than a half of the 32,796 percent occurred in Brazil where, although the military regime was very dependent on the short term public opinion, politics were reasonably stable. As it was earlier affirmed, innovation takes place when entrepreneurs feel confident about the potential gains of their endeavors. It was surely not the case of Argentina.

Table 12 Variations in the labor productivity and explanatory power of the TFP calculated as annual averages between 1970 and 1979.

	$\Delta Y/\Delta L$	$\Delta TFP/\Delta Y$
<b>Argentina</b>	1,825%	12,153%
<b>Brazil</b>	5,256%	32,796%
<b>Mexico</b>	1,218%	13,071%

Source: Calculated with data from Heston *et al.* (2012).

The Mexican situation was different. Their political stability was quite high in comparison to the other leading economies in the region. Still, bad economic decisions resulted in a technical change as low as Argentina's. Aiming at promoting a distributive policy, the government boosted its public spending during the first half of the decade and ended up with difficulties to afford its debt. In the second half, when the country was getting prepared to enact austerity policies, new oil reserves were found. Making use of the favorable scenario, the new president kept increasing public spending. Whereas the country grew at an average yearly pace of 6,449 percent, technical change was extremely low because most of the economy directed itself to the oil industry, leaving the manufacturing sector aside. Evidences of a Dutch disease are seen as the high profitability of oil drilling left industrialization (and innovation) efforts behind. Theory shows that profit is an essential

incentive to innovation. Once innovation is not essential or other mechanisms are more profitable, technical change won't be a significant tool of economic expansion<sup>9</sup>.

In 1981 the developing world was hit by the credit crisis. Highly indebted, Latin American countries had no means to keep funding their import substitution industrialization nor to renew their loans in order to pay old debts. Not even the Mexican oil reserves were a last salvation as the barrel price started going down. The 1980s were marked by an economic regime change where public expenditure had to be adjusted to the new world reality. It was not a calm transition though. No consensus was reached on the causes of hyperinflation or mechanisms to stabilize the problems and retake growth - without external funding. Several different policies were adopted in Argentina, Brazil and Mexico. None of them was successful and once against the region stagnated. It was a lost decade to the whole region.

It is noteworthy to point out that education kept advancing in all the three countries. Public policies and new government bodies led to an increase in the average years of schooling in Argentina, Brazil and Mexico. Higher and vocational education were also expanded. New institutions were created, old ones were expanded and research bodies were developed aimed at funding innovation. Nevertheless, the links between firms and universities were rare and, in general, related to the provision of skilled workforce. In this sense, innovation was hardly a result of university endeavors but a process led by the import of machinery and the adjustment of foreign technologies to local peculiarities. National innovation systems were being built but they still were far from the ones in the north.

#### 4.4 WASHINGTON CONSENSUS

In a new reality where external funding was limited and the Cold War was coming to an end, the import substitution industrialization became unfeasible in most Latin American nations. New mechanisms of growth had to be found and, throughout the transition initiated by the oil crisis in 1973, the emerging world went into a path of austerity and economic liberalization. The role of the United States as a major partner increased, all the Latin American republics became members of the General Agreement on Tariffs and Trade, or the

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<sup>9</sup> Several scholars dedicated their studies to show how direct State intervention could generate economic growth and innovations. A remarkable paper was published by Stiglitz (2000) where he presents several weaknesses driven by non-interventionism and capital market liberalization.

World Trade Organization, by 2000 and countries as Argentina, Brazil and Uruguay joined the Cairns Group seeking free trade in agriculture (BULMER-THOMAS, 2003).

The importance of the United States in this process of economic liberalization is enormous. Besides being the largest economy of the world, empowered by the Soviet Union's fall, it was the country with greater power over credit mechanisms as the International Monetary Fund and the World Bank. It means that most negotiations in regards of credit and foreign investments would pass through the American politicians or technocrats. To this effect their opinion was highly influential in order to set new policies or economic regimes across the developing world (BULMER-THOMAS, 2003).

Nevertheless, it is inconsistent to affirm that the United States, the World Bank or the International Monetary Fund had one single view about what was going on and how the problems should be solved. Several political and academic debates used to take place, as it happened in the spring of 1989 when John Williamson testified before a congressional committee in the United States in regards of the Brady Plan – a trial of debt renegotiation with mostly Latin American countries. His position was that these nations were undergoing a regime change with the adoption of several austerity measures and, for this reason, deserved to be bailed out (WILLIAMSON, 2008).

After facing some disbelief, Williamson engaged into a project of hosting a conference dedicated to examine if these changes were indeed taking place. It was called *Latin American Adjustment: How Much Has Happened?* and was initiated by a background paper, entitled *What Washington Means by Policy Reform*, where he tried to summarize desirable changes considering the mainstream ideology of the US Government and its technocrats. The paper identified ten policy instruments and was followed by case studies written by different authors proving that real change was taking place in the region (WILLIAMSON, 2008).

Williamson (2008) proposed instruments were: *fiscal discipline*; *re-ordering public expenditure priorities* to benefit basic health care, education and infrastructure; *tax reform*; liberalizing interest rates, or *financial liberalization* as he later formulated; *a competing exchange-rate*; *trade liberalization*; *liberalization of inward foreign direct investment*; *privatization*; *deregulation*; and *property rights*. Of course there were several critics but, in general, the paper was widely accepted not only as desirable policy elements but as instruments that were already being adopted – under different intensities – by most Latin American countries. In other words, the Washington Consensus was not a proposal per se but

a narrative of desirable practices already being used by the region in the pursuit of economic stability and better relations with foreign creditors and investors.

As it will be further discussed in the next items, the Washington Consensus' ideas weren't introduced all at once nor at the same time in every Latin American country. It was a gradual process initiated in the late 1980s and early 1990s that is still present and discussed nowadays in many economies.

#### 4.4.1 Argentina

In Argentina an evident crisis was going on during the 1980s. It was the result of political battles and economic decisions that led to an unstable country where growth was negative, debt was barely unpayable, international reputation was deteriorated and hyperinflation affect both the economy and people's lives. Gerchunoff and Llach (2004) affirm that liberalization policies had to be implemented either by ideology or necessity. That is what happened when the *peronista* Carlos Saúl Menem was elected president in 1989.

Menem had been a member of the *Partido Justicialista* since his early adulthood. He had worked at the national union *Confederación General de Trabajo* and was governed La Rioja twice, being jailed for five during the last military regime. In 1988 he won his party's nomination with a wide support having a strong legitimacy to be the candidate of *Peronismo* and, later, the country's president. The anecdote says, and Menem has shown it in practice, that it is easier for leftists to adopt right wing policies as the complaints aren't going to be so big. That is exactly what happened during the ten years he stayed in power (GERCHUNOFF; LLACH, 2004).

Gerchunoff and Llach (2004) point out that protectionism was substituted by financial globalization due to a cyclical trend: in one hand, international trade was used to open new markets that could benefit the local industry with export gains; on the other hand, opening borders allowed the inflow of foreign investments (specially direct investments) of companies looking for profitable opportunities easily found in emerging countries where productivity and the capital-labor ratio were still low in comparison to the developed world. Furthermore, increasing domestic investments, or savings, meant reducing present consumption. Foreign investments allowed the expansion of production and productivity without restrictions on



employment or consumption. It was a path to reduce demand inflation without affecting life quality.

Whereas import substitution industrialization was marked by an intense State intervention in the market, economic liberalization in Argentina started with a strong market intervention in the State. It started in 1985 when representatives of Bunge & Born, an Argentine multinational corporation, presented Raul Alfonsín a plan developed by the company's economists to reverse the negative trend followed the economy. The current president rejected it. In 1989 the company presented its plan once again, this time to Eduardo Angeloz, a member of Alfonsín's party. It was rejected once again. A few weeks before the election, Bunge & Born tried the opposition candidate, Carlos Menem, who liked the idea and, as the newly elected president, decided to implement it. In order to that, Menem offered the company the possibility of nominating the Minister of Economy, among other staff members of the government. Oddly, the same political group that had kidnapped the directors of Bunge & Born in 1974 was, 15 years later, leaving the economy on their hands. An article published in the New York Times on August 1989 evidences the high level of interaction between the government and this firm:

Miguel Roig, a retired Bunge & Born executive vice president, was Mr. Menem's first Minister of Economy. He died, reportedly of a heart attack, on July 14 and was replaced as minister by the man who had succeeded him at Bunge & Born, Nestor Rapanelli. Another Bunge & Born executive, Orlando Ferreres, is the Secretary of Economic Coordination, in effect Mr. Rapanelli's deputy. (CHRISTIAN, 1989, p. ).

Bunge & Born's reform drastically changed the Argentine economy's structure. Their first measure was cutting all the protection formerly given to the local industry, from export subsidies to State purchases. The public sector was hit by a wave of privatizations, including telecommunications, transportations, steelmaking and petrochemical; and wage restrictions were set to the remaining employees. Currency controls followed the monetarist guidebook and the debt was renegotiated. As in the beginning of 1991 hyperinflation was still unresolved and the GDP continued recessive, Bunge & Born lost the Ministry of Economy to Domingo Cavallo, an economist educated at the Harvard University who had been the president of the *Banco Central de la República Argentina* for one month during the military regime (GERCHUNOFF; LLACH, 2004; HESTON *et al.*, 2012).

Cavallo had also been Menem's Minister of Foreign Relations, accountable for the approximation with the U.S. Government. When nominated to control the economy, his first measure was approving the *Ley de Convertibilidad*, a bill aimed at setting a parity between

the dollar and the peso, outlawing any changes on the rates or even printing pesos above the country's dollar reserves. Summing it up with the new fiscal balance left by Bunge & Born and the economy opening to international trade, inflation started decreasing. Furthermore, the fact that people used to acquire dollars in the black market for either saving or making expensive purchases have ceased to exist. Tax collection improved and the Argentine economy was going into a path of credibility. The economy left its recession achieving early growth rates of 10,496 and 10,305 percent in, respectively, 1990-1991 and 1991-1992 (GERCHUNOFF; LLACH, 2004; HESTON *et al.*, 2012; ROMERO, 2002).

Table 13 GDP's, labor's, capital stock's and TFP's variations calculated as annual averages between 1990 and 1999.

	$\Delta Y$	$\Delta L$	$\Delta K$	$\Delta TFP$
<b>Argentina</b>	4,281%	0,748%	1,805%	2,951%
<b>Brazil</b>	1,696%	0,467%	2,735%	0,214%
<b>Mexico</b>	3,383%	3,154%	3,532%	0,027%

Source: Calculated with data from Heston *et al* (2012).

The 1990s definitely marked a transition to the Argentine economy. Although variations in capital stock were relatively low, it was a period of institutional reform where technical change is accountable for 68,930 percent of the yearly variation of 4,281 percent in the country's GDP. The comparison with the other leading economies of Latin America makes Argentina's achievement even more striking. Respectively, the explanation power of the total factor productivity in Brazil and Mexico was of, respectively, 12,638 and 0,793 percent (HESTON *et al.*, 2012).

All this structural change welcomed a flood of foreign investments. The new inflow of FDIs was multiplied by 22 from 1989 to 1999. Paradoxically, it resulted in a period of deindustrialization as the parcel of manufacturing products in the GDP shrank from 30,949 percent in 1989 to 15,499 percent in 1999. This is explained by the intense competition faced by Argentine firms in the newly opened economy. In the past periods subsidies and protection would allow the existence of firms with high prices and bad quality products. Once these companies had to compete against multinational corporations, their products would not be bought by Argentineans anymore. Finally, it led to a boom in unemployment rates, going from 5,8 percent of the population in 1991 to 14,1 percent in 1999 (WORLD BANK, 2015; RANIS, 2005).

It is noteworthy that although the manufacturing sector's parcel in the GDP shrank, its share in total export remained almost the same (from 35,1 to 31,8 percent). It means that the

companies that already competed in the international market hadn't gone bankrupt as the smaller ones, and kept their share in the economy. Although they might have benefited from State protection in the past, they were not part of the highly dependent firms of the nascent industry (ECONOMIC COMMISSION FOR LATIN AMERICA AND THE CARIBBEAN, 2015).

By the end of his term, social problems have been seriously damaging Carlos Menem's reputation. Besides this, the economy had left its expansionary trend to become recessive. In the period 1998-1999, its GDP had decreased 3,385 percent. It led to the election of Fernando de la Rúa, an oppositional candidate whose promises were based in maintaining the economic stability while distributing the gains through increased employment rates and social policies (GERCHUNOFF; LLACH, 2004; HESTON *et al.*, 2012).

De la Rúa's initial proposal was to cut public expenditure in order to show a signal of austerity that would attract more foreign investments and, thus, reactivate the economy. From 1999 to 2000, the government's general consumption remained practically the same. In the next period it shrank 2,069 percent and in 2001-2002 it varied in -5,078 percent. These changes weren't enough. In the same three periods, the net inflow of foreign direct investments decreased, respectively, 56,568, 79,208 and 0,795 percent. From 2001 to 2002 the economy would decay 10,894 percent achieving the worst result among all the analyzed period (WORLD BANK, 2015; HESTON *et al.*, 2012).

Fernando de la Rúa can't receive all the blame, though. During his term several policies were tried. José Luis Machinea was his first Minister of Economy who tried to solve the problem by cutting the expenditure. His trial was specially harmed by the end of Bill Clinton's administration in the United States – as Clinton was the one behind the Brady Plan for renegotiating Latin American debts. In 2001 Ricardo López Murphy, an economist educated at the University of Chicago, was nominated Minister of Economy. His proposal of drastic cuts in the public expenditure – especially in education – caused intensification on popular protests and he resigned after two weeks. The former minister Domingo Cavallo was then invited to retake the position (GERCHUNOFF; LLACH, 2004).

Cavallo tried to adjust his *Ley de Convertibilidad* by creating a new parameter of parity that would include euro's and dollar's average. Although it didn't cause any internal change, it reduced the government's credibility abroad and the bets were that Argentina would not be able to hold the parity for too long. It generated a bank run and, in response, Cavallo imposed a restriction on cash withdrawals. The political situation became too instable

resulting in the resignation of both Cavallo and de la Rúa in the end of 2001 (GERCHUNOFF; LLACH, 2004).

*Peronismo* was back to the government once again with the president Rodríguez Saá who spent only one week in the office. It was enough to declare the debt's default before ceding the position to Eduardo Alberto Duhalde, who would remain in power until May 2003. In the first week of 2002, Duhalde ceased with the *Ley de Convertibilidad* and initiated a constant devaluation of the national currency aiming at fostering exports and the local industry. During the whole decade, although the presidency changed to Néstor Kirchner (2003-2007) and his wife, Cristina Fernández Kirchner (2007-present), similar economic measures were adopted. It included, besides currency control, the renationalization of several firms, real gains on wages and constant subsidies to local firms (GERCHUNOFF; LLACH, 2004; SANTARCÁNGELO; PERRONE, 2012).

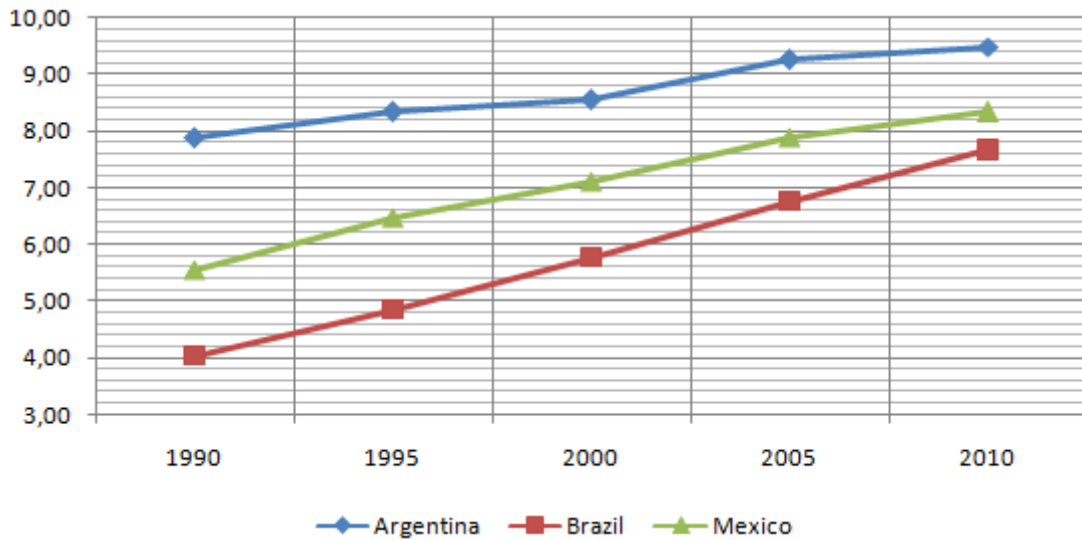
The economy retook its growth. After a decrease of 10,898 percent in 2002-2003, it achieved a growth of 8,837 percent in the following period, sustaining an average yearly growth of 4,077 percent. It is true that it was a similar result from the 1990s – including the manufacturing sector's share in both the GDP and exports – but this time labor had had a stronger role in the variation. Whereas its average yearly growth in the past decade was 0,748 percent, during the 2000s it was 1,438 percent. It responds for the drastic variation in the unemployment rate: from 18,3 percent in 2000 to 7,7 percent in 2010 (WORLD BANK, 2015; HESTON *et al*, 2012).

Table 14 - GDP's, labor's, capital stock's and TFP's variations calculated as annual averages between 2000 and 2010.

	$\Delta Y$	$\Delta L$	$\Delta K$	$\Delta TFP$
<b>Argentina</b>	4,077%	1,438%	1,972%	2,347%
<b>Brazil</b>	3,701%	2,746%	2,679%	0,999%
<b>Mexico</b>	2,276%	0,897%	3,595%	-0,265%

Source: Calculated with data from Heston *et al*. (2012).

The increase in labor's growth with a maintained level of variation in GDP and no changes in the industrial output reflected in slower growths on labor productivity and the total factor productivity. Their annual average variation changed from, respectively, 3,529 to 2,674 percent and 2,951 to 2,347 percent. Although these variations are minimal and, in both cases, they are superior to the other leading economies in Latin America, it confirms the already discussed fact that entrepreneurs tend to innovate more when facing stronger competition once it is highly needed to keep their market share.



Graphic 9 - Educational attainment measured by average years of total schooling in Argentina, Brazil and Mexico, 1990-2010.

Source: Calculated with data from Barro and Lee (2010).

During these twenty years, Argentina maintained itself as the leading Latin American country in schooling attainment. By 2010 the average years of schooling was 9,48. Still, its growth pace had slowed down while Brazil and Mexico are managing to catch up especially in regards of tertiary education where Argentina lost the lead with an average of 0,30 years in 2010 in comparison to 0,39 and 0,62 in Brazil and Mexico, respectively. When taking into consideration general schooling, Argentina's average growth during this period per each five years was 4,759 percent. In Brazil and Mexico it was 17,372 and 10,704 percent (BARRO; LEE, 2010).

Different reasons may be accounted to explain this phenomenon. The first of them regards cuts in the public expenditure. Still, it would only be reasonable for the 1990s during Menem's government. When comparing to the available data, it is possible to notice that trends in average schooling years are reasonably similar in both decades. A second argument would point out to the fact that the largest a certain sector is, the harder it is to achieve new gains. It is the same logic of Solow's Convergence Theory which makes a lot of sense when used to understand Argentina's, Brazil's and Mexico's trends.

Different policies were launched on these two decades in order to boost science and technology. Fanelli (2007) points out to two mechanism of funding created by Menem's administration in order to boost Argentina's universities. The first of them, the *Programa de Incentivo a los Docentes-Investigadores*, aimed at conceding financial benefits to successful research groups, and the *Fondo para el Mejoramiento de la Calidad*, in partnership with the

World Bank, aimed at financing general improvements in the universities. In the same period, as Anllóet *al* (2007) identified in 1990 the creation of the *Ley de Promoción y Fomento de la Innovación Tecnológica* intended to subsidize technological development. In 1994, in a joint initiative with the Inter-American Development Bank, the government created the *Programa de Modernización Tecnológica* (PMT). Through its *Fondo Tecnológico Argentino*, 3,9 percent of the Argentine manufacturing firms had projects funded by 2001. Interestingly, studies point out to the fact that only a small portion of these firms were engaged in technological innovation, especially when these subsidies were non-repayable.

#### 4.4.2 Brazil

Economic regime change didn't occur only in Argentina. Promoted by the Washington Consensus and the Brady Plan, as previously said, it also has taken place in Brazil since the election of President Fernando Collor de Mello in 1990. The new democratic government aimed at boosting the country's competitiveness even if it could cause radical changes, as mass bankruptcies and unemployment. Castro (2011) named it the "carrot and stick" policy, comparing the national industry to a cart, stimulated and forced to move forward.

Collor implemented different pro-market reforms, including privatizations, the reduction of trade barriers and the stimulus to research and development. The *Programa Nacional de Desestatização* resulted in 33 privatized companies between 1990 and 1994 resulting in an income of US\$8,6 billion plus a total debt of US\$3,3 billion transferred to the private sector. It included steel-making industries as the *Siderúrgica Brasileira* and *Usiminas*, and the airline *Viação Aérea São Paulo*. His trade agenda included free exchange rates, the abolishment of import restrictions and tariff reductions. From an average of 32,2 percent in 1990, tariffs were around 14,2 percent in 1993. Finally, R&D spending increased from 0,5 percent of the GDP in 1989 to 1,3 percent in 1994 (CASTRO, 2011; GUERRA, 1997).

Collor also tried to stabilize the economy through different heterodox plans. Further than being unsuccessful, as earlier mentioned, his plans generated massive protests and political seclusion culminating in an impeachment process in 1992. His vice-president, Itamar Franco, took office amid a serious crisis. In 1991-1992, the economy had shrank 0,450 percent; electric energy consumption per capita increased only 0,641 percent, the worst level

since the credit crisis in 1980-1981; the manufacturing sector's output decreased 4,211 percent; and technical change varied -1,179 percent (HESTON *et al.*, 2012; INTERNATIONAL ENERGY AGENCY, 2014; WORLD BANK, 2015).

Itamar Franco would not change the economic liberalization initiated by Fernando Collor. On the other hand, his monetary reform would be far more orthodox, being led by Fernando Henrique Cardoso and his team, which included renowned economists as Gustavo Franco, Armínio Fraga, Edmar Bacha and Pedro Malan. The *Plano Real* created a new currency under a restrictive policy aimed at reducing public and private expenditure while establishing a parity of one real per one dollar – what Gustavo Franco (1998) would later call the *brazilianization* of Domingo Cavallo's *Ley de Convertibilidad*.

Fernando Henrique Cardoso was elected president in 1994 and re-elected in 1998. During his years, *Plano Real* was continued altogether with a pro-market policy that levied circa US\$100 billion in an extensive privatization effort as part of Collor's *Programa Nacional de Desestatização*. These initiatives were part of a process of State modernization led by the Minister Luis Carlos Bresser Pereira whose reforms were inspired by New Public Administration model previously used by Ronald Reagan and Margaret Thatcher. Data for the period between 1990 and 2002 is clear at presenting these policies' outcome: whereas public expenditure grew 17,658 percent, GDP grew 33,798 percent – almost the double (PEREIRA, 2009; GIAMBIAGI, 2011; HESTON *et al.*, 2012; WORLD BANK, 2015).

Bresser Pereira was not the first policy-maker to import Reagan's ideas. The idea that *no industrial policy was the best policy* became a motto for Fernando Collor even with the adoption of the *Nova Política Industrial e de Comércio Exterior*. Once the same line was followed by Fernando Cardoso from 1995 until 2002, it is possible to analyze the outcomes of the 1990s as the results of an intense liberalization process – as it happened in Argentina – accompanied by a solid stabilization process initiated after 1994.

Several authors are extremely critical about the policies adopted (or not adopted) in this period. Erber and Cassiolato (1997), Suzigan and Furtado (2006) and Guerra (1997) affirm that the quick transition from a highly protected economy to an opened one caused problems was deindustrialization, bankruptcies, unemployment and, thus, low growth. Indeed Table 15 clearly evidences a slowdown on economic activity measured by variations in electric power consumption per capita in Brazil. These quantitative losses are also shown on the level of unemployment. In 1991, 6,9 percent of the economically active population had no

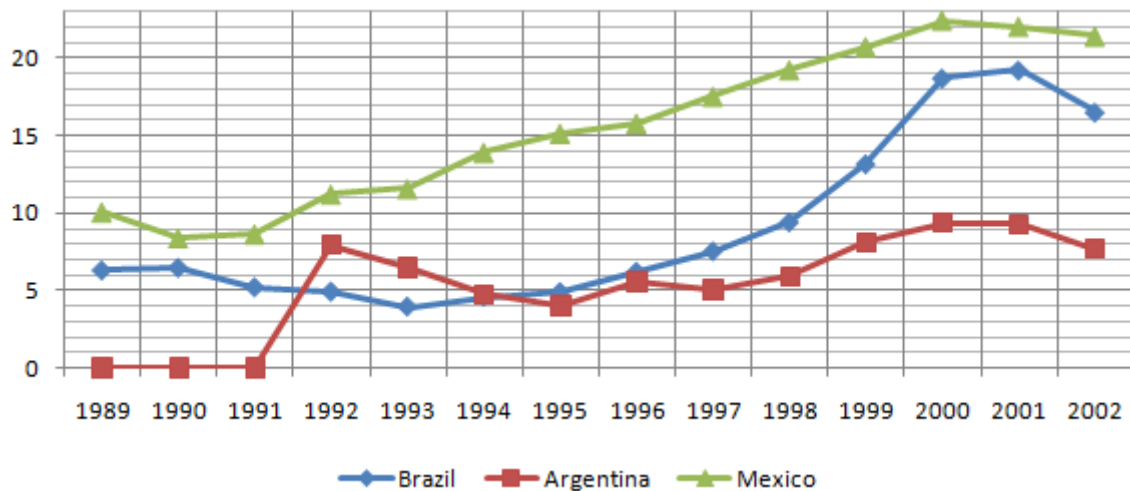
jobs. This level was reduced to 6 percent until the first year of Cardoso's administration. By 2002 it had reached 9,1 percent with a peak of 9,6 percent in 1999 (WORLD BANK, 2015).

Table 15 - Variations in electric power consumption per capita per decade in Brazil, 1971-2009.

Year	1971-1979	1980-1989	1990-1999	2000-2009
<b>Variation in consumption</b>	104,932%	43,119%	26,212%	15,857%

Source: Calculated with data from the International Energy Agency (2014).

On the other hand, qualitative gains are undeniable. The bubble created by protectionism had burst, forcing firms to invest in research and development, increase productivity and improve products. Led by Cardoso's economic stabilization, the parcel of high-technology exports rose from 6,2959 percent in 1989 to 16,5203 percent in 2002, reaching a peak of 19,2461 percent in 2001 – more than the triple of the pre-liberalization index (Graphic 10). Guerra (1997) notes that from 1994 to 1996 increases in production and sales of consumer durable goods accounted around 40 percent, especially for vehicles, electronics and home appliances.<sup>10</sup>



Graphic 10 - Parcel of products with high R&D intensity in total exports of Argentina, Brazil and Mexico, 1989-2002

Source: Calculated with data from the World Bank (2015).

In 2002 Luiz Inácio Lula da Silva was elected president of Brazil. As it was the case of Nestor Kirchner in Argentina, Lula was a representative of the left wing. Still, the Brazilian president didn't implement profound reforms as Kirchner did. Plano Real's orthodoxy was continued but social and industrial policies were strengthened. In regards of the latter, Da

<sup>10</sup> Data for Argentina is not available for 1989, 1990 and 1991.



Silva implemented the *Política Industrial e de Comércio Exterior* (PITCE) in 2003, his first year in the government (SUZIGAN; FURTADO, 2006).

Implemented by the *Agência Brasileira de Desenvolvimento Industrial* (ABDI), the PITCE intended to increase the economic efficiency and spread technological innovations aimed at boosting competitiveness in international trade – a clear response to the flaws exposed by the market opening in the 1990s. Some of the most relevant gains of this policy were (a) the new legislation that included the *Lei de Inovação*, *Lei do Bem*, *Lei de Biossegurança* and the *Política de Desenvolvimento de Biotecnologia*; (b) the creation of institutions as the ABDI and the *Conselho Nacional de Desenvolvimento Industrial* increasing the relationship between firms and the government; (c) improvements in the intellectual property rights regulations through the *Instituto Nacional de Propriedade Intelectual*; and (d) sectoral credit policies implemented by the *Banco Nacional de Desenvolvimento Econômico e Social* (BNDES), as the ones for the pharmaceutical goods and softwares (FERRAZ, 2009).

It is noteworthy the links between the *Lei de Inovação* and the *Lei do Bem* with the Triple Helix concept. The first one regulates public-private partnerships in the development of new technologies, while the second creates tax exemptions to firms engaged in the process of innovation. Both of them are key elements added to the *Fundo Nacional de Desenvolvimento Científico e Tecnológico*, enacted in 1999 by Fernando Henrique Cardoso, aimed at providing sectoral credit for innovation, as did Lula through improvements in the mechanisms of the BNDES (SILVA *et al.*, 2012).

It is possible to point out some evidences after comparing these historical facts with the variations calculated with data from Heston *et al* (2012) as presented on Table 16. The first of them is the negative impact caused by political instability. President Fernando Collor initiated pro-market reforms to increase domestic firms' competitiveness but his government was marked by an intense political instability that led to an impeachment process. As it happened in Argentina in several periods, this instability resulted in a negative average TFP and, consequentially, a decrease on the GDP and on the labor productivity (HESTON *et al.*, 2012).

Table 16 - GDP's, labor's, capital stock's, TFP's and labor productivity's variations calculated as annual averages between 1990 and 2010.

	$\Delta Y$	$\Delta L$	$\Delta K$	$\Delta TFP$	$\Delta Y/\Delta L$
Fernando Collor (1990-1992)	-1,257%	0,750%	1,682%	-2,424%	-1,974%
Itamar Franco (1993-1994)	5,344%	0,659%	1,967%	4,081%	4,654%
Fernando Cardoso (1995-2002)	2,290%	1,411%	3,245%	0,071%	0,906%
Lula da Silva (2003-2010)	4,054%	2,503%	2,734%	1,459%	1,512%

Source: Calculated with data from Heston *et al.* (2012).

In the following two years, Itamar Franco continued the pro-market policies but managed to have enough political stability to implement the *Plano Real* – responsible for drastically reducing inflation rates and balancing most macroeconomic indexes. During his period, gains in capital stock didn't differ much from what happened during Collor's administration, but the average technical change rose from -2,424 to 4,081 percent reaching equality high variations on GDP and labor productivity (HESTON *et al.*, 2012).

From 1995 to 2002, Cardoso intensified the pro-market agenda through an extensive privatization program while maintaining the monetary policy with *Plano Real*. Technical change was nil but gains in capital stock were the highest when compared to all the four post-Washington Consensus administrations. Interestingly, it was during these years that the high-technology sector achieved its peak, composing 16,5203 percent of the total exports in 2002 against 4,8882 percent in 1995. Whereas the industrialization process slowed down, political stability and open-market economy resulted in concentrated gains in international competitiveness (Table 16) (HESTON *et al.*, 2012; WORLD BANK, 2015; ECONOMIC COMMISSION FOR LATIN AMERICA AND THE CARIBBEAN, 2015).

Table 17 - Share of manufacturing sector in the GDP and in total exports, and high-technology goods in total exports for Brazil, 1990-2010.

	<b>Mfct. in GDP</b>	<b>Mfct. in total exports</b>	<b>High-Tech in total exports</b>
<b>1990</b>	17,3%	51,9%	6,5%
<b>1995</b>	16,8%	53,5%	4,9%
<b>2000</b>	15,4%	58,4%	18,7%
<b>2005</b>	15,5%	53,0%	12,8%
<b>2010</b>	13,8%	37,1%	11,2%

Source: Calculated with data from the Economic Commission for Latin America and the Caribbean (2015) and the World Bank (2015).

Lula didn't achieve the same high-technology gains as Cardoso did nor managed to increase the manufacturing sector. On the contrary, it has even decreased as shown on Table

17. The same happened with the competitiveness of high-technology goods whose share in total exports decreased from 18,7 percent in 2000 to 11,2 percent in 2010 even with all the stimulus to research and development. On the other hand, the growing GDP accompanied by an average technical change of 1,459 percent per year shows that Da Silva's policies might have achieved economic growth through distributing technological gains in a decentralized manner (HESTON *et al.*, 2012; WORLD BANK, 2015; ECONOMIC COMMISSION FOR LATIN AMERICA AND THE CARIBBEAN, 2015).

#### 4.4.3 Mexico

The liberalization process started in Mexico right after the debt crisis with De La Madrid and was intensified by presidents Carlos Salinas de Gortari (1989-1994) and Ernesto Zedillo Ponce de León (1995-2000). Data presented by Chong and López-de-Silanes (2005, p. 351) evidences the two contrasting periods of the 1970s, marked by drastic increases in public spending, and the 1980s and 1990s when privatizations took place (*Table 18*). In 1970, the government had control over 272 firms. In 1982, year of the debit crisis, this number had boomed to 1155. Twenty years after, only 210 companies remained under State control.

Table 18 - State-owned firms in Mexico, 1940-2003.

<b>Year</b>	<b>1940</b>	<b>1954</b>	<b>1970</b>	<b>1975</b>	<b>1982</b>	<b>1993</b>	<b>2003</b>
<b>Number of State-owned firms</b>	36	144	272	504	1155	258	210

Source: Adapted from Chong and López-de-Silanes (2005, p. 351).

Chong and López-de-Silanes (2005) also details the privatization process by detailing how each administration performed in this process. During De La Madrid's terms, the largest number of enterprises was released from State control. Still, most of them (249 out of 489) were liquidated while a smaller part was privatized (157 out of 489). During Salinas de Gortari's era, a smaller number of firms were privatized but they represented a larger portion of the total number of State-owned firms: 61,261 against 42,337 percent in the previous period. Furthermore, most of these companies were not liquidated but sold to the private sector (226 out of 408). Whereas De La Madrid intended to reduce the State's size to align its economy to a new model closer to International Monetary Fund's recommendations, Salinas

de Gortari aimed at internationalizing the Mexican economy while intensifying the private sector's role in boosting investments.

Besides privatizations, these governments also engaged into trade reforms aiming at boosting the country's competitiveness and globalizing its economy. Data presented by Dornbusch and Werner (1994, p. 261) evidences these reforms' outcomes which, although quite similar to the ones in Brazil, differ as they took a longer period to be reached (*Table 19*).

Table 19 - Trade protection in Mexico, 1982-1992.

	<b>1982</b>	<b>1986</b>	<b>1992</b>
<b>Average tariff</b>	27,0%	22,6%	13,1%
<b>Imports subject to restrictions</b>	100,0%	28,0%	11,0%

Source: Adapted from Dornbusch *et al.* (1994, p. 261)

Moreno-Brid and Ros (2009) discuss the gains of trade liberalization by showing that it brought radical changes to the Mexican trade pattern. Instead of oil, the country's capitalists directed their investments to the manufacturing sector already after the reforms initiated in 1980s. Considering the period between 1985 and 1994, Mexico ranked fifth in the ranking of countries that increased the most their share in world exports of manufactures. In 1994, the country joined the North American Free Trade Agreement (NAFTA) co-signed by the United States and Canada. In the following ten years (1994-2004) Mexico climbed to the second place in the same ranking – losing only to China – being responsible for 2,8 percent of the manufacturing exports in the world market.

Data presented on Table 20 confirms the industrialization process stimulated by free trade policies and shows a similar trend of what happened in Brazil. The clear difference, in this case, is that in Mexico the process was even more intense, reaching a level of 83,5 percent of manufacturing goods in the total exports in 2000, where 22,5 percent were composed by high-technology goods (an increase of 14,1 percent in ten years) (ECONOMIC COMMISSION FOR LATIN AMERICA AND THE CARIBBEAN, 2015; WORLD BANK, 2015).

Table 20 - Share of manufacturing sector in the GDP and in total exports, and high-technology goods in total exports for Mexico, 1990-2010.

	<b>Mfct. in GDP</b>	<b>Mfct. in total exports</b>	<b>High-Tech in total exports</b>
<b>1990</b>	16,5%	43,5%	8,4%
<b>1995</b>	16,2%	77,7%	15,2%
<b>2000</b>	17,7%	83,5%	22,5%
<b>2005</b>	16,5%	77,1%	19,6%
<b>2010</b>	15,6%	76,0%	16,9%

Source: Calculated with data from the Economic Commission for Latin America and the Caribbean (2015) and the World Bank (2015).

Some negative shocks took place during the structural changes from the 1980s and 1990s. A great parcel of the Mexican manufactured goods was destined to exports. It was the case of the *maquiladoras*, a type of factory created by law in 1965 aimed at receiving raw material from abroad, transforming it into a manufactured product, and re-sold to a foreign country. Once the local industry was export-led, the increased purchase power of the new urban population created a strong demand for imported goods. For several years, Mexico's trade balance recorded deficits weighting exchange rates. In 1995, after the creation of NAFTA, a one-year currency crisis<sup>11</sup> led the country's GDP to a contraction of 6,167 percent (MORENO-BRID, 2009; HESTON *et al*, 2012).

Further than that, the success of exporting industries was quite concentrated in a few sectors and firms. Automobile and auto parts, electronic and electrical equipments and garments accounted for 71 percent of total exports of manufactures in 1994-2003. In the same period, around 300 firms – many of them transnational corporations – were responsible for the majority of Mexico's exports (MORENO-BRID *et al*, 2005; MORENO-BRID; ROS, 2009).

The beginning of the new century would mark a renewal in Mexican politics. After seven decades of heads of State belonging to the *Partido Revolucionario Institucional*, Vicente Fox, from the *Partido Acción Nacional*, was elected president of Mexico. His government, still, didn't put the country's economy into a different path. González (2009) evidenced a strong effort in enacting administrative reforms aimed at boosting the public sector's efficiency and reducing its corruption – same goals as the previous governments'. In the end, the neoliberal post-Washington Consensus matrix of a reduced but productive State was unchanged, and variations in general public expenditure maintained its short pace (WORLD BANK, 2015).

<sup>11</sup> The *Efecto Tequila* is further explained and discussed by Mishkin (1999) and Ffrench-Davis (1997).

Table 21 - Variations in general government final consumption expenditure in Mexico from 1989 to 2012.

	<b>Total variation in government expenditure</b>
<b>Carlos Salinas de Gortari (1989-1994)</b>	26,072%
<b>Ernesto Zedillo Ponce de León (1995-2000)</b>	5,330%
<b>Vicente Fox Quesada (2001-2006)</b>	7,210%
<b>Felipe Calderón Hinojosa (2007-2012)</b>	13,450%

Source: Calculated with data from the WORLD BANK (2015).

As previously noted, the average growth achieved by neoliberal policies was not the same as the one from the import-substitution era. Still, it induced a new process of industrialization in Argentina and Brazil during the 1990s that would be reversed by leftist governments in the 2000s. Interestingly, the same movement took place in Mexico under the pro-market administrations of Fox and Calderón (Table 14). Several reasons are presented by different authors to explain this phenomenon. In the next paragraphs, a greater focus will be given to the inexistence of an industrial policy, lack of domestic credit, rigid regulations and competition against China.

Peters (2003) wrote a paper in the middle of Vicente Fox's term blaming the lack of attention given to the industrial sector. The government, as it happened before in Mexico and other Latin American countries, worked on the thesis that no industrial policy was the best policy, using its administrative reforms and the liberalization process to force the domestic industry to look for improved ways of incrementing its productivity. Indeed low or nil variations in the total factors productivity were a common trace of Argentina, Brazil and Mexico during the neoliberal years and have increased after intervention policies in Argentina and Brazil in the 2000s (*Table 14*). On the other hand, the importance of the manufacturing sector in the total output decreased in the three countries in the last decade, although Mexico adopted different policies to the ones from Argentina and Brazil.

Peters (2003) also mentioned the restrictive credit policies adopted by Mexico as a reason for the industry's slowdown. This argument is shared by Hanson (2010) who blames the poor credit mechanisms in the country. This fact, evidenced by the data presented on Table 22, is helpful to understand the previously mentioned concentration and the lack of innovation in the Mexican industry. Once credit is unavailable to entrepreneurs, only big firms tend to have enough reserves to expand its capital stock (as it indeed happened in the 1990s and 2000s) or to invest in research and development.

Table 22 - Total variations in net domestic credit from 1989 to 2012.

	<b>Total variation in net domestic credit</b>
<b>Carlos Salinas de Gortari (1989-1994)</b>	219,653%
<b>Ernesto Zedillo Ponce de León (1995-2000)</b>	153,417%
<b>Vicente Fox Quesada (2001-2006)</b>	40,499%
<b>Felipe Calderón Hinojosa (2007-2012)</b>	38,611%

Source: Calculated with data from the World Bank (2015).

A third reason, the aggressive competition against China, is pointed out by Hanson (2010) and Arias *et al* (2010). It was earlier argued that Mexico benefited from export-led development in several periods, as in the World Wars or after the creation of NAFTA, making us of different productive schemas under the manufacturing sector, including transnational corporations and the *maquiladoras*. Although the parcel of high-technology goods in total exports was higher in Mexico than in Argentina and Brazil, its manufacturing economy was still specialized in labor-intensive products. Once China's participation in the global market increased, it became extremely difficult to compete against a country where low skilled workforce is vast and cheap. Considering that in the early 2000s above 80 percent of the Mexican total exports were composed by manufactured goods, the competition against China caused a serious harm to the country's industry.

Finally, Hanson (2010) and Arias *et al* (2010) discuss the elevated transaction costs in Mexico. It was affirmed that China disposes of a vast and cheap amount of labor to its industry. Once costs with labor are lower, their total costs are reduced, allowing competitive prices in the international markets. Mexico, on the other hand, has one of the most rigid labor legislation in Latin America. As exposed by Arias *et al* (2010), Mexican payroll taxes are high, and additional costs of hiring and firing and unpredictable legal disputes make it even more expensive to contract workers. Furthermore, as Hanson (2010) affirms, besides having vast oil reserves and being the home country of the world's richest telecommunications mogul, electricity, telephone and internet costs are very high in Mexico. All these factors make international competitiveness extremely hard for Mexican industrials who have poor access to the import-dominated local economy.

#### 4.4.4 Some remarks

Argentina, Brazil and Mexico passed through several difficulties after the oil crisis. More than being affected by the barrel prices, they suffered with the lack of credit that resulted from this crisis. The easy to fund their import-substitution endeavors had ceased and they were faced with the need to look for alternatives to supply their demand for international currencies. The possibility of being assisted by the Brady Plan, the opportunity of being the destination of an increased amount of foreign direct investments and, consequentially, promoting growth without excessive public expenses motivated most Latin American countries to adopt the suggestions proposed by John Williamson at his Washington Consensus.

An intense process of liberalization was initiated in Argentina, Brazil and Mexico in the late 1980s and deepened in the 1990s. Presidents as Carlos Menem, Fernando Henrique Cardoso and Carlos Salinas de Gortari privatized most of their countries' public firms. All of these countries adopted currency controls, establishing a parity with the US Dollar as it happened in Argentina with the *Ley de Convertibilidad* defining that one dollar would be worth one peso. Public consumption was drastically controlled and, although it didn't decrease in most cases, its variations were below the GDP's growth.

Two different analyses are to be made in regards of this period. The first one regards growth accounting, including variations on the GDP, capital stock, total factors productivity and labor productivity. The second one is more specific to the process of industrialization, encompassing the manufacturing sector's output, its parcel in the economy, its competitiveness and the level of technology aggregated to the produced goods.

Beginning with the first analysis, related to the growth accounting, Argentina was definitely an outlier during the 1990s. It was in this period that the country enjoyed political stability for the first time and, accompanied by the economic reforms, the yearly average variation on the technical change was 2,951 percent – the greatest for the whole period calculated at this study. Although no clear industrial policy was enacted, the country had a well-educated labor force ready to serve the incoming technologies from foreign investments. This variation explained in 68,930 percent the annual average increase of 4,281 percent in the GDP, similar to the one achieved in the 1960s. On the other hand, Mexico and Brazil had almost nil variations on their total factors productivity. The Brazilian growth was the lowest



for all the six decades and the gains of the Mexican GDP only surpassed the ones in the 1980s. Interestingly, Brazil and Mexico were also destinations of a reasonably high amount of foreign investments, explaining variations in their stock capital above the one achieved by Argentina. Still, they were not enough to provoke any technological change in the period.

If the three countries engaged in similar liberalization processes, why technical change was representative in only of them? As political instability was used to explain Argentina's economic failure since the presidency of Juan Domingo Peron, the existence of one decade of a politically and economically stable regime when both output and technical change reached their best paces makes evident that politics is a key element to motivate or demotivate entrepreneurs to engage into new or greater endeavors. The fact that Brazil and Mexico didn't enjoy the same technical change as Argentina even though they also had relatively stable regimes in the 1990s points out to the *change factor* lived by the Argentine population<sup>12</sup>. The country of Carlos Menem have been the most educated one in Latin America but its people, and especially its entrepreneurs, had their economic spirit repressed by all the instability. Once profit became achievable through open market and diminished political influence, entrepreneurship flourished.

In the 2000s, Mexico continued its neoliberal reforms while left-wing presidents were elected in Argentina and Brazil. Besides the instability caused by the failure of Fernando de la Rúa to manage the Argentine economic crisis in the early 2000s, Nestor Kirchner to re-establish stability in the country since his election in 2003. Once again, Argentina's TFP increased at a yearly average pace above two percent and represented 57,578 percent of the economy's growth. Brazil accelerated its growth pace surpassing Mexico and achieving an average variation on its total factors productivity four times greater than the one in the last decade. Interestingly, variations in stock capital remained almost unchanged in Argentina and Brazil, while variations in labor went from 0,748 and 0,467 percent in the 1990s to 1,438 and 2,746 percent in the 2000s. It shows that the 1990s liberalization and stabilization processes allied with the subsidies enacted by Kirchner and Lula reduced unemployment by decentralizing financial gains and creating a more inclusive economy. As earlier presented, it goes in agreement to the argument made by Acemoglu and Robinson (2013) that inclusive economic and political institutions are key elements to promote growth.

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<sup>12</sup> It is true that a regime change also occurred in Brazil with the end of the military period. Still, all the political and economic transformation took place at a slow pace being initiated by president Ernesto Geisel in the late 1970s.

On the other hand, Mexico didn't manage to grow as fast as Argentina and Brazil in the 2000s. Its reforms facilitated the income of foreign investments, represented by the increased gains in capital stock, but its industrial sector kept concentrated in the hand of few entrepreneurs. Furthermore, the reforms reduced the State's size but weren't successful in reducing transaction costs, making it very expensive to produce in Mexico. Once China's participation in the international economy grew, Mexico ended up losing competitiveness and, thus, growth potential.

Finally, the second analysis regards the process of industrialization led by these neoliberal reforms and, in the cases of Argentina and Brazil, the influence of subsidies in the 2000s. In order to better understand what happened during these two decades, data already presented in this study was reorganized as shown on Tables 23 and 24.

Table 23 - The manufacturing sector's share in the GDP and total exports in Argentina, Brazil and Mexico in 1990, 2000 and 2010.

	<b>Argentina</b>		<b>Brazil</b>		<b>Mexico</b>	
	<b>Mft. in GDP</b>	<b>Mft. in Exp.</b>	<b>Mft. in GDP</b>	<b>Mft. in Exp.</b>	<b>Mft. in GDP</b>	<b>Mft. in Exp.</b>
<b>1990</b>	21,701%	29,100%	17,267%	51,900%	16,451%	43,500%
<b>2000</b>	18,205%	32,500%	15,432%	58,400%	17,742%	83,500%
<b>2010</b>	19,676%	33,200%	13,778%	37,100%	15,601%	76,000%

Source: Calculated with data from the Economic Commission for Latin America and the Caribbean (2015) and the World Bank (2015).

Table 24 - High-technology goods' share in total exports in Argentina, Brazil and Mexico in 1990, 2000 and 2010.

	<b>Argentina</b>	<b>Brazil</b>	<b>Mexico</b>
<b>1990</b>	n.a.	6,461%	8,429%
<b>2000</b>	9,352%	18,727%	22,451%
<b>2010</b>	7,505%	11,208%	16,938%

Source: World Bank (2015).

First of all, besides Mexico, liberalization caused a decrease in the share of the manufacturing sector in the economies of Argentina and Brazil. As it was expected, a number firms lacked quality – including machinery, technology, administrative methods, etc – and didn't succeed when competing against multinational corporations and other international exporters. On the other hand, it was successful in forcing national industrialists to improve their productivity and invest in technology, more than doubling the parcel of high-technology goods in total exports and the manufacturing sector, as a whole, in total exports. It means that,

although many firms ceased existing, the remaining ones became good enough to compete in the international level.

In the next decade, relative deindustrialization kept happening in Brazil and was initiated in Mexico. China's ability to produce manufactured goods at a lower cost definitely played an import role in this process and was favored by the inability of Brazil and Mexico to reduce their transaction costs. In the specific case of Brazil, Lula's social policies subsidizes did help the country to distribute economic gains, but it was not helpful in stimulating innovation and entrepreneurship.

On the other hand, the situation in Argentina kept improving. Besides losses in the high-technology sector, the industrialization process didn't slow down increasing the manufacturing sector's share in both the GDP and total exports. Once the new policies were fairly similar to the ones adopted by Lula in Brazil, it is possible to deduce that the results obtained in the 2000s were still being caused by the repressed entrepreneur spirit released by the economic and political post-Menem stability.

## 5 CONCLUSIONS

This study was aimed at finding out the role of institutions in the process of innovation and industrialization in Argentina, Brazil and Mexico from 1950 to 2010. Its understanding of institutions lied both in the rules of the game, as a broad concept, and on concrete bodies created by different governments in order to pursue specific goals. Innovation and industrialization were discussed as the phenomena in which new methods or new products are inserted in market economies by public or private entrepreneurs usually motivated by the possibility of obtaining profit. More specifically, industrialization regards the use of different tools and machinery, identified as capital stock, capable of increasing labor productivity.

An evolutionary approach was used to understand historical events with a specific emphasis on the relationship between governments, firms and universities. This approach had been extensively discussed and used by scholars engaged into the Triple Helix theory. Furthermore, these historical events were compared to numerical data calculated through the neoclassical macroeconomic growth model, developed by Solow (1956, 1957), which gives special attention to variations in labor, capital stock and the total factors productivity to explain changes in an economy's output. Particularly important, the TFP, also understood as technical change, was seen as a measure of institutional or productive changes. Finally, secondary data made available by other researchers and data banks, as the World Bank, was used to confirm the hypotheses presented during this study.

The first historical analysis develop to initiate the study was based on a literature review aimed at understanding the industrial evolution of Argentina, Brazil and Mexico until 1950, so that it was possible to identify their strengths and weaknesses in regards of innovation and economic growth. First of all, it was noted that all the three countries had already developed a certain level of industrialization, although their industrial output was still small when compared to the developed world. Argentina was an outlier mainly due to its vast availability of skilled labor force and its advanced manufacturing sector, which in 1950 had already surpassed the agriculture's output. Mexico was geographically privileged, being located besides the United States and benefiting by the American unsupplied demand for manufactured goods during the two World Wars and the 1929 Crisis. Brazil lacked skilled workforce and was not close to any rich country but benefited – as Argentina and Mexico did – from protectionist policies that helped the development of an infant industry. Market-

oriented innovation, as far as literature evidenced, was restricted to the initiative of a few industrialists representing above-all outlying experiences.

The post-II World War period was marked by an intense process of import substitution policies including exchange rate controls, special tariffs, subsidies and import quotas, among other protectionist policies. It is undeniable that radical changes occurred in this period. In the 1950s, both Brazil and Mexico achieved average growth rates above 6 percent per year which had at least half of it explained by technical change. In the 1960s, all the three countries grew at an accelerated pace pushed once again by increased rates of technical change.

Although Argentina entered the 1950s with extremely favorable conditions, it was a negative outlier. Its political scenario was a powder keg with several internal conflicts and coups. The impact of this instability was quite clear in the variations on the total factors productivity in the 1950s: while Brazil's and Mexico's annual averages were 3,604 and 3,827 percent, Argentina's was -0,391 percent. In this sense, the main cause for Argentina's slow growth in the 1950s was the lack of predictability in regards of its economic and political events. Once national and international entrepreneurs were unsure of what was to happen, their willingness to invest and innovate was restricted, creating a correlation between political stability and industrialization.

It is true that the political situation in Brazil was not totally stable. In the 1960s the country passed through a presidential renounce and military coup. Nonetheless, most of the Brazilian presidents had enough legitimacy and credibility to implement their economic policies which included a strong support to the industrial sector. That is why the country achieved an average GDP growth of 7,190 percent per year with an elevated variation on the TFP in the same decade when different political conflicts occurred. Further than that, it was thanks to the economic and political stability built by the military regime in Brazil, and the *Partido Revolucionário Institucional* in Mexico, that both countries maintained their accelerated growth pace in the 1970s while rich countries were struggling with the Oil Crisis.

Before going into what occurred in and after the 1970s, it is important to discuss the relationship between industrialization and innovation in the post-II World War period. The fact that a firm is increasing its capital stock does not imply automatically that it is innovating. Importing machinery and incoming foreign direct investments do increase the amount of technology in a certain country. Still, to produce its own technology a firm should invest in research and development through its own means – in a specific internal department, for example – or through a partnership with universities. Although public investment in

education was being increased and new bodies were being created in order to stimulate science and technology, evidence of research and development in Argentina, Brazil and Mexico is very scarce when compared to developed countries. Once most of the industrializing efforts were inward-looking and aimed at substituting goods that were not being imported anymore – or were being imported at higher prices – there were few or no incentives to compete with foreign firms, resulting in few or no reasons to innovate. In this sense, the period was marked by an intense industrialization process but infrequent innovative efforts.

As it was said, the world faced a severe crisis in the 1970s caused by drastic increases in oil prices. In this decade, it didn't affect Argentina and Brazil directly. Both countries maintained their access to international money through loans and foreign direct investments and, with a good level of stability, Brazil achieved its best decade in the century with an average yearly growth above eight percent. Argentina, as it had already happened, kept suffering due to its political instability.

Despite its high growth indexes, Mexico followed a different path than Brazil. Instead of continuing to balance growth and stabilization, Mexico's government decided to increase public spending to decentralize economic gains. This model of growth based on government consumption was sustained by new oil reserves – discovered in a period when barrel prices were extremely high. In the early 1980s when oil prices started going down and international credit was unavailable due to the crisis, Mexico declared its moratorium and had to cut its spending in order to be helped by the International Monetary Fund.

In the 1970s, at the same moment when Mexico was suffering from the Dutch disease as most of its investments were migrating from the manufacturing to the mining sector, Brazil kept its high rates of investment at its industrialization. It explains the average increase of 8,960 percent per annum in capital stock and, consequentially, 2,900 percent in technical change – caused once again by imports of machinery and technology. In this decade, Mexico lagged behind with a technical change average below one percent per year, as it happened in Argentina.

In the 1980s, due to the lack of credit to finance the import-substitution industrialization, this economic model was strangled and all the three Latin American countries had negative variations at their total factors productivity. Understanding the impossibility to keep the same kind of policies, most governments started engaging into new policies, directed to attract as more foreign investments as possible.

It all culminated in the pro-market reforms summarized by the Washington Consensus and stimulated by the Brady Plan. From the late 1980s on, Argentina, Brazil and Mexico would assume a neoliberal attitude, privatizing most of its public enterprises, eliminating tariffs and other trade barriers, over valuating their currencies and reducing subsidies. The results were mixed.

Argentina enjoyed its first decade of political stability since the election of Juan Domingo Perón in 1946. It pushed entrepreneurs to liberate their repressed willingness to invest and, helped by the high skilled labor force available, the country achieved an average yearly growth of 4,281 percent explained in 68,930 percent by its high variation in technical change. As political instability was the reason for poor economic results and unchanged institutions, the stability established by Carlos Menem explained the Argentine success.

On the other hand, as it also happened in Brazil and Mexico, the role of the manufacturing sector in the GDP decreased. It was a direct effect of the competition imposed by the newly imported products. Once local firms didn't have to compete against foreign companies, their production's quality was limited and unfit to an open-market economy. These bankruptcies also affect unemployment rates which rose from 5,8 (1991) to 18,3 percent (2001) in Brazil and 6,9 (1991) to 9,3 (2001) percent in Argentina.

At the same time open-market economy was extremely negative to subsidized entrepreneurs who have gone bankrupt when the inefficiency bubble burst, it was an incentive to innovate to the remaining entrepreneurs. It is shown by the data on exports. In all the three countries, during the 1990s, both exports of manufacturing and high-technology goods increased. In Brazil, the share of high-technology goods in total exports rose from 6,5 percent in 1990 to 18,7 percent in 2000. In Mexico, the parcel of manufacturing goods in total exports jumped from 43,5 percent in 1990 to 83,5 percent in 2000.

Three important understandings should be extracted from this decade. The first of them is that, as it was earlier said, industrialization and innovation are neither synonymous nor interconnected phenomena. It is possible to have high levels of industrialization and low levels of innovation, and *vice-versa*. The second one, also mentioned, is the importance of political stability to achieve economic growth and technical change. The third lies on the fact that, whereas protection and subsidies are important elements to promote industrial growth, it is competition and profit that push entrepreneurs to innovate.

Finally, Argentina and Brazil started moving into another direction in the 2000s. Their governments maintained a neoliberal structure but adopted, once again, protectionist policies as the devaluating their currencies and implementing different schema of subsidies. Although unemployment was reduced in both countries – especially in Brazil, shrinking from 18,3 in 2001 to 7,7 percent in 2010 – their final outcomes varied.

Argentina faced some political conflicts after the election of Fernando de la Rúa, but Nestor Kirchner was able to regain stability and push domestic and foreign entrepreneurs to invest in the country. During this decade, the economy kept its growing pace with an elevated technical change while presented gains in the manufacturing sector's size and competitiveness. Brazil also achieved a higher growth, mostly pushed the drastic decrease on unemployment rates, but its manufacturing sector suffered big losses. While its parcel in the output decreased from 15,4 percent in 2000 to 13,8 percent in 2010, its share in total exports shrank from 58,4 to 37,1 percent in the same period. High-technology exports also followed the same path: 18,7 percent in 2000 to 11,2 percent in 2010.

Mexico's situation in the 2000s is not directly comparable to Argentina and Brazil as its government didn't implement any kind of protectionism in this decade, following the same liberalization trend pursued in the 1990s. As a consequence, all of its results for the decade were negative. Unemployment, although low, increased, the economy grew at a slow pace with negative technical change and the manufacturing sector not only shrank but also lost competitiveness.

If it was argued that an open-market serves as a stimulus to competition, why hasn't Mexico succeeded in the 2000s? The evidence points out to weak institutions inherited from the previous decades. High transaction costs caused by rigid regulations and monopolistic prices in basic services as telecommunications and electricity reduced Mexico's competitiveness in a period when countries as China were increasing their share in global markets. Indeed the same could have happened in Argentina and Brazil but firms from these two countries could count on some protection schemas and were not inserted into the global market of manufacturing goods as Mexico was.

Finally, a common point between all the three countries was the lack of interaction between firms and universities. It is true that the government of Argentina, Brazil and Mexico acted to modernize their educational and research institutions aiming at a greater interaction with businesses to develop new technologies. Still, universities have functioned more as providers of skilled labor force than as business-partners or innovators.



After-all there is no pure formula to promote industrialization and innovation. Once the same rules may generate different outcomes depending on the economy's conditions, one government must be very cautious when planning its policies or reforms. What it should take into consideration are general lessons from the sixty years between 1950 and 2010. They are the importance of institutional stability to originate domestic and foreign investments, government action to create preconditions to the development of a nascent industry and to reduce transaction costs to existent players and open market competition to motivate entrepreneurs to engage into research and development practices to innovate and promote gains in the international level.

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APPENDIX A – Calculated data for Argentina<sup>13</sup>

Period <sup>14</sup>	$\Delta Y$ <sup>15</sup>	$\Delta L$ <sup>16</sup>	$\Delta K$ <sup>17</sup>	$\Delta TFP$ <sup>18</sup>	$\Delta Y/\Delta L$ <sup>19</sup>
1950-1951	5,906%	3,339%	6,647%	0,942%	2,485%
1951-1952	-5,956%	-7,063%	4,376%	-4,514%	1,191%
1952-1953	4,220%	7,921%	4,528%	-2,034%	-3,430%
1953-1954	3,256%	2,610%	3,903%	0,011%	0,630%
1954-1955	6,985%	5,133%	4,504%	2,161%	1,761%
1955-1956	2,637%	-0,242%	3,615%	0,984%	2,887%
1956-1957	3,843%	4,407%	4,005%	-0,366%	-0,540%
1957-1958	6,604%	2,797%	4,338%	3,050%	3,704%
1958-1959	-4,843%	-5,305%	3,274%	-3,754%	0,488%
1959-1960	10,865%	4,021%	6,557%	5,598%	6,580%
1960-1961	3,254%	3,041%	6,772%	-1,621%	0,207%
1961-1962	0,640%	-3,913%	4,148%	0,591%	4,738%
1962-1963	-3,672%	-5,424%	2,239%	-2,014%	1,852%
1963-1964	7,772%	4,550%	3,928%	3,528%	3,082%
1964-1965	9,199%	4,509%	3,764%	5,056%	4,488%
1965-1966	0,236%	-2,334%	3,075%	-0,088%	2,632%
1966-1967	2,787%	-0,099%	3,080%	1,324%	2,890%
1967-1968	5,165%	1,389%	3,463%	2,757%	3,724%
1968-1969	9,166%	4,608%	4,871%	4,428%	4,357%
1969-1970	3,197%	3,676%	4,514%	-0,891%	-0,463%
1970-1971	3,761%	0,907%	4,760%	0,960%	2,828%
1971-1972	2,078%	0,744%	4,436%	-0,481%	1,324%
1972-1973	3,744%	0,748%	3,450%	1,668%	2,974%
1973-1974	5,406%	0,375%	3,428%	3,531%	5,013%
1974-1975	-0,593%	-4,259%	3,228%	-0,013%	3,829%
1975-1976	-0,011%	5,301%	3,724%	-4,537%	-5,045%
1976-1977	6,384%	2,729%	4,956%	2,561%	3,559%
1977-1978	-3,221%	-0,950%	3,405%	-4,411%	-2,293%

<sup>13</sup> All the data that was used to calculate the results presented on the three annexes were extracted from *Heston et al* (2012).

<sup>14</sup> According to what was already denoted for  $\Delta$  the period 1950-1951 means, for example,  $\Delta V_{1950-1951} = \frac{V_{1951} - V_{1950}}{V_{1950}}$ .

<sup>15</sup> Variation on GDP calculated according to the previously stated variation. It takes into consideration the “Real GDP at constant 2005 national prices (in mil. 2005US\$)”.

<sup>16</sup> The measure of labor was calculated by multiplying the “Number of persons engaged (in millions)” by the “Average annual hours worked by persons engaged”. Its variation was calculated as previously stated.

<sup>17</sup> Variation on capital stock calculated according to the previously state variation. It takes into consideration the “Capital stock at constant 2005 national prices (in mil. 2005US\$)”.

<sup>18</sup>  $\Delta TFP = \Delta Y - (\beta \cdot \Delta L + \alpha \cdot \Delta K)$  where  $\beta$  is the “Share of labor compensation in GDP at current national prices” and  $\alpha$  is the share of capital stock compensation in GDP calculated as  $\alpha = 1 - \beta$ .

<sup>19</sup> “Real GDP at constant 2005 national prices (in mil. 2005US\$)” is divided by the amount of labor previously stated as “Number of persons engaged (in millions)” multiplied by “Average annual hours worked by persons engaged”. The variation is then calculated.

1978-1979	7,017%	0,468%	3,648%	4,987%	6,519%
1979-1980	1,453%	0,923%	3,724%	-0,846%	0,525%
1980-1981	-5,417%	2,900%	2,748%	-8,242%	-8,082%
1981-1982	-3,161%	3,188%	1,455%	-5,498%	-6,153%
1982-1983	4,112%	-0,140%	1,833%	3,283%	4,258%
1983-1984	2,005%	1,449%	1,864%	0,353%	0,549%
1984-1985	-6,956%	0,903%	1,533%	-8,169%	-7,789%
1985-1986	7,144%	-1,537%	1,434%	7,221%	8,817%
1986-1987	2,533%	3,404%	1,515%	0,057%	-0,843%
1987-1988	-1,953%	0,804%	1,465%	-3,081%	-2,735%
1988-1989	-7,011%	0,957%	0,637%	-7,810%	-7,892%
1989-1990	-1,339%	0,829%	0,271%	-1,894%	-2,150%
1990-1991	10,496%	1,739%	0,799%	9,219%	8,607%
1991-1992	10,305%	0,824%	1,480%	9,158%	9,403%
1992-1993	6,252%	0,077%	2,058%	5,201%	6,170%
1993-1994	5,836%	-0,002%	2,723%	4,476%	5,839%
1994-1995	-2,845%	3,078%	1,616%	-5,138%	-5,747%
1995-1996	5,527%	0,923%	1,858%	4,072%	4,562%
1996-1997	8,111%	-0,389%	2,592%	6,749%	8,534%
1997-1998	3,850%	0,134%	2,791%	2,188%	3,711%
1998-1999	-3,385%	0,265%	1,862%	-4,525%	-3,641%
1999-2000	-0,789%	-0,188%	1,149%	-1,338%	-0,602%
2000-2001	-4,409%	-0,208%	0,530%	-4,599%	-4,210%
2001-2002	-10,894%	-15,648%	-0,392%	-5,000%	5,635%
2002-2003	8,837%	8,401%	0,758%	5,372%	0,402%
2003-2004	9,030%	8,238%	1,788%	4,834%	0,731%
2004-2005	9,179%	8,979%	2,420%	4,150%	0,184%
2005-2006	8,466%	3,942%	3,080%	5,019%	4,352%
2006-2007	8,653%	0,538%	3,564%	6,388%	8,072%
2007-2008	6,758%	1,874%	3,402%	4,012%	4,794%
2008-2009	0,850%	-1,512%	2,556%	0,040%	2,398%
2009-2010	9,161%	1,401%	2,836%	6,941%	7,653%

## APPENDIX B – Calculated data for Brazil

<b>Period</b>	<b><math>\Delta Y</math></b>	<b><math>\Delta L</math></b>	<b><math>\Delta K</math></b>	<b><math>\Delta TFP</math></b>	<b><math>\Delta Y/\Delta L</math></b>
1950-1951	4,897%	3,118%	2,988%	1,837%	1,725%
1951-1952	9,509%	3,136%	3,695%	6,123%	6,179%
1952-1953	5,082%	3,155%	2,113%	2,394%	1,868%
1953-1954	8,204%	3,173%	3,056%	5,083%	4,876%
1954-1955	6,455%	3,192%	2,884%	3,401%	3,162%
1955-1956	3,630%	3,212%	2,453%	0,758%	0,405%
1956-1957	10,041%	3,232%	4,220%	6,366%	6,596%
1957-1958	6,382%	3,252%	3,813%	2,879%	3,032%
1958-1959	7,711%	3,273%	5,147%	3,598%	4,298%
1959-1960	7,762%	3,293%	4,414%	3,967%	4,327%
1960-1961	14,073%	2,368%	8,274%	9,059%	11,435%
1961-1962	5,173%	2,415%	4,779%	1,699%	2,693%
1962-1963	6,446%	2,463%	3,646%	3,453%	3,888%
1963-1964	4,163%	2,513%	3,974%	0,996%	1,610%
1964-1965	6,970%	2,563%	4,420%	3,575%	4,296%
1965-1966	3,964%	2,615%	4,608%	0,456%	1,315%
1966-1967	5,734%	2,668%	3,738%	2,587%	2,986%
1967-1968	11,200%	2,722%	4,857%	7,521%	8,253%
1968-1969	6,415%	2,776%	7,574%	1,489%	3,540%
1969-1970	10,923%	2,832%	6,724%	6,347%	7,868%
1970-1971	11,340%	4,048%	7,805%	5,609%	7,008%
1971-1972	11,940%	3,804%	8,965%	5,824%	7,838%
1972-1973	13,970%	11,423%	9,647%	3,342%	2,286%
1973-1974	8,150%	1,513%	9,679%	2,978%	6,538%
1974-1975	5,170%	1,716%	9,814%	-0,174%	3,396%
1975-1976	10,260%	1,922%	10,384%	4,547%	8,181%
1976-1977	4,930%	8,287%	9,026%	-3,688%	-3,100%
1977-1978	4,970%	1,971%	8,869%	-0,091%	2,941%
1978-1979	6,760%	-2,597%	8,686%	4,302%	9,607%
1979-1980	9,230%	-2,187%	9,117%	6,352%	11,673%
1980-1981	-4,250%	3,079%	6,897%	-9,039%	-7,110%
1981-1982	0,830%	4,457%	5,511%	-4,099%	-3,472%
1982-1983	-2,930%	-0,214%	4,382%	-4,776%	-2,722%
1983-1984	5,400%	4,197%	3,810%	1,376%	1,154%
1984-1985	7,849%	8,736%	2,801%	1,772%	-0,816%
1985-1986	7,490%	-0,316%	4,834%	5,499%	7,831%
1986-1987	3,530%	2,424%	4,224%	0,299%	1,080%
1987-1988	-0,060%	2,328%	3,727%	-3,015%	-2,334%
1988-1989	3,160%	1,695%	3,593%	0,615%	1,440%
1989-1990	-4,350%	1,702%	1,895%	-6,139%	-5,951%

1990-1991	1,030%	0,486%	1,602%	0,044%	0,542%
1991-1992	-0,450%	0,064%	1,548%	-1,179%	-0,513%
1992-1993	4,836%	0,319%	1,594%	3,915%	4,503%
1993-1994	5,852%	1,000%	2,340%	4,248%	4,805%
1994-1995	4,224%	1,088%	3,848%	1,952%	3,102%
1995-1996	2,151%	-2,615%	3,821%	1,951%	4,893%
1996-1997	3,375%	0,375%	4,321%	1,185%	2,989%
1997-1998	0,035%	0,846%	3,840%	-2,168%	-0,804%
1998-1999	0,254%	1,405%	2,536%	-1,666%	-1,135%
1999-2000	4,306%	5,741%	2,772%	-0,062%	-1,357%
2000-2001	1,313%	0,711%	2,619%	-0,273%	0,598%
2001-2002	2,658%	3,733%	2,201%	-0,354%	-1,036%
2002-2003	1,147%	1,439%	1,809%	-0,470%	-0,288%
2003-2004	5,712%	5,310%	2,148%	1,930%	0,382%
2004-2005	3,160%	2,824%	2,142%	0,660%	0,327%
2005-2006	3,957%	2,095%	2,562%	1,644%	1,824%
2006-2007	6,091%	1,218%	3,134%	3,987%	4,814%
2007-2008	5,163%	3,244%	3,687%	1,718%	1,858%
2008-2009	-0,331%	0,640%	2,831%	-1,940%	-0,965%
2009-2010	7,534%	3,252%	3,559%	4,146%	4,147%

## APPENDIX C – Calculated data for Mexico

<b>Period</b>	<b><math>\Delta Y</math></b>	<b><math>\Delta L</math></b>	<b><math>\Delta K</math></b>	<b><math>\Delta TFP</math></b>	<b><math>\Delta Y/\Delta L</math></b>
1950-1951	9,659%	1,138%	1,703%	8,200%	8,425%
1951-1952	3,796%	1,138%	2,117%	2,102%	2,629%
1952-1953	-0,734%	1,137%	1,929%	-2,322%	-1,851%
1953-1954	10,931%	1,138%	2,474%	9,034%	9,683%
1954-1955	8,216%	1,171%	2,995%	6,008%	6,963%
1955-1956	8,030%	1,398%	4,321%	4,970%	6,541%
1956-1957	8,065%	1,398%	4,470%	4,921%	6,575%
1957-1958	4,468%	1,397%	3,482%	1,885%	3,028%
1958-1959	2,072%	1,397%	3,205%	-0,353%	0,666%
1959-1960	8,950%	1,448%	3,817%	6,155%	7,395%
1960-1961	2,846%	2,347%	5,026%	-1,024%	0,488%
1961-1962	3,912%	2,347%	3,494%	0,913%	1,530%
1962-1963	9,624%	2,347%	4,482%	6,064%	7,111%
1963-1964	13,673%	2,347%	5,721%	9,409%	11,067%
1964-1965	5,580%	2,538%	6,336%	0,882%	2,967%
1965-1966	6,191%	2,677%	6,471%	1,357%	3,423%
1966-1967	5,675%	2,677%	6,221%	0,984%	2,920%
1967-1968	9,065%	2,677%	7,070%	3,890%	6,221%
1968-1969	3,651%	2,677%	5,433%	-0,593%	0,949%
1969-1970	6,615%	2,917%	5,450%	2,258%	3,593%
1970-1971	4,171%	5,257%	4,603%	-0,714%	-1,031%
1971-1972	8,488%	5,489%	5,520%	2,981%	2,843%
1972-1973	8,409%	5,582%	6,052%	2,560%	2,678%
1973-1974	6,111%	5,647%	6,528%	-0,037%	0,439%
1974-1975	5,611%	6,415%	6,837%	-1,044%	-0,756%
1975-1976	4,239%	4,538%	6,351%	-1,330%	-0,286%
1976-1977	3,443%	4,537%	4,927%	-1,316%	-1,047%
1977-1978	8,250%	5,067%	5,927%	2,694%	3,029%
1978-1979	9,155%	6,263%	7,167%	2,378%	2,722%
1979-1980	8,324%	6,409%	8,005%	1,008%	1,799%
1980-1981	8,794%	3,305%	9,352%	2,051%	5,313%
1981-1982	-0,707%	3,137%	5,581%	-5,233%	-3,727%
1982-1983	-4,296%	0,081%	1,535%	-5,204%	-4,373%
1983-1984	3,600%	3,904%	2,159%	0,687%	-0,293%
1984-1985	2,772%	4,725%	2,778%	-0,846%	-1,865%
1985-1986	-3,754%	3,109%	2,260%	-6,380%	-6,656%
1986-1987	1,856%	3,498%	1,933%	-0,752%	-1,586%
1987-1988	1,245%	3,568%	2,463%	-1,694%	-2,243%
1988-1989	4,198%	3,879%	1,903%	1,443%	0,308%
1989-1990	5,068%	3,718%	2,665%	1,949%	1,302%



1990-1991	4,222%	3,447%	3,314%	0,851%	0,750%
1991-1992	3,629%	2,292%	4,298%	0,196%	1,307%
1992-1993	1,951%	1,439%	4,190%	-1,052%	0,505%
1993-1994	4,415%	3,679%	4,744%	0,135%	0,710%
1994-1995	-6,167%	-1,078%	1,194%	-6,503%	-5,144%
1995-1996	5,153%	5,592%	2,161%	1,730%	-0,415%
1996-1997	6,772%	8,098%	3,215%	1,687%	-1,227%
1997-1998	5,030%	-0,455%	4,667%	2,363%	5,510%
1998-1999	3,757%	4,804%	4,872%	-1,089%	-1,000%
1999-2000	6,591%	-0,854%	5,095%	3,922%	7,509%
2000-2001	-0,033%	-1,181%	4,704%	-2,260%	1,162%
2001-2002	0,772%	4,781%	3,928%	-3,510%	-3,826%
2002-2003	1,390%	-1,699%	3,315%	0,132%	3,143%
2003-2004	4,070%	2,482%	3,118%	1,199%	1,549%
2004-2005	3,275%	4,931%	3,430%	-0,732%	-1,578%
2005-2006	5,059%	2,460%	3,450%	1,972%	2,536%
2006-2007	3,363%	1,483%	3,421%	0,651%	1,853%
2007-2008	1,218%	1,880%	3,575%	-1,737%	-0,650%
2008-2009	-5,997%	-5,175%	2,900%	-5,944%	-0,867%
2009-2010	5,324%	0,755%	2,611%	3,391%	4,535%