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**THE BRAZILIAN HCI DRIVE:
SUCCESS OR FAILURE?**

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1. Introduction

Like many other countries, Brazil adopted a pro-active industrial policy during much of its recent history. Although it was able to shift the structure of its economy in favor of certain industries, most of the time it failed to develop industries that were internationally competitive.

This being the case, in addition to identifying and describing the policies adopted by the Brazilian government over time, this article will attempt to provide an understanding the reasons for this policy failure in terms of international competitiveness. In this regard, it proved to be helpful to compare Brazil with countries in similar circumstances that, unlike Brazil, have been successful. Accordingly, we chose to contrast Brazil with South Korea.

Particular emphasis will be given to the period that begins with the Target Plan, the first organized and articulated industrial policy planning experience in Brazil, and ends with the II NDP, when this experience resumed. This is the period when Brazil began to venture beyond the consumer goods industries, seeking to encourage the development of more capital-intensive heavy and chemical industries. Hereafter this is referred to as the HCI drive.

Specifically, we intend to show how flaws in the design and implementation of incentives in industrial policy, the failure to pay sufficient attention to human capital formation, the lack of care in dealing with innovation and the inability to make adjustments while the process of industrialization was underway, were responsible for the differences in results in the experiences of Brazil and South Korea with respect to industrial policy.

2. The First Brazilian HCI Drive: The Target Plan

2.1. The HCI Drive: Why?

Although the first attempts at industrial development policies date back to the 1920s, only in the beginning of the 1930s a systematic concern about this issue by the Brazilian government begin to emerge. But it was not until after the end of World War II that this concern was transformed into a more articulated and conscious industrial policy.

In fact, the efforts for analysis and planning began a few years earlier. In the Eurico Gaspar Dutra (1946-1951) administration the SALTE Plan was designed. It did not include a strategy for industrialization, but prepared an analysis of need for infrastructure, which ultimately became one of the bottlenecks for Brazil's industrial development. Further, although it never got

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beyond the paper stage, the SALTE Plan resulted in the creation of the National Bank for Economic Development (BNDE) in 1952, during the second administration of Getúlio Vargas (1951-1954).¹ The government planning and analysis effort continued with the Joint Brazil-United States (Joint Commission), and later with the Joint ECLAC-BNDE Group (GMCB).² The results were used in the preparation of a program for the promotion of industry, coordinated by the staff of the presidency, which once again was not put into practice. However, the efforts for analysis and institutional mobilization culminated in the definition of the Target Plan, put into practice during the administration of Juscelino Kubitschek (1956-1961) [Suzigan (1996)].

Brazil had already been through an initial process of import substitution, which eventually generated a poorly integrated process of industrialization focused mainly on consumer durables. There were huge bottlenecks, especially in energy and transportation, but also with respect to intermediary industrial inputs. The efforts at analysis mentioned above had identified the need for significant investments in infrastructure, and the development (or expansion) in domestic productive capacity in certain basic industries. The main economic reason for justifying the HCI drive was external vulnerability.

However, this was not the only option. Nor even the most obvious. The Brazilian economy was already showing signs of crisis. By the 1950s, inflation exceeded 25% per year, there was a severe fiscal imbalance and external strangulation was imminent. At the same time, most countries in Latin America were opting for contractionist adjustment. Even Brazil was already thinking about solutions in this direction during the second Vargas administration (1951-1954) and the abbreviated government Café Filho (1954-1955) [Vianna (1990) and Pinho Neto (1990)].³

From a political point of view, a broad consensus had formed and there was a base of support for HCI drive, as opposed to the economic stabilization alternative. For the Brazilian industrialists, maintenance of expansionist policies and the promotion of domestic production of selected inputs was an attractive solution. Added to this, the philosophy of Brazilian developmentalist economic thought – with an emphasis on state planning to promote industrialization – that originated with from ECLAC was widely held by many technical experts. In addition, several other organized sectors of the public were mobilized in favor of the HCI drive, under the banner of economic nationalism. There were national aspirations to have Brazil participate in industrial sectors that are more often associated with mature economies [Rabelo (2003)].

In other words, the HCI drive was not only motivated by economic necessity, but also as the result of a strong political will of the government that was

¹ Not until 1982 did the Bank assume its present name: National Bank for Economic and Social Development (BNDES).

² The Joint Commission was formed under the Ministry of Finance and composed of experts from US and Brazil. It was the result of negotiations between Brazil and the United States that began in 1950, to finance a program of modernization of the infrastructure sectors of the Brazilian economy. ECLAC refers to the Economic Commission for Latin America.

³ Vice President Café Filho assumed the Presidency after the suicide of Getúlio Vargas, originally elected for a term of five years between 1951 and 1955.

validated by various sectors of the Brazilian public. For this reason, the Target Plan went beyond a simple response to the need to correct external imbalances generated by the previous process of import substitution. In fact, it encouraged the development of capital goods sectors producing capital goods that tended to generate additional pressure on imports [Lessa (1975)].

Not coincidentally, President Juscelino Kubitschek (1956-1961) was elected with a government program whose motto was to advance “Fifty Years in Five”, and put the Target Plan, an ambitious program of investment in infrastructure and promoting the domestic industry into operation.

2.2. The Role of Government

In addition to identifying the sectors that would be the targets of industrial policy, the government took an active role in the HCI drive. The policies used by the government can be grouped into three broad categories: (i) selective protection of the domestic market, (ii) attraction of foreign capital, (iii) directing credit (both public and private). As a result, as with the analysis, many of the necessary policy tools were already available prior to the decision to promote these sectors.

A. Selective Protection of the Domestic Market

In 1949, under President Eurico Gaspar Dutra (1946-1951), a system of import licensing was implemented. Only imports of essential consumer goods were allowed and only then when similar goods were not available on the domestic market.⁴ An overvalued exchange rate also made the import of capital goods relatively cheaper, which helped to foster investment in new industrial sectors, funded by the significant increase of credit by public banks, especially by the Bank of Brazil [Vianna (1990)].⁵

However, exchange rate appreciation eroded the competitive position of Brazil’s main export products. Thus, in 1953, during the second Getúlio Vargas administration (1951-1954) there was a period of currency reform. This resulted in Superintendence of Currency and Credit (SUMOC) Instruction 70, which created a system of multiple exchange rates.⁶

In the Target Plan a multiple exchange rates system was used for a more systematic development of selected sectors. Higher priority was given to the imports of essential raw materials, some types of equipment (especially capital goods associated with the shipbuilding and automobile sectors) and goods that could not count on a reliable domestic supply, which enjoyed a

⁴ It is the Similar Nacional Law sanctioned in the late nineteenth century, but its use was intensified in 1949. For more details see Baer (1996). It should be noted that initially import controls were adopted to overcome the shortage of foreign currency reserves. Gradually, as the effects in terms of promotion of domestic industry were perceived, it turned into an instrument of industrial policy.

⁵ The Bank of Brazil is a public commercial bank. At that time it was responsible for more than 40% of private banking and was the main financial agent of the government.

⁶ At that time Brazil had no central bank (it not created until 1964), and its functions were divided between the SUMOC, the Ministry of Finance and the Bank of Brazil.

relatively more favorable exchange rate. At the same time, the sectors selected for development were protected from international competition by an undervalued exchange rate.

Import tariffs were also significantly increased, and rates reached 150% in some cases. Furthermore, Brazil increased and tightened the examinations of “similarities”: the industries that proved to be able to meet domestic demand were protected from foreign competition. Minimum domestic content requirements also became common [Orenstein & Sochaczewski (1990)].

B. Attracting Foreign Capital

Another important policy tool was SUMOC Instruction 113 enacted in 1955, during the Café Filho administration (1954-1955), that allowed the discretionary issue of licenses to import equipment without hedging the exchange rate. With declining revenues from coffee exports and increasing external strangulation, this was one of the solutions to modernize the domestic industry without pressuring the balance of payments. In addition, this measure also was designed to attract the foreign capital investment needed to sustain growth in Brazil. Basically, imported equipment was recorded on corporate balance sheets as an investment under a free exchange rate, while the profit remittances were made at a preferential exchange rate. Exchange rate differentials made these investments more attractive [Caputo & Melo (2009)].

C. Directed Credit

Finally, the government played an important role in directing credit to selected sectors. In this respect, the creation of the BNDE in 1952 had a preponderant role. Initially BNDE loans were funded through compulsory loans from income tax receipts and were used to finance infrastructure investments. With the advent of the Target Plan, its activities were redirected to making long-term loans to domestic companies, at low rates of interest, extended grace and amortization periods, and covered a significant percentage of the project [Lessa (1975)].⁷

In addition, the BNDE was important in underwriting projects by assuming co-responsibility for the settlement of foreign debts and loans, obtained from foreign companies that were willing to invest in the sectors that were included in the Target Plan.

D. Summary

In summary, the Target Plan was based on a three-point nexus formed by government, private domestic and private foreign capital. The government, in addition to assuming responsibility for investments in infrastructure, also increased its direct activities in certain industries through state enterprises. Private domestic capital was attracted to sectors selected by the BNDE for in direct credit and surety for international financing, as well as those in the domestic market that were protected through policy exchange and import controls. Private foreign capital also benefited from the protection

⁷ Given the high rates of inflation, real interest rates of these loans often became negative.

mechanisms in the domestic market, and also by a more foreign investment friendly policy, under SUMOC Instruction 113.⁸

2.3. Selected Industries and Participating Companies

A. Selection Criteria

One of the fundamental elements of the Target Plan was the selection of the industries to be promoted, with the definition of production targets for each. It should be noted that the goals were often to be taken as indicative and often described in terms of sectors rather than specific companies. Moreover, there was no kind of punishment in case the failure to comply with the goals.

Accordingly, the selection of the majority of the sectors was based on the principal bottlenecks in the Brazilian economy, as identified by the US-Brazil Joint Commission and the ECLAC-BNDE Commission. In other words, the Target Plan was primarily focused on investment in infrastructure (energy and transportation) and substitution of imports in some sectors that produced intermediate inputs (chemicals, steel, heavy machinery and electrical equipment).

For this reason, investment planning was largely done to ensure the Brazil's self-sufficiency with respect to these inputs in order to mitigate the external constraints that Brazil was facing. The targets were selected based on studies that estimated the trend of domestic demand for each input in subsequent years. From the existing domestic supply, the increase in production needed to meet this demand was calculated (and revised as the plan was being put into practice). Included in this group, among others, are the steel, aluminum and chlorine-soda industries, petroleum refining, pulp and paper and cement.

However, as noted above, the Target Plan also included sectors producing capital goods, which unlike those promoted to mitigate external constraints, tended to add to the pressure on imports. The shipbuilding and automobile industries certainly fit that description.⁹

As for the participating companies, the option was the use of state-owned enterprises in sectors where private sector interest was lacking. In other sectors, both private domestic and foreign capital were encouraged to participate in the investment effort.

The private projects were selected by sector executive groups that evaluated their feasibility, and passed through the filters of the BNDE and SUMOC, to make sure that the projects were compatible with other projects in the sector, and capable of attracting international financing and having foreign exchange earnings capacity (this governance process will be explored in more detail below).

⁸ Although they were less important, tax reductions and exemptions were also used.

⁹ The decision to develop the automotive industry is in part a result of the option to prioritize investments in road infrastructure in the Target Plan. Something similar can be said with regard to shipbuilding and investment in modernization and expansion of the Brazilian ports. As less attention was given to the railroads, the same occurred with the industry rail transport technology.

The following are some sectors that were identified under the Target Plan that are further analyzed with respect to the selected companies and funding sources.

B. Steel

In the steel industry the option was mostly for companies with state control. Brazil already had some capacity in the sector, mainly due to the start up of operations of the National Steel Company (CSN) in 1946. The construction of the plant was the result of diplomatic agreement signed in 1942 between Brazil and the United States, which included a loan, key to enabling the creation of CSN (and also of Companhia Vale do Rio Doce – Vale). The Target Plan caused installed capacity to increase and the costs were paid from its own resources, capital increases and loans from the Eximbank.

In addition to expanding the capacity of smaller steel companies – Belgo Mineira, Aliperti, Acesita, Lanari and Barra Mansa – two new large companies were developed: Cosipa and Usiminas, both with state control. Cosipa used public funding (BNDE, the federal government and the state government of São Paulo) as well as private funding, from Europe (with the approval of the BNDE). Usiminas also had international funding (from Japan, endorsed by the BNDE), as well as domestic capital from BNDE loans and capital subscription by the federal government, the state government of Minas Gerais and private shareholders. For the industry as a whole, approximately 40% of total investment originated from abroad [Dias (1993)].

C. Aluminum

Brazilian production of aluminum was started in 1951, controlled by two groups: Electrochemical Brazilian (Elquisa), owned by the Canadian Alcan and Brazilian Aluminum Company (CBA), national private company. The production did not reach the installed capacity, due to shortfalls in electric power supply. Accordingly, the Target Plan envisaged investments in hydroelectric power to overcome this problem, as well as investments in the expansion of production capacity of these two companies. The BNDE was involved in the financing the expansion of CBA, directly financing the investments and giving its approval for a foreign loan. For the industry as a whole, BNDE was directly responsible for 20% of the funds, with the remainder divided between companies assets (18%), private domestic sources of funding (32%) and foreign financing (31%).

D. Chlorine - Soda

In the chlorine-soda industry the majority of options were for state-owned enterprises. The Target Plan provided them with funding from the BNDE, achieving a substantial increase in production capacity at the state-owned Companhia Nacional de Alkalis (CNA), then the nation's largest provider of caustic soda and soda ash (sodium carbonate). Some smaller projects involving private national capital were also provided with federal funding. Most funds originated with the BNDE and the endorsements by the bank for foreign loans for CNA. The CNA also embodied French capital and technology [Pereira (2010)].

E. Petroleum Refining and Related Industries

In this sector the option for state companies was even stronger. In 1953, during the second Vargas Administration (1951-1954), a state monopoly in refining (and production) of oil was established and Petrobras was created. The Target Plan forecast an increase in the refining capacity of the state-owned company, as well as the start of an oil prospecting program.

In related industries, although there was not a state monopoly defined by law, the option was also to use Petrobras. For example, it was deemed the company's responsibility to build a synthetic rubber plant and another for fertilizers.

F. The Automotive Industry

In the automotive industry, the first choice was to use private capital. In this case, foreign capital was predominant in the production of motor vehicles, while Brazilian companies, often associated with companies from other countries, were more important in the production of auto parts.

The sector was the largest beneficiary of SUMOC Instruction 113, receiving approximately US\$ 190 million in foreign direct investment between 1955 and 1964. Of this total, the majority came from the US (48.2%) or from Germany (28.7%). As an example, General Motors invested around US\$ 25 million, Ford approximately US\$ 22.5 million and Volkswagen US\$ 14.3 million [Caputo & Melo (2009)]. The BNDE played a very small role in financing these investments.

The Target Plan not only called for an increase in the production of motor vehicles, but also imposed domestic content requirements. These requirements helped several companies to develop a national metalworking industry, specifically in the auto parts sector. Between 1946 and 1960 the number of companies producing parts in Brazil increased from 30 to 1,300 [Colistete (2010)].

While companies from other countries established subsidiaries in Brazil, the presence of domestic companies was remarkable. Many of them associated themselves with foreign firms to import, assimilate and adapt technology. Examples of this strategy are Metal Leve, which gained technical assistance from the German company Mahle in the production of pistons and piston pins, Cofap, which entered into several partnership agreements with German (Boge and Mahle) and American companies (Perfect Circle, Monroe and Thompson) for the production of piston rings, shock absorbers and cylinder parts, and Cobrasma, who joined the North American Rockwell Spring for the production of truck axles and differentials [Dias (1993), Colistete (2010)].

BNDE funding was much more important in the case of auto parts than in the production and motor vehicles. The development bank participated either through direct financing or through the support for foreign borrowing for several projects, including for the Cobrasma and producers of electrical parts, forgings, cast iron parts, engine blocks and parts made of malleable iron.

G. The Shipbuilding Industry

In the shipbuilding industry, in the majority of cases, funding came largely from private capital. Several small Brazilian shipyards were upgraded and production capacity was increased. This was especially true for the CCN Mauá shipyard, which obtained major funding from the BNDE.

In addition, two large shipyards linked to international groups were installed. The first – Ishibrás – was linked to Japanese shipbuilders Ishikawajima and received funding as well as equipment from the head office and funding from the BNDE. The other – Verolme – was a subsidiary of the Dutch group Verolme United Shipyards [Dias (1993), Geipot (1999)].

H. Where to Find Key Factors of Production?

Table 1 summarizes the information in this section, indicating the sources of funding, technology and principal companies in some of the sectors in the Target Plan.

Table 1: Target Plan - Where to Look for Key Factors of Production

Industry	Sources of Funding	Sources of Technology	Leading Companies
Steel	BNDE and foreign capital (U.S. - Eximbank - for CSN, European and Japanese Cosipa for Usiminas)	United States and Japan	CSN*, Usiminas* and Cosipa*
Chlorine-Soda	BNDE, and foreign (French) capital	France	CNA*
Aluminum	BNDE private domestic and foreign capital		CBA**, Elquisa***
Oil Refining and Related Industries	Government budget and BNDE		Petrobras*
Automotive	BNDE and foreign capital, mainly through Instruction 113 of SUMOC	United States and Germany	Ford***, GM***, Volkswagen*** and Mercedes Benz*** in vehicle production and several Brazilian companies in auto parts manufacturing (Romi**, Cofap**, Metal Leve**)
Naval	BNDE and foreign capital (Japan for Ishibrás and the Netherlands for Verolme)	Japan and the Netherlands	Ishibrás***, Verolme*** and CCN Mauá**

Notes: * company with state control, ** private domestic capital, *** private foreign capital or subsidiary of a foreign company.

Source: The author with data taken from various authors. More details throughout the text.

2.4. Governance

As mentioned previously, while the Target Plan implied an increase in direct public sector participation in the economy, the government was also given the important role of inducing private sector activities (domestic and foreign). Thus, it became necessary to create a framework of governance to harmonize activities within the government and coordinate them with the efforts of the private sector.

To do so, the Council for Development, connected directly to the Office of the President, was created. Initially its role was to be the overall coordinating agency and formulator of policies associated with the Target Plan. However, it

was not successful in do so, and limited itself to monitoring the implementation of actions and verifying their results.

While it did not function well as a coordinator of the Target Plan, the Development Council gave rise to several special administrative entities, one for each sector covered by industrial policy. These were collegial bodies that coordinated the efforts of the government agencies responsible for handling different policy instruments. Among these were the Executive Group of the Automotive Industry (GEIA), the Executive Group of Shipbuilding Industry (GEICON), Executive Group of Agricultural Machinery (GEIMAR) and Executive Group of Heavy Mechanical Industry (GEIMAPE).¹⁰

Given its composition, the proposals of the executive groups were not very difficult to meet, and it functioned as a coordinating body of the various agencies of government and acted to remove any bureaucratic obstacles to achieving the goals set for each sector [Lessa (1975)].

Another important coordinating body was the BNDE. As a practically mandatory checkpoint for government programs, it assumed, albeit informally, the function of a center for analysis of the Target Plan. The BNDE played an important role in the alignment and organization of programs and decisions taken in isolation at the sector level, a function that initially fell to the Development Council [Dias (1993)]. SUMOC had similar role, but limited to assuring the compatibility between the availability of foreign currency and the authorizations granted by CACEX to import at favorable exchange rates [Lessa (1975)].¹¹

Finally, for the exclusive goals of the public sector, the biggest challenge was to overcome the administrative rigidity and the Brazilian budgetary process, which made the funding of projects that required large investments for long periods of time more difficult. The solution was to use state-owned enterprises and independent agencies, which enjoyed greater operational freedom, combined with funds from sources that were not subject to budget restrictions. In this case, since the funds were insufficient and it was necessary to complement them with outside funding, it fell to BNDE to act as the overall coordinator of the actions associated with the goals of the public sector as it did with the private sector.

2.5. Human Capital and R&D: The Forgotten Elements of the Target Plan

Despite the arrival of a reasonable contingent skilled foreign workers (Europeans, mostly) to Brazil, the supply of skilled labor was quite scarce at the start of the Target Plan [Thoumi & Teitel (1986)].

But in contrast with the South Korean experience, little attention was devoted to human capital formation. In 1951 the National Campaign for the Improvement of Higher Education was created, in order to ensure the supply of skilled personnel in sufficient quantity and quality to guarantee the

¹⁰ While some groups have enjoyed much autonomy and extensive duration (GEIA and GEICON, for example), others existed only briefly.

¹¹ CACEX was the agency responsible for the licensing of exports and imports. Also worked in the financing of Brazilian foreign trade.

development of Brazil.¹² Although in the early years it encouraged the hiring of foreign teachers and granted scholarships for Brazilian students to study abroad, its activities were very discreet under the Target Plan.

Coincidentally, planned investments in education accounted for only 2.8% of the total Target Plan, and basically were used for vocational education programs and the establishment of the Federal University of Brasilia (UNB).¹³ In later years investment in higher education and professional training increased, but nothing to compare with the South Korean effort to recruit and train engineers demanded by sectors subject of industrial policy and the promotion of professional training centers [Kim (2013)].

Moreover, during the Target Plan and in the following years, basic education was relegated to the background. This explains why the average levels of education of the population, which was already lower than most developing countries, stagnated throughout the 1970s (more details on this topic in section 5).

The same can be said with regard to research and development. In 1951 the National Research Council (CNPq) was created, which at the time centralized the coordination of national policy for science and technology.¹⁴ But the BNDE only opened a specific financing line for innovation and technology, the Fund for Scientific and Technical Development (FUNTEC), in 1964 and not until 1965 was a government agency established specifically for the promotion innovation, the Research and Projects Financing Agency (FINEP). But even after these initiatives, the government's actions remained focused, with rare exceptions, on increasing production capacity, with little attention and less mobilization of funding for actions to promote innovation, research and development [Suzigan (1996)].

2.6. Political Turbulence and a Temporary Change in Course

The years that followed the government of Juscelino Kubitschek (1956-1961) were politically turbulent. The elected president, Jânio Quadros resigned seven months after taking office. Vice President João Goulart assumed the Presidency 1961, but was deposed by a military coup in 1964.

Economic disequilibrium was also exacerbated with accelerating inflation, deficits in the balance of payments and fiscal deterioration. Because of this, more emphasis was placed on policy reforms and macroeconomic adjustments. During the government of João Goulart (1961-1964) the Three-Year Plan was put into practice, which had little success in correcting the imbalances of the Brazilian economy. After the military coup, in the Castelo Branco government (1964-1967) the Government Economic Action Program (PAEG) was launched, which among other things, reduced government spending (but not investment), improved the tax collection system, restricted credit, depressed wages and fixed utility rates (which were lagged for inflation). The PAEG also made several reforms that modernized and

¹² It is currently called Coordination of Improvement of Higher Education Personnel (Capes).

¹³ The creation of UNB was a necessity derived from the construction of the new capital, and not a strategy to meet the demand for human capital in the sectors that were targeted in the Target Plan.

¹⁴ Not until 1971 did it assume its current name: National Council for Scientific and Technological Development.

strengthened domestic credit [Baer (1996)]. It was not a genuinely orthodox stabilization plan, but an attempt to keep the Brazilian economy growing without letting inflation accelerate as well. Industrial policy, similar to that of the Target Plan, was relegated to less important status.

In the following years protection for the domestic market was also reduced, amore lenient test of similarity was applied, exchange rates were unified (and depreciated) and nominal tariffs on imports were reduced. In addition, the tax bias against exports was gradually removed, replaced by a growing number of incentives for this activity, such as tax exemptions, subsidized credit to exporters and duty drawbacks [Balassa (1979), Cardoso (1980)]. In fact, export subsidies were concentrated in manufacturing industries and some minerals, and were attempts to offset the high cost of intermediate inputs (protection had decreased, but still remained high).

3. The NDP II: Deepening the Import Substitution Model

After a few years of relative stagnation, the Brazilian economy once again began to experience high growth rates, a result of the accumulation of excess of production capacity and reforms of previous years. This is the period known as the Brazilian Miracle (1967-1973), when the economy grew at rates of over 10% per year for six consecutive years.

Gradually, industrial policy agenda regained importance. In 1972, the government of Emilio Garrastazu Medici (1969-1974), put into practice the I National Development Plan – NDP I, with three-year horizon (1972-1974). It was the first experience with the new HCI drive. As a response to the first oil shock, in the government of Ernesto Geisel (1974-1979), industrial policy finally returned to a prominent place in the menu of economic policies with the II National Development Plan – NDP II (1975-1979).

Compared to Target Plan, the NDP II expanded policy of import substitution. Other sectors producing intermediate inputs were included as targets of industrial policy (petrochemicals, for example), along with advanced technology industries (telecommunications, aircraft, armaments, nuclear and computer processing). Import substitution policies were also extended to imports of capital goods, which in the Target Plan were primarily for vehicles and transport equipment.

The protection system was expanded and deepened. The tools of tariff protection were being abandoned (despite maintaining high rates) in favor of using increasingly intense bureaucratic and discretionary mechanisms of non-tariff protection: examination of similarity indices, minimum domestic content requirements, preference margins for domestic firms in procurement of capital goods, and others. In other words, the opening that occurred after the Target Plan reversed course and the Brazilian economy became closed to imports. For capital goods, in addition to the tools noted above, the policy of import substitution also drew upon measures such as accelerated depreciation allowances for equipment and national tax exemptions on the purchase of domestically manufactured equipment [Carneiro (1990)].

Targeting mechanisms were focused on subsidized credit for investment in priority sectors (BNDE) and the promotion and export financing (CACEX). Added to this there was a policy of mini-devaluations of the domestic currency.

With respect to infrastructure investment, state-owned enterprises continued to play a major role. In addition to energy and transportation (the focus of the Target Plan), investments in communications, storage, urbanization and sanitation were also targeted by the government. Also the importance of state enterprises in sectors producing intermediate inputs increased. The private sector continued to dominate the production of capital goods.

In education, emphasis was placed on the expansion of higher education (but with little investment in elementary or primary education). At the same time a national system of scientific and technological development was established. However, when compared with the emphasis on production capacity, again little attention was paid to innovation.

With the crises of the late 1970s and early 1980s, protectionism was again intensified and export subsidies were scaled up to enable improvements in the trade balance. Among the protectionist policies of that era, special mention should be made of the Computer Law, enacted in 1984, which created a protected market for domestic manufacturers of computers and other electronic products.

With the worsening of inflation and macroeconomic imbalances, public investments in education and infrastructure were reduced, but the autarchies in the Brazilian economic environment were maintained.

Since the 1990s, there has been a marked shift towards a more open economy, a reduction in the role of government as an entrepreneur through privatization and the control of inflation with the implementation of the Real Plan in 1994. But although several elements of industrial policy remained from previous years, its importance diminished considerably [Guimarães (1996)].

4. Evaluation of the HCI Drive

A. Overview

Overall, the share of manufacturing industry in Brazilian GDP increased, with some ups and downs, until the beginning of the 1970s (see Chart 1). However, the NDP II, and the spread of import substitution policy that followed, was not able to sustain this growth. Instead, after the first oil shock a declining trend and be perceived that extends to the present day.¹⁵

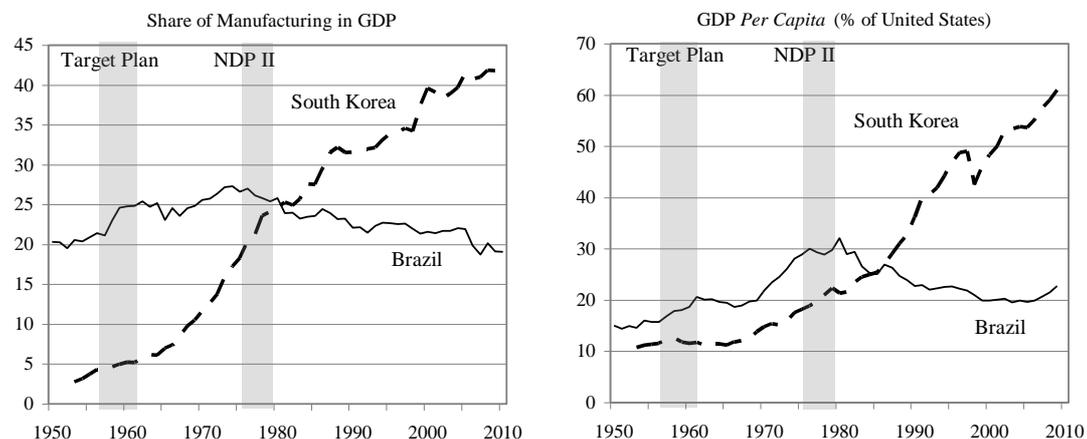
However, structural change is not an end in itself (or at least should not be), but is a tool to achieve economic development. The per capita income of

¹⁵ In fact, depending on how the share of GDP is computed (constant or current prices), the share of manufacturing industry in the Brazilian GDP has different behavior. We chose to use data from Timmer & De Vries (2009), calculated at constant prices and GDP converted to US dollars (PPP), as a comparison with South Korea. With current price data in domestic currency, participation continues to increase until the mid-eighties of last century, when it finally starts to decrease.

Brazil as a percentage of US per capita income increased until the end of the 1980s, and then began a cycle of decline that continued until the beginning of the XXI century (see Chart 1).

In both cases, the comparison with South Korea makes the difference in performance between the two countries quite clear.

Chart 1: Share of Manufacturing Industry in GDP and GDP Per Capita



Source: Timmer & De Vries (2009) for share of manufacturing in GDP and Heston *et al* (2011) for GDP *per capita* (in PPP).

B. Value Added, Employment and Production

The HCI drive resulted in accelerated growth of the manufacturing industry, at a rate greater than that of the economy taken as a whole. This trend continued until the mid 1970s (see Table 2), and is consistent with their increased share of GDP in the same period (see Chart 1).

Table 3 shows in more detail the evolution within the manufacturing industry from 1950 to 1985.¹⁶ Note that the heavy and chemical industries increased in importance in terms of value added and employment. In 1950, before the Target Plan, these industries accounted for only 24.7% of value added and 25.8% of industrial employment. By 1960, these percentages reached 47.4% and 39.0% respectively, and continued to increase until 1985, the last year for which data are available.

¹⁶ After this year, there was a change in methodology that makes comparison difficult. In any event, in 1985 the process of structural transformation of the industry had already cooled.

Table 2: Annual Growth Rate of GDP and Manufacturing Industry

	GDP	Manufacturing Industry
1950-1954	6.3%	8.4%
1955-1959	8.0%	10.3%
1960-1964	5.7%	6.8%
1965-1969	6.5%	6.7%
1970-1974	11.1%	12.4%
1975-1979	6.4%	6.2%
1980-1984	1.5%	-0.5%
1985-1989	4.4%	3.9%
1990-1994	1.2%	0.5%
1995-1999	2.0%	0.1%
2000-2004	3.0%	3.8%
2005-2009	3.6%	0.3%

Source: IBGE.

Table 3: Share in Manufacturing (HCI and Light Industries)

	HCI	Light Industries
Value Added		
1950	24.7%	75.3%
1960	47.4%	52.6%
1970	52.9%	47.1%
1975	57.5%	42.5%
1980	59.7%	40.3%
1985	61.8%	38.2%
Employment		
1950	25.8%	74.2%
1960	39.0%	61.0%
1970	43.1%	56.9%
1975	46.5%	53.5%
1980	46.8%	53.2%
1985	47.4%	52.6%

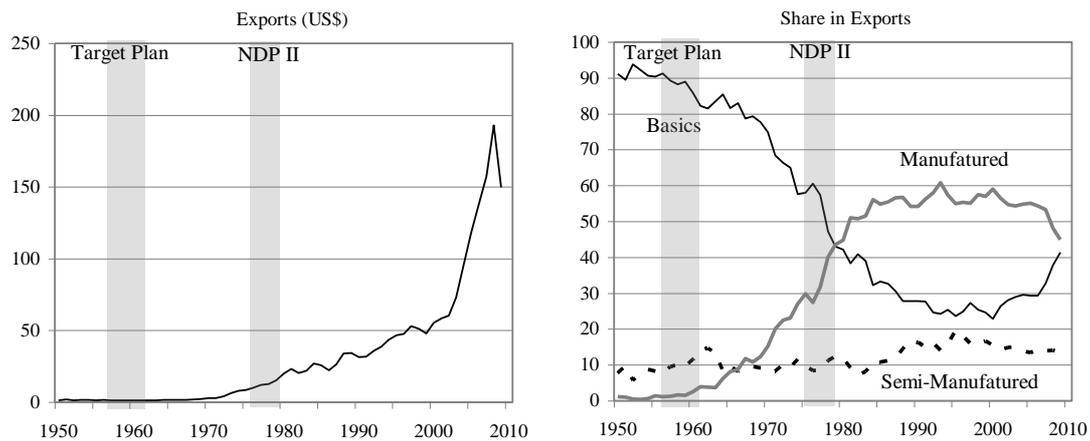
Source: IBGE.

C. Structure of Exports and Trade

Note that not until the end of the 1960s, or more than ten years after the start of the Target Plan, did Brazilian exports begin to increase (see Chart 2). As noted above, this is a result of removing the bias against exports and policies of subsidies for this activity that were practiced at the time.

Unfortunately specifically with regard to the insertion of heavy and chemical industries in exports, it was not possible to construct a series dating from 1950 that reflects this change. The most that could be done is to separate industries into basic (agriculture and mining), semi-manufacturing (some light industries) and manufacturing industries (HCI, but also including some light industries). That is, the manufacturing segment includes the heavy and chemical industries but also some light industries. This clearly shows the effect of the HCI drive to increase the share of manufactures in exports, as well as a reduction of the share of basic commodities. This trend continued until 1985. More recently, basic industries have again increased their export share, due to the increase in international demand for soybeans and iron ore, products in which Brazil is a major global producer (see Chart 2).

Chart 2: Exports from Brazil



Source: Secex.

Within manufacturing, it is possible to identify the behavior of the most important products (see Table 4). This confirms the increased importance of the sectors affected by industrial policy in the Target Plan and the NDP II. It also confirms that exports did not show an increase until the late 1960s.

The increase in exports, however, does not mean that the Brazilian HCI drive was focused outward. Rather, it is a process of autarchic industrialization, geared to the domestic market. This is illustrated by the fact that the degree of openness (the ratio of imports plus exports to GDP) declined in the years after Target Plan and has changed little since the NDP II (see Table 5). Only recently has the degree of openness of the Brazilian economy increased, although it is still very low. This observation reflects the fact that even after the HCI drive, the profile of the Brazilian economy has changed little.

Table 4: Share of Selected Products in Brazilian Exports

	Metallurgy	Chemicals	Pulp and Paper	Transport Materials	Machinery and Equipment	Total
1950-1954	0.1%	0.3%	0.0%	0.0%	0.0%	0.4%
1955-1959	0.0%	0.3%	0.0%	0.1%	0.2%	0.7%
1960-1964	0.2%	0.4%	0.0%	0.7%	0.6%	2.0%
1965-1969	5.1%	1.3%	0.2%	0.4%	1.8%	8.8%
1970-1974	3.9%	1.8%	0.8%	1.5%	3.8%	11.8%
1975-1979	4.1%	2.1%	1.1%	5.1%	7.4%	19.7%
1980-1984	10.8%	4.6%	2.6%	7.3%	8.1%	33.4%
1985-1989	14.3%	6.1%	3.2%	8.4%	9.8%	41.8%
1990-1994	17.0%	6.5%	4.1%	8.3%	11.5%	47.4%
1995-1999	12.5%	7.2%	4.5%	9.9%	11.9%	46.0%
2000-2004	10.4%	6.6%	3.8%	13.1%	12.4%	46.2%
2005-2009	9.9%	6.6%	3.0%	12.8%	10.0%	42.2%

Source: Secex.

Table 5: Brazil – Patterns of Trade and Degree of Openness

	Exports (% GDP)	Imports (% GDP)	Degree of Openness	Share in World Trade
1950-1954	10.3%	9.0%	19.3%	2.1%
1955-1959	9.6%	8.1%	17.6%	1.4%
1960-1964	6.8%	6.4%	13.2%	1.0%
1965-1969	6.0%	4.8%	10.8%	0.9%
1970-1974	6.7%	7.7%	14.4%	1.0%
1975-1979	6.6%	7.8%	14.5%	1.0%
1980-1984	10.1%	8.2%	18.3%	1.2%
1985-1989	9.9%	5.2%	15.1%	1.2%
1990-1994	8.1%	5.4%	13.5%	1.0%
1995-1999	6.4%	7.0%	13.4%	0.9%
2000-2004	11.8%	9.3%	21.0%	1.0%
2005-2009	11.8%	8.8%	20.6%	1.2%

Source: Secex.

D. Collateral Effects

The development of heavy and chemical industries led to a number of side effects. The first was an acceleration of inflation, especially after the Brazilian Miracle, reaching levels of more than 1000% per year in the late 1980s and early 1990s. There were also problems with recurring external bottlenecks due to the need to import of machinery and equipment.

This also called attention to increasing regional disparities. The development strategy concentrated investments in the South and Southeast, relegating other regions, especially the Northeast, to the sidelines. Although some regional policies were adopted (such as creation of regional development agencies), they had little impact in mitigating regional imbalances.

Finally, the HCI drive did little to change the unequal distribution of income in Brazil, which was reinforced by the neglect of primary school education (more details in the next section).

5. What Went Wrong?

A. Classification of Public Policy

For purposes of organization of ideas, public policy will be classified according to two dimensions, as to type – provision of public goods or market intervention – and transversality – vertical (limited to few sectors) and horizontal (for broader sectoral range) (see Figure 1). Examples of horizontal policies in the provision of public goods include quality basic education, ensuring property rights and a reduction in business bureaucracy. Creating engineering schools, for example, involves the provision of public goods, but is vertical in nature – it meets the needs of certain sectors (electronics, for example) but not others (agriculture). Here the distinction between sectors and activities is helpful. Activities are actions that potentially cut across various sectors and activities that are not normally carried out at the company level (innovation, for example).¹⁷ In turn, in the lower right quadrant are included policies that distort relative prices of specific sectors (trade protection and subsidies for certain sectors, for example). Finally, there are market interventions that are designed to affect certain activities (subsidies for research and development, subsidies for job training, subsidies for investment in capital, for example) and not specific sectors (lower left quadrant).

Figure 1: Classifications of Public Policy

		Transversality	
		Horizontal	Vertical
Type of Policy	Provision of Public Goods		Light Industrial Policy
	Market Intervention	Light Industrial Policy	Heavy Industrial Policy

Source: Adapted from Pagés (2010).

That said, industrial policy is defined as actions to change the production structure of the economy in order to increase production and improve the technological capacity in certain sectors. In other words, industrial policy is defined to be selective; it is associated with vertical policies, but may also include horizontal measures of market intervention (the gray areas in Figure 1). Moreover, within what is defined as industrial policy, some authors make a distinction between mild or neutral industrial policy (upper right quadrant, associated with the provision of public goods, and the lower left quadrant, related to changes in relative prices of activities, in particular research and development) and heavy industry policy (right lower quadrant, associated with

¹⁷ Obviously, it is not always clear distinction between industry and activity, or between what is political horizontal and vertical. However, these distinctions are useful to organize the discussion.

interventions that distort relative prices of sectors) [Harrison & Rodriguez-Clare (2010)].

B. Poorly Designed Heavy Industry Policy

Comparing the experiences of industrial policy in Brazil and South Korea, it is clear that, in broad terms, both countries have made a number of policies that are similar in essence. In this case, the question is: given the similarities, what explains the difference in performance between countries? In this regard, although the same tools of industrial policy were used, some key differences with respect to the implementation of these policies can be identified.

First, there are marked differences with respect to the incentives for productivity increases. In South Korea, companies and sectors that were targets of industrial policy were exposed to mechanisms that combined both incentives and punishments. Some kind of target was always set, usually associated with exports, which if not achieved entailed a penalty or withdrawal of benefits. Moreover, the government gave credible signals that protection would be reduced over a given period of time. Both mechanisms lead to significant gains in productivity that were needed to be successful in meeting export targets and to prepare itself against the withdrawal of protection in the domestic market [Lee (1997)].

In Brazil, by contrast, the domestic market remained isolated from international competition for a long period of time and no indications that lower levels of protection might be forthcoming were issued by the authorities. Thus, although it managed to diversify its economy, Brazil failed to achieve international competitiveness in most of the sectors covered by industrial policy. Again, this is a predictable result in economic theory: excessively protected sectors tend to develop using outdated or obsolete technologies, and are therefore unable to achieve a competitive position in the international market.

Another notable difference relates to how imports of intermediate inputs and absorption of technologies from other countries were treated. Again, in the example of South Korea, the focus of industrial policy continued to be on achieving international competitiveness in selected sectors. If by making changes in the domestic economy with regard to the directions of the inputs could make it possible to achieve this goal so much the better. If not, there no barriers to the import of inputs were imposed. On the contrary often the importation of certain inputs received incentives.

This approach is in direct contrast with the Brazilian experience. Early in the process of import substitution, imports of capital goods and intermediate inputs were eased. However, industrial policy has been gradually moving towards an increasingly closed but growing economy, with a growing disincentive to import intermediate inputs in favor of domestically produced goods, with the latter highly protected.

The negative effect of this kind of policy becomes more important in the light of evidence that importing inputs, especially of capital goods, is an important channel through which firms in developing countries acquire and absorb technology. The importance of this aspect in the development of East Asian

countries has been emphasized by several authors [Pack (2001)], in particular for the South Korean case [Rodrik (1995)].

Indeed, from the end of the 1970s, Brazil's industrial policy has been characterized by a number of barriers to adoption of new technologies, unlike the East Asian countries which created mechanisms to facilitate this activity. The Computer Law is one of the best examples in this regard. Evidence indicates that it implied a price and/or performance lag of at least three years in computers produced (and used) in Brazil in relation to international standard, and generated welfare losses on the order of 20% of domestic spending on this kind of equipment [Luzio & Greenstein (1995)].

Thus, excessive and indefinite protection, besides to hampering the process of absorption of technology, also reduced the incentives for investment in research and development and innovation. Again, as regards the provision of incentives for innovation, Brazilian domestic industry should have gradually been exposed to international competition [Miyagiwa & Ohno (1999)]. Empirical evidence confirms this view, indicating that one of the main drivers of investment in innovation is the competitive pressure exerted by competitors, be they domestic or foreign [Aghion and Griffith (2005)].

C. Little Attention Was Paid to Light Industrial Policy

Another aspect that illustrates the differences in the experiences of industrial policy in Brazil and South Korea are the differences in emphasis on light industrial policies. Even when heavy industrial policies were dominant, South Korea devoted special attention to enabling companies to innovate and provide human capital formation. In Brazil these elements of industrial policy, with few exceptions, were neglected.

To illustrate this point, it may prove helpful to contrast the experiences of Brazil and South Korea with respect to the development and promotion of the shipbuilding industry. Although the role of heavy industrial policy was important in South Korea, the government also encouraged investment in R&D through the use of grants, tax incentives and direct investment, as with the creation of the Korean Institute of Technology. Initially the focus was on the assimilation of leading edge technology, mainly through joint venture agreements between foreign and South Korean shipyards, in which there was a tacit requirement for technology transfer. Gradually South Korean companies became able to develop their own technologies, evolving into the most highly developed shipbuilding industry innovation cluster in the world [Bain & Company *et alli* (2009)].

In the Brazilian case, policies to develop the sector were based in large plans for the shipbuilding industry with ambitious targets for the nationalization index for parts and components. Imports were authorized on a case by case basis and often favored vendors that lacked the appropriate scale and experience, paying higher prices than in the international market as a result. Bureaucratic delays in the approval of imports of inputs led to delays in construction schedules, further increasing the cost of production of ships.

The technological dimension was completely overlooked and programs or goals for the systematic technological development or increases in productivity were never established. The total lack of exposure to international market competition further added to the disincentives for investment in research and development and increases in production efficiency by domestic shipyards. The result is that, after having been the second largest shipbuilding industry in the world, Brazil's naval construction industry virtually disappeared during the 1980s, when the resources to fund protectionist policies waned.

It is also useful to mention briefly two cases of successful Brazilian HCI drive in terms of international competitiveness. Not coincidentally they were exceptions to the general neglect of human capital formation and innovation capacity building. The first example is the Brazilian aircraft manufacturer Embraer, founded in 1969, whose development received technical support from the Aerospace Technical Center (CTA).¹⁸ The CTA is an institution founded in the 1950s, as the result of collaboration with the Massachusetts Institute of Technology (MIT). They were responsible for the education and training of the labor force and the development of the technology and expertise for the domestic production of aircrafts [Forjaz (2005)].

The other example is *Petrobras*, which in 1963 established the Cenpes, its R&D and basic engineering center. It was through Cenpes that the company was able to assimilate the technology needed to make offshore oil production viable in Brazil, and later become a major global player in the development of technology for ultra-deep water drilling [Dantas & Bell (2009)].

D. Beyond Industrial Policy

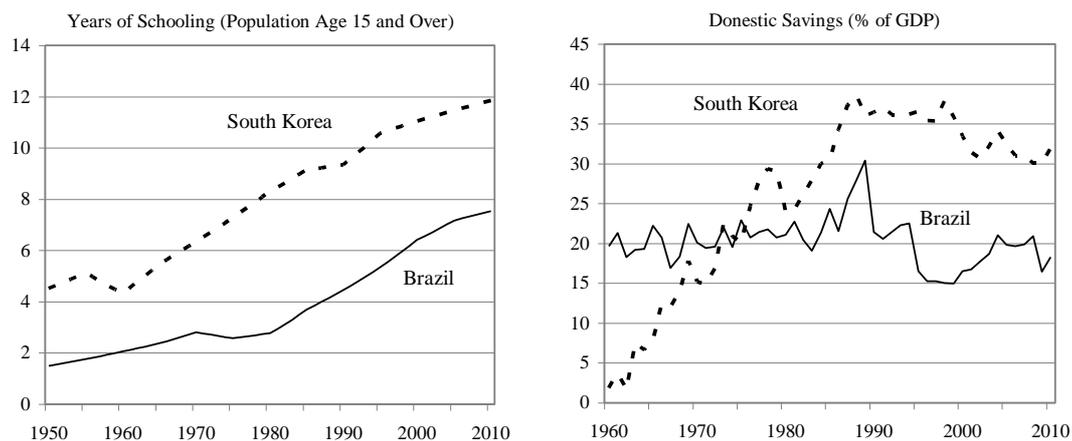
Besides differences in industrial policy, it is possible to point to other differences in policy between the two countries? The answer would appear to be yes. South Korea launched industrial policies, but also other policies that had a positive effect on growth, particularly horizontal policies. It lies beyond the scope of this paper to address this issue in detail. But by way of illustration, it is worth commenting briefly on some of the differences between the experiences of Brazil and South Korea.

The difference in emphasis with respect to investment in human capital is important. In 1950, the average educational level of South Koreans was already well above that of Brazilians and continued to grow significantly (see Chart 3). Brazil, in turn, in addition to starting from a lower level of education, had relatively small growth rates (remaining almost stagnant during the 1970s).¹⁹ Accordingly, there is evidence that approximately two thirds of the difference in per capita income between Brazil and South Korea today is due to Brazil's lower educational levels [Canêdo-Pinheiro *et alli* (2007)].

¹⁸ Today it is called the Aerospace Technical Center.

¹⁹ And the issue of the quality of education is not even mentioned, in which Brazil is at a level well below that of South Korea, given the poor ratings on Brazilian international proficiency tests. In 2009, the latest edition of the PISA exam, Brazil ranked 53rd in reading, 57th in math and 53rd in science, out of a total of 65 countries. By comparison, South Korea came in 2nd place in reading, 4th and 6th in mathematics in science.

Chart 3: Education and Domestic Savings



Source: Barro and Lee (2010) for education and World Bank (2011) for domestic savings.

It should be noted that the positive effects of industrial policy are greater when the stock of human capital is higher. For example, there is evidence that the externalities associated with foreign direct investment and import of inputs – for example, the ability to assimilate technology – are only manifest when human capital has reached sufficiently high levels [Pack (2001)].

Also notable is the difference between the two countries with regard to investment in infrastructure. While Brazil invested heavily in infrastructure in the early years of the HCI drive, the government, mainly responsible for these investments, lost its ability to do so after the NDP II. By way of illustration, the Brazilian infrastructure deficit explains about 35% of the difference in the growth rate in comparison with South Korea in the 1980s and 1990s [Calderón & Servén (2004b)]. Additionally, there is evidence that if Brazil had the stock of infrastructure that South Korea has, income inequality would be approximately 15% lower [Calderón & Servén (2004a)].

Another difference relates to the macroeconomic environment. The South Korean HCI drive generated some macroeconomic imbalances. However, they were nothing comparable to the Brazilian experience with hyperinflation or the lack of austerity in the conduct of fiscal policy in Brazil.

Finally, another important factor that helps countries to change their levels of income, to catching up the developed countries, is the creation of incentives for capital accumulation. While South Korea has made a considerable effort to increase saving, in Brazil the levels of domestic savings have remained at a level similar to countries such as the United States, which is already in the dynamic of long-term balanced growth, over the past forty years (see Chart 3).

6. Some Final Thoughts

Brazil and South Korea have both had experiences with industrial policy. In fact, most countries have experienced some type of industrial policy. Some managed to grow steadily and today are developed countries, such as South Korea, but most of them were not able to achieve the desired results, such as Brazil.

The difference between success and failure lies in how they created incentives for companies and sectors covered by industrial policy. Excessive indefinite protection, the lack of sunset clauses, barriers to imports of inputs and the adoption of new technologies – typical of the Brazilian experience – seem to be a recipe for failure. South Korea, by avoiding these mistakes, managed to change the structure of its economy and grow steadily.

In addition, certain horizontal policies are necessary conditions in order to attain higher levels of income. In fact, it is not known if country can succeed without, for example, satisfactory provisions for infrastructure, significant investments in human capital and an appropriate macroeconomic environment.

In summary, the success of South Korea seems to be a combination of horizontal policies (investments in education, infrastructure and innovation), light industrial policies (investment in the training of engineers) and well designed heavy industrial policies (protection and directed credit to certain sectors, but with the gradual reduction of support and increased exposure to international competition).

Accordingly, after a brief period in which industrial policy was relegated to the background, it has gradually regained importance among public policies in Brazil. In the XXI century, successive industrial policy plans have been announced – The Industrial, Technological and Foreign Trade Policy (PITCE) in 2003, the Productive Development Policy (PDP) in 2008 and Brazil Master Plan (PBM) in 2011.

Progress has been made in encouraging innovation, but the emphasis on heavy industrial policies has grown. The role of the BNDES is being increased. The importance of local content requirement policies and use the purchasing power of the government to stimulate the domestic industry has grown. The same can be said about the creation of the so called national champions (through mergers encouraged by the BNDES or by state pension funds) and policies to provide exemptions for some sectors have been created [Canêdo-Pinheiro (2011)]. Broadly speaking, it follows the same guidelines as the Target Plan and NDP II policies for autarchic growth. We have learned from the results of those policies. We must also learn from the mistakes.

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