

L.A.S. Series No.4

**A Study on the Impact of Economic Liberalization
in Brazil: 1995-2002**

Nobuaki Hamaguchi (Organizer)
João Carlos Ferraz
Carlos Frederico Leão Rocha

March 2003

Institute of Developing Economies
Japan External Trade Organization

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The Latin America Studies (L.A.S.) series aim at disseminating results of research and study done under the Area Studies Department II of the Institute of Developing Economies – Japan External Trade Organization (IDE-JETRO). This book is a result of the joint study carried out in Rio de Janeiro, Brazil, during the fiscal year 2002, written by Nobuaki Hamaguchi (Researcher, IDE-JETRO), Professor João Carlos Ferraz (Director General, Instituto de Economia – Universidade Federal do Rio de Janeiro), and Professor Carlos Frederico Leão Rocha (Director of Undergraduate Program, Instituto de Economia – Universidade Federal do Rio de Janeiro).

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Preface

This book is an outcome of a research project “Economic Liberalization under the Cardoso Administration and Structural Changes in the Brazilian Industry” conducted in Rio de Janeiro during the period from June 2002 to February 2003. The research was funded by the Institute of Developing Economies – Japan External Trade Organization and hosted by Instituto de Economia – Universidade Federal do Rio de Janeiro (IE-UFRJ), where I am a visiting researcher during June 2000 – May 2003. I thank for valuable participation of João Carlos Ferraz and Carlos Frederico Leão Rocha from IE-UFRJ. I am indebted to David Kupfer and Mariana Iooty who co-authored Chapter 2. I am also grateful for the support generously granted by the entire organization of IE-UFRJ.

This study intends an evaluation of the economic liberalization in Brazil in the past decade in multi-dimensional way dealing with macroeconomy, sectors, firms, and regions. It did not pretend a subjective judgment whether liberalization is good or bad, but instead we tried to identify in which aspects the liberalization had effect to change the structure of the Brazilian economy and how robust those changes were.

We find today’s Brazil in a unique situation where a “global standard Brazil”, apt for a globalization, coexists with disordered “third world Brazil”. It is one of the most richly endowed countries with natural resource, but there are quite a few people suffering from indigence and epidemics. Brazil exports substantial amount of high-technology goods and is a showcase of multinational firms but it is still far from accomplishing universal provision of formal primary education for basic reading and calculation. People are paying almost one-third of the national income for a tax but public attend patients school continue to be precarious and doctors in public hospitals are having hard time to attend patients making a long queue. The country continues sound macroeconomic management for almost a decade holding inflation under control and avoiding explicit balance of payment crisis. Still, the rating companies alert that Brazil is one of the highest financial risk countries. The Brazilians showed that a democracy is at work here by choosing the government representing the people’s votes. Yet, the urban life is more and more seriously threatened by aggressions of violence and terror attempted by the organized crime related to drug dealers.

While this project was in progress, we witnessed a political transition in Brazil from President Fernando Henrique Cardoso’s administration (1995-2002) to the new government of the Partido dos Trabalhadores (Workers’ Party) and its center-left allies headed by President Luis Inacio Lula da Silva who won the October 2002 election with highly popular votes. The new government is backed by enthusiasm and high hope for changing the contradicting social situation. Yet, the reform should be conducted without referable models and will be constrained by the recent trajectory of economic policies and international economic scenario. This is quite a challenge and requires careful analysis on where do we stand. We hope this study can contribute to such debate.

Rio de Janeiro, March 2003
Nobuaki Hamaguchi

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Summary of the Study

The Brazilian economy lived a wide-ranged structural transformation in the 1990s. The change in the macroeconomic sphere was quite dramatic. Brazil was under a hyperinflation of annual rate around 2,500 percent in 1993-94. The economic policy during the first half of the 1990s was unstable having an impeachment of the President, eight ministers of finance, and five governors of the central bank in five years. Because of the high uncertainty, access to foreign savings was barred and growth became volatile. The success of the Real Plan stabilization since July 1994 settled the inflation at one digit level. It boosted domestic demand and helped the recovery of the confidence in the Brazilian economy. Foreign direct investment inflow spurred principally into some deregulated sectors. The economic policy was guided consistently by one minister of finance and two central bank governors during the two consecutive mandates of President Fernando Henrique Cardoso (1995-2002), contributing to restoration of confidence in the Brazilian economy.

Reforms in the 1990s left two marked differences in productive dimension. One is the trade liberalization which substantially increased the share of imports and increased competitive pressure in the domestic market. Secondly, ownership structure has been internationalized to a large extent, as a result of acquisitions of local firms by multinational firms including privatizations. They were expected to lead to enhance the efficiency of the economy and growth promoting.

However, the macroeconomic performance since the inflation stabilization is not prone to criticism. Increased dependence on foreign finance after the liberalization amplified the volatility of the economic structure. The economy has been “shaken and stirred” from time to time by occasional external shocks and growth was never sustained. The mechanism of translating and amplifying external shocks into domestic economy is a topic of Chapter 1, which also serves as an introduction to the following chapters.

Further contrary to the expectation, the inflation stabilization and return of foreign investment did not result in recovery of economic growth and increase in employment.

We may set the following list of questions to solve this puzzle: How the changed environment has affected the competitive strategies of firms? Has the ownership change led to more efficient productive structure? Could liberalization solve the problem of inefficiency in public-owned infrastructure? Has the liberalization stimulated technology development of the industry?

Discussion in this book can be summarized as what follows.

In Chapter 1, based on the empirical result that the past economic growth performance was largely based on capital accumulation, the recent low growth record is attributed to low level of investment affected by the macroeconomic volatility. We interpret that the macroeconomic volatility derives from: (1) weak financial linkage to international market; and (2) shallow and conservative domestic financial market. Thus, negative external shocks are easily associated to interest rate hike and the question of vulnerability is structural because of the lack of ability to implement anti-cyclical fiscal policy. We still could find varied sectoral reactions against this macro-level observation. By looking at investment performance of each sectors, we found that investment performance was relatively high in sectors with slack demand such as recently privatized sectors and export-oriented sectors, but in general investment growth was slow and mergers and acquisitions became common practice as a mean of a protection from short-term fluctuation by increasing market power.

Chapter 2 addresses the question of how the competitiveness of the Brazilian industry and the pattern of competition strategy were affected by the liberalization in the 1990s. The study is based on the comparison of the current situation with what was observed in ten years ago. We found that sectoral performances can be grouped into four industrial categories – commodities; traditional goods; consumer durables; and technology diffusers (capital goods) – and this grouping has not been changed from ten years ago. Pattern of competitive strategies showed adaptation to liberalization. Industries in the commodity sector (steel, pulp & paper, concentrated orange juice, and petrochemicals, soy beans complex, and iron ore mining) stay highly competitive based on their highly productive natural advantage and further enhanced by vertical integration to logistics and energy sector and consolidation of leading firms through M&As (which is not yet

conclusive in some industries). During the last ten years, the tendency to export low value-added products and to supply high value-added products has become more prevalent. In the traditional goods sector (food & drinks, furniture, textile & garment, shoes), we observed heterogeneous reactions. Larger firms in this sector became more competitive by modernizing production facility or intensifying exploration of low cost labor force in the Northeastern region. The consumer durable goods sector benefited from boosted domestic and regional (Mercosur) demand but at the same time competition intensified by entry of new players. Firms in the sector showed high ability of adjustment by modernization of production system including installation of new facilities and implementation of global sourcing. The technological diffuser (machinery, telecommunication equipments) sector suffered worst consequences from liberalization due to fragile technological base and deficient production system, previously created by strong government support.

Chapter 3 investigates the role played by M&A transactions in the change of concentration levels in Brazil from 1996 to 2000. Using information from Thomson Financial Securities Data and from the Annual Industrial Survey of IBGE, it concludes that: (i) the period was marked by a small increase in concentration levels, (ii) different markets had different concentration trajectories. The dispersion levels of concentration changes are very high; (iii) there seems to be a slight participation of M&A in the increase of concentration levels. This participation seems to be greater when eight and twelve firm concentration ratios are considered than when four firm concentration ratio is taking into account, (iv) the increase in concentration does not seem to affect negatively efficiency outcomes.

Chapter 4 analyzed the impact of privatization and introduction of market mechanism into previously government-owned and controlled public infrastructure, for the case of electric power. After achieving significant success until the 1970s, the Brazilian electric power sector stalled due to financial problems. The government promoted a shift toward a private ownership model and tried to entrust the market with creating a stable and efficient energy supply. However, the energy crisis highlighted the difficulties in this transition. This paper points out that the uncertainty inherent in the market-based model increased information rent for the private companies and complicated the post-

privatization expansion scenario. Privatization driven by macroeconomic problems should be carefully reexamined, especially for public utilities with strong natural monopoly characteristics, since markets tend to fail to supply the socially optimal supply, thus directly affecting people's lives.

Chapter 5 presents three cases of localized high technology-based industrialization: telecommunication equipment in Campinas (São Paulo), aircraft in São José dos Campos (São Paulo), and biotechnology in Belo Horizonte (Minas Gerais) after the liberalization. The former two cases are originated from mission-oriented national research centers and the latter emerged from spontaneous spin-off from a university with local business support institutions. The case of Campinas showed disconnected development because the past telecommunication equipment agglomeration was mostly taken over by foreign enterprises but academic knowledge pool in the university turned to be attraction for technology based multinationals being keen to local R&D. On the other hand, the aircraft industry in São José dos Campos developed as an extension of the past model by internationalizing the risk sharing partnerships. Such natural transition owes to the establishment of competitiveness in core technology as well as business model valuing technological partnership during the state-ownership period. In contrast to the two cases, the biotechnology industry in Belo Horizonte consists of a number of small firms. As a shown by the pioneering example of an insulin producer Biobrás, these firms should face constraints to be matures in the middle stage of the venture firm development due to the competition with much larger scale multinational firms and lack of financial resource for investment.

Our study provided some evidences to sustain that the Brazilian industry showed its ability to adjust to uncertainties created by macroeconomic volatility and institutional changes brought by liberalization. At the macro level, low GDP growth was attributable to timid increase in aggregated capital stock. However, noticeable changes occurred to the structure of productive asset while leading companies sought to increase their operational efficiencies.

First, capital goods were updated and there was a replacement of labor by machineries as well, especially in consumer durable goods and tradable traditional goods seeking to

strengthen competitiveness in the midst of boosted demand and more competition at the same time. There was a geographical change in seek for cheaper labor and more generous tax incentives. These movements led to a slight increase in capital stock and higher productivity but employment was drastically reduced especially in traditional manufacturing centers.

Secondly, ownership structure was changed. Switching the entitlement does not increase the aggregate capital stock, but transferring the ownership to more efficient firm can enhance productivity of capital and eventually lead to more investment. Efficiency may be reduced, however, if an acquiring firm would abuse its enlarged market power exploiting a monopolistic rent. In the Brazilian case, there was a sign of productivity increase associated with market concentration, due to high contestability in the market. Such efficiency gains may have risen from the post-acquisition consolidation but a synergy effect for substantial creation of new investment is yet to be seen. In the case of privatization of electric power, such conservatism coupled with mismanaged market regulation failed to maintain minimal supply capacity in the eventual climate condition.

Thirdly, trade liberalization and ownership structure change so far have been challenging to technology intensive and technology diffuser sectors. Activity in these sectors had been promoted by the exclusive procurement power of the government and market reserve. Some companies with consolidated core technological capability have been revitalized by effective partnership with foreign companies and specialization to product in which they are most competitive. Interactions between science and industry and locally concentrated supports are found useful to amplify technological dynamics.

Chapter 1

Macroeconomic Uncertainty and the Brazilian Industry

Nobuaki Hamaguchi

I. Introduction

Uncertainty and vulnerability to volatile external factors are becoming major issues of the current discussion on development prospects of Latin American economy (ECLAC, 2002). In fact, vulnerability has been an old theme for the region since the “Manifesto” by Raul Prebisch (1962), although it has been discussed in different means in different context¹. The case in point now is the volatility of international capital flow to emerging markets. While internationally concerted efforts are needed to control a fluctuation, each net debtor country’s active undertakings to build robustness should be highly beneficial.

Yet, it is still puzzling to workout reduce the vulnerability. Theories of aggregate investment alert that if we take an irreversibility of investment and imperfect competition into consideration, uncertainty should reduce investment (Caballero and Pindyck 1996). Because of irreversibility it is costly to undo an investment in bad times, then firms facing high degree of uncertainty discount cash flow obtainable from the project. For a good time, in turn, although the demand may expand for an industry as a whole, a firm under imperfect competition facing a downward sloping demand curve expects new entries truncating the demand for this firm. Thus, even a symmetric uncertainty will discourage investment.

Brazilian economy has experienced substantial change in the 1990s. Although the effective stabilization program finally ceased hyperinflation, the macroeconomic condition remained under high tension of vulnerability to external shocks. Moreover, the structural reform with deregulation and trade liberalization provoked substantial

¹ As one might recall, the original discussion of the terms of trade deterioration led to import substituting industrialization, then claims for dependence on foreign intermediate goods as the cause of external imbalance provoked argument for advancing import substitution, and unhappy net resource transfer to abroad as a form of debt service justified the moratorium.

change in rules of the market and the restitution of new market order is still underway. This added further uncertainty in institutional aspect.

This paper analyzes the source and determinants of uncertainties of the current Brazilian economy. The next section concentrates on macroeconomic issues, followed by a section addressing the institutional changes. The final section concludes the discussion.

II. Problems of macroeconomic uncertainties

Background

Brazilian economy grew at annual average rate of 1.2% per capita in real term in the second half of the 20th century. As Table 1 details the growth performance during the fifty years, stark contrast can be made between the first 30 years of sustained high growth (1950-80) growing constantly 4.3% per year and the last 20 years where the economy registered practically zero growth (0.4% annually).

Table 1. Brazilian real GDP per capita growth during the second half of the 20th century

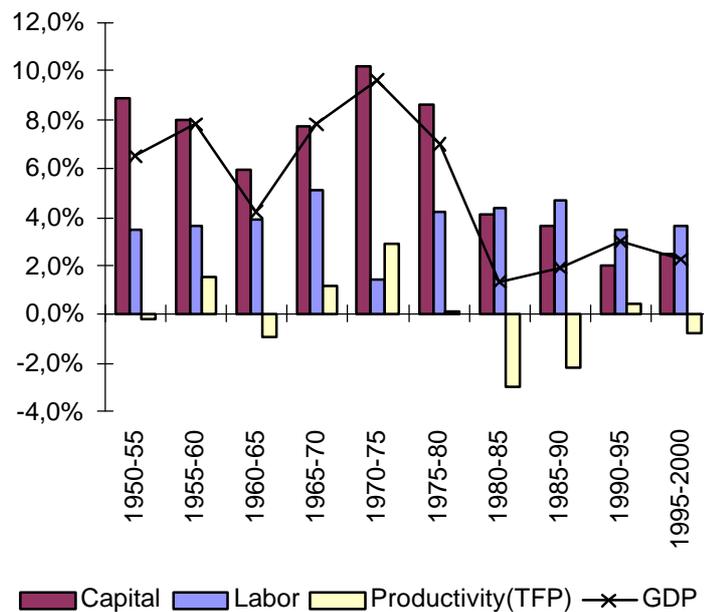
Period	Growth rate	Period	Growth rate
1950-55	3,6%	1975-80	4,1%
1955-60	4,8%	1980-85	-0,8%
1960-65	1,3%	1985-90	0,1%
1965-70	5,0%	1990-95	1,5%
1970-75	7,0%	1995-2000	0,9%

(Source) IPEA Data (<http://www.ipeadata.gov.br>)

The growth accounting in Figure 1 reveals that the high growth period was driven by active resource mobilization, with particularly strong correlation of growth of GDP and capital input. Productivity growth was not very significant initially but started to be significant in early 1970s but dropped afterwards. Import substituting industrialization (ISI) was made relatively successfully with consumer-durable goods such as automobile and electronics, the heavy capital investment in the 1970s to proceed to the second phase of ISI, including technology based industries such as informatics and upstream products such as petrochemical, never obtained economically viable scale because of the economic crisis in the 1980s. This may partly explain the rise and fall of

the total factor productivity in Brazil. The figure also shows that in the low growth period of the 1990s the productivity growth made com-movement with GDP growth, although low capital growth was responsible for the low level of GDP growth. This fact provides an open question whether internal efficiency was improved by productive restructuring by firms, or it has to do with ownership change (M&A and privatization).

Figure 1. Factor decomposition of the growth of the Brazilian economy (1950-2000)



(Note) Total Factor Productivity (TFP) is by author's own calculation based on the assumption of the Cobb-Douglas production function with the labor income ratio of 0.4 and annual depreciation of 0.6. Labor service was calculated multiplying the number of employed workers with estimated average years of schooling.

(Source) IPEADATA for capital stock and real GDP. Summers, Heston, and Atten, Penn World Table Mark 6.1 at <<http://pwt.econ.upenn.edu/>> for number of workers and Human Capital Updated Files <<http://www.cid.harvard.edu/ciddata/ciddata.html>> for the average year of schooling.

In the high growth period, Brazil implemented extensive import substituting industrialization program. The sizable domestic market was protected from competition with foreign products. The developmental state style government constructed huge resource mobilization apparatus such as: state enterprises (CSN – National Steel Company, Embraer – Brazil Aeronautic Enterprise), natural resource monopoly (Petrobras, CVRD), public utility holding companies (Telebras <telecommunication>

and Eletrobras <electric power>), development bank (BNDES-National Bank for Economic and Social Development), and commercial banks (Banco do Brasil, Caixa Economica Federal, and local state banks). Moreover, balanced national integration was pursued through the construction of Brasilia and development projects of the regional development agency (SUDENE, SUDAM).

Although limited internal saving capacity could have been a bottleneck for such ambitious investment projects, the confidence level of the growth potential of the Brazilian economy was so high that it attracted abundant investment and finance from abroad. There was thus mutually reinforcing relationship between favorable external evaluation and high degree of autonomy of the development policy.

On the contrary, the unsatisfactory performance in last two decades can be characterized by a vicious circle of a loss of confidence imposing more and more tight external constraint and a loss of the autonomy. After the Mexican balance of payment crisis in 1982, access to foreign savings was largely denied during the 1980s until the mid-1990s. The weak capability to comply with external obligations led Brazil to look for rescue packages from the International Monetary Fund several times. In the 1980s, the government was unable to conduct autonomous structural reform fitting to the new reality, although it was apparent that the overweight public sector was not sustainable due to the hard fiscal constraint. The reluctance left Brazilians no other choice than inflationary financing (budget deficit with money printing), leading to hyperinflation despite of some ad-hoc attempts of price controls.

This new situation brought tremendous uncertainties to Brazilian economy. Inflation destroyed relative price structure among goods and services and distorted the resource distribution. Exchange rate had to be adjusted daily basis and it was hard to predict even a near future.

On the other hand, the government's maintenance of market protection policy let domestic industries remain under little threat of external competition. This allowed firms to take defensive strategy of avoiding investment and longer utilization of capital goods, cost reduction by smaller variety and higher scale production, and high mark-up pricing.

The reform plan of the Collor administration in 1990, including "elimination of fiscal deficits", "trade liberalization" and "privatization", was new for Brazil at that time. The list of import prohibition was eliminated and the import tariff was reduced. The

National Privatization Plan (PND) predicted comprehensive transfer of ownership of government owned productive assets such as steel mills, petrochemical complex, and aircraft industry to the private sector. Although the administration's inflation stabilization program including confiscation of bank deposit and freezing of price and wage was complete failure, and the president was impeached in 1992 for his involvement in illegal drug money operation, their structural reform idea had lasting effect which was later inherited by the Cardoso administration. The climate of uncertainties increased because of even intensified inflation and the liberalization and the privatization were changing the market condition and it was hard to predict how will be and should its ultimate shape.

The FHC era was initiated with recovery of growth in 1995 induced by successful implementation of the stabilization policy – Real Plan which brought the annual four digit hyperinflation to one digit by means of quasi-fixed nominal exchange rate as an anchor of the monetary policy. A direct effect was the surge of domestic demand because of the real income growth due to the end of inflationary tax and recovery of faith in local currency. Thanks to the price stabilization, external finance returned to Brazil. The access to foreign saving was important to maintain the quasi-fixed exchange rate without losing the foreign exchange reserve while the current account was in sizable deficit because of the surge of import.

The external saving dependent stabilization was proved to be vulnerable to external shocks. By the nature of the exchange rate control, deterioration of the balance of payments should be defended by raising the interest rate to stop the capital outflow and to curb the import growth. For this end, interest rate was shot up several times above 40%, especially during the turmoil of the global emerging market financial crisis in 1997-99. As seen in Figure 2, the loss of foreign reserve triggered interest rate hikes. This kind of policy response failed to restore the external imbalance in the late 1998 and the Real Plan had to be abandoned, paving the way to the floating exchange regime.

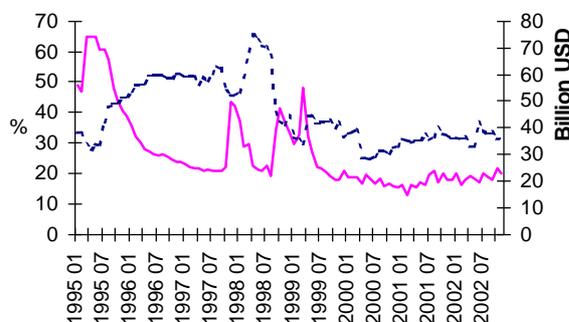
At that systemic change, a resurgence of inflation was much afraid of. Yet, the Central Bank successfully contained the inflationary pressure by establishing inflation targeting as a new monetary policy rule, and the Ministry of Finance perfectly combined forces by tight fiscal policy to generate sufficient primary budget surplus. Brazil muddled through the crisis of 1999 and there was a sign of strong recovery with investment and employment growth in late 2000.

Table 2. Recent Economic Growth

	Growth rate (%)
1995	2.8
1996	1.2
1997	1.9
1998	-1.2
1999	-0.5
2000	3.0
2001	0.2
2002	0.2

(Source) IPEA data.

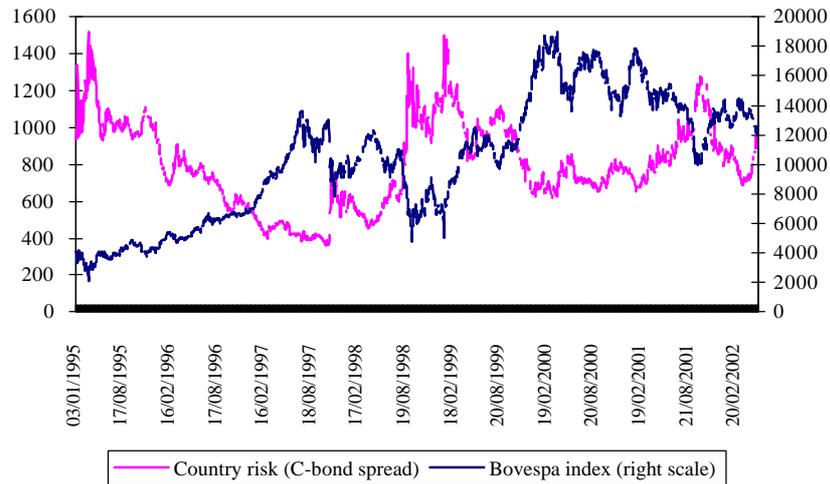
Figure 2. Instability of interest rate



However, the economic recovery plunged as the economic environment returned unfavorable with the countrywide serious electric power shortage for almost a year in 2001 and political uncertainty in the expectation of opposition party's winning the presidential election in 2002 and predicted substantial change in economic policy. Net foreign capital inflow fluctuates quite sensitively to outsiders' evaluation of country risks, which then has an effect on the country's economic stability. Thus, although Brazil's macroeconomic confidence rose by the virtue of inflation stabilization, the country still has not got rid of vulnerability to external factors. Notice that, in contrast to the previous hyperinflation period in which the government was virtually bankrupt and inflation accommodative monetary policy was taken, during the post-1999 crisis period inflation rate has been kept under control and the Brazilian government was truly committed to the compliance of the fiscal and monetary policy target agreed with the International Monetary Fund and its economic fundamentals were considered sound. Still, as Figure 3 shows, country risk premium (represented by the spread of C-bond, the most traded Brazilian external bond) makes up down swings, which, in turn caused great fluctuation to the capital inflow and contracted the level of liquidity in the domestic financial market, as partly evidenced by the opposite movement of the Sao Paulo Stock Market (BOVESPA) index. The real sector performance is also strongly influenced by such unstable financial indexes (Figure 4).

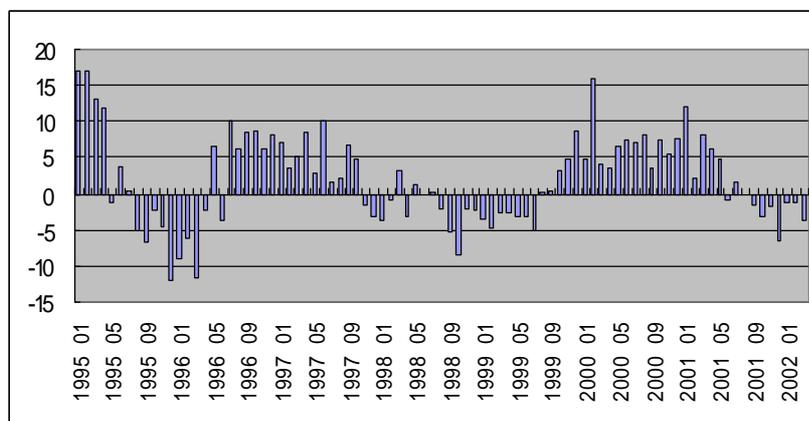
So, Brazil is doing their best to keep its house in order: then, who should be blamed and what can be done? In the next section, we will pay attention to the perverse logic of current macroeconomic policy.

Figure 3. Country risk and stock market index



(Source) IPEADATA

Figure 4. Industrial production index growth rate (12 months, %)



Source of Vulnerability

According to the research done by ECLAC (2002), external vulnerability of Latin American economy has been strengthened during the 1990s. It is particularly noted that: (1) availability of domestic credit is strongly influenced by influx of external financing which fluctuate depending on the external factors than internal ones; and (2) fiscal policy behaved in a pro-cyclical way such that in a low growth phase

governments reduce fiscal expenditure to avoid the government debt / GDP ratio to rise. The latter question amplifies vulnerability due to inability to implement anti-cyclical macroeconomic policies to mitigate an impact of the external shocks.

The success of the Real Plan, ironically, revealed that the public finance of Brazil had depended much on inflationary tax and substantial reform was required to establish sustainable balanced account. The fall of primary fiscal surplus in 1994-98 was alarming. In this initial period of the FHC era, although some adjustments were done², they were not enough to save the primary balance from turning into deficit in 1996-98. The situation was particularly worrisome in local government. Besides, Figure 5 shows that public debt service burden almost doubled as a proportion to GDP in 1997-98 due to the sharp rise of interest rate, leading to the sharp rise of the public debt to GDP ratio as seen in Figure 6. Thus, it was noticeable that the interest rate rise responding to external shocks was translated into public deficit which should be financed by additional issuance of debt. Notice that these are domestic bond (Figure 7) assumed by local financial institutions.

Obviously, increasing debt-GDP ratio was not sustainable and the Brazilian government had to face two major policy reforms. One is to abandon the nominal exchange rate anchor in order to avoid the galloping interest rate to defend the exchange rate and international reserve. At the same time, the government implemented bold structural reforms. Most notably the government passed a constitutional amendment in 1998 to reform the social security system and the Law of Fiscal Responsibility in 2000 ruled at three administrative level (federal-state-municipal) compulsory commitment to fiscal goals, setting limits to personnel expenditure and debt contract. These measures boosted the cash generating capacity with the return to the primary surplus.

After the floating of the exchange rate, the domestic financial institutions demand that their yield would be linked to exchange rate to neutralize the exchange rate risk to which they are exposed in external funding. The proportion of the public debt indexed to exchange rate has been increased considerably. Any substantial depreciation of the real affects fiscal account through increase of interest payment and increases the necessity of the borrowing. Any external shock leading to depreciation of the real should be concerned for two reasons: inflationary pressure and rising debt/GDP ratio.

² There were initiatives such as collection of new tax (i.e. CPMF- Provisionary Financial Transaction Tax) and introduction of FEF-Fiscal Stability Fund to retain a part of the transfer to local government in the central government treasury, in addition to privatization of several public enterprises.

This gives the central bank a motive for raising interest rate, which, yet adds undesirable pressure to debt/GDP ratio. Since higher indebtedness raise sensitiveness of foreign creditors, the government is induced to announce tighter fiscal policy to boost the debt payment capacity. The pro-cyclicality of macroeconomic policy is thus institutionalized, as ECLAC (2002) points out, limiting autonomous reaction to external shocks.

Figure 5 Fiscal balance and interest payment (% GDP)

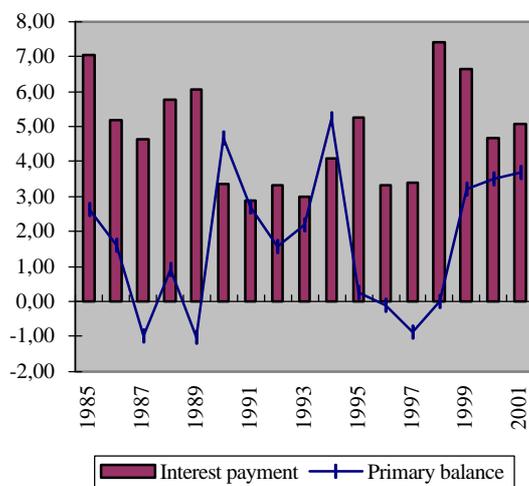


Figure 6. Evolution of the public debt (% GDP)

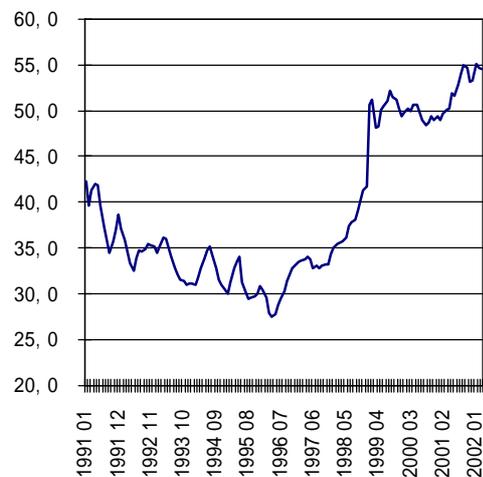
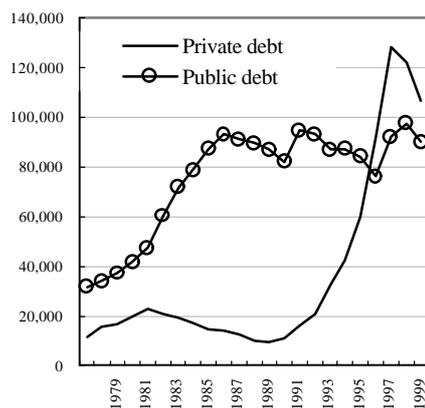


Figure 7 Evolution of external debt by holders



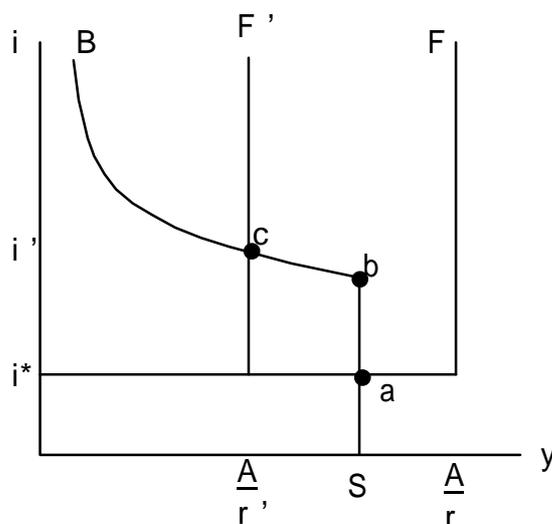
Vulnerability to external shocks

These arguments point to the basic problem of the current Brazilian economy. Let us illustrate with a model depicted as Figure 8, which is a modified interpretation of Caballero (2000). We take the following minimalist approach to attribute the vulnerability of an economy on two factors. One is weak international financial links that constrain access to external financing especially when it is needed. The other is limited role of the domestic financial market whose credit creation policy is so conservative.

Departing from the original Caballero (2000) model, we consider that the final credit taker is a government who needs liquidity to finance the current deficit by pledging the future fiscal surplus (S) based on its sovereign credibility. We assume that the government will not borrow from the foreign creditors directly and only finance through the domestic financial market. Although the government can be loaned directly in reality, this assumption is plausible in light of Figure 8 which demonstrates that the private external debt rose sharply while the public sector external debt stagnated in the 1990s.

Consider that foreign creditors depicted by F-curve lend money to the banking sector of this country at the international interest rate i^* up to its asset value A/r , where A is the nominal value of the asset and r represents a country risk. The graph also expresses that since the international financial link is so weak that the foreign creditors will not supply credit more than A/r , which is regarded as the ultimate collateral.

Figure 8 External finance constrained crisis model



The domestic banking sector, in turn, lends this money to the government which has the financing requirement S . No further financial demand exist beyond this amount, therefore the B-curve is vertical at this point. Banks require interest rate premium upon i^* as the reward for the financial intermediation. We assume that the higher the predicted default risk, the higher the premium would be, and the smaller the amount of the future budget surplus that the government can pledge and accepted by the banks. Therefore, the B-curve slopes downward.

In a normal situation where the country is sufficiently creditworthy, $A/r > S$, therefore there is enough external finance at point a with i^* , satisfying the government's financial need S at the interest rate margin corresponding to the distance between b and a . Suppose, then, that, for whatever the reason³, the country risk of this country rise, becoming $A/r' < S$ and shifting F-curve left-ward to F' . If the domestic banks would believe that the external shock would not affect the government's promise to comply with the future surplus creation of S , they would create additional credit to maintain point b . However, conservative domestic banks will reduce the finance to the government in accordance to the availability of the external credit and require higher risk premium at point c . The government, in turn, cannot fully finance S and should curtail a current fiscal expenditure, which may negatively affect economic growth.

This simple model represents a perverse situation of the Brazilian economy. Due to the fiscal fragility with dependence on the external financing, coupled with the conservative decision of the domestic financial sector, the impact of the external shock is directly translated to the domestic interest rate. Moreover, contrarily to the standard macroeconomic theory, the fiscal policy should become pro-cyclical because the government should take restrictive fiscal policy against the negative external shock. Thus, the country's inability to take counter-cyclical macroeconomic policy will make it highly vulnerable to external shocks.

Our result resembles to Razin and Sadka's (2002) assertion on strong influence of external factors on Brazilian economy. They assume that an economic growth depends on the growth of investment which is basically financed by external borrowing. The model results in two equilibriums: a good equilibrium with low risk premium, higher investment and higher growth and bad equilibrium with high risk premium, low

³ A reader can imagine the situation when the Brazil faced contagious effect from financial crises in Russia (1998) and Argentina (2001), or when the pre-election political uncertainty in 2002.

investment and doomed economic growth. The authors argues that the switch from good to bad equilibrium may occur abruptly because the investment level critically depends on the pro-cyclical formation of external rating of country risk. The gloomy fate of this story is no matter how well the government and the central bank get the economic fundamentals right, the crisis may come if external evaluators cannot believe and there is nothing that policy makers can do against that.

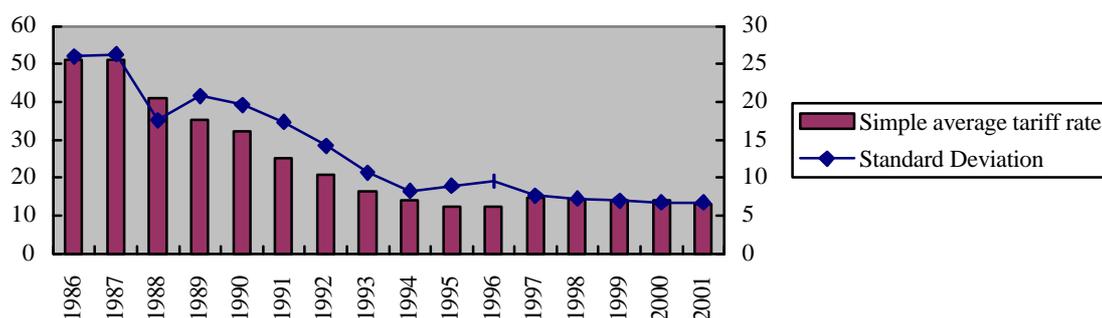
Notice that occurrence of this problem depends crucially on the assumptions of the weak link with the international finance and the conservative domestic banks which will not create credit beyond the availability of external funding. If these conditions are relaxed, then we will have positively smoothly sloping F-curve for $y > A/r$ and vertical B-line on the pledged future surplus level S . This means that foreign creditors' provision of finance will not be constrained to the level of the country's current convertible asset. For this, there is strong need for structural measures to restore policy autonomy. It is true that the restoration of policy autonomy and attaining the foreign creditors' confidence cannot be done immediately. As pointed out by Garcia (2002), an important transitory measure is to increase "exportability" of the economy, which stands for about 14% of GDP although it has picked up from 8% in 1997. This can be interpreted as the leftward shift of the F-curve of Figure 8, making the psychological border A/r less probable to bind in the event of small shocks. As for the domestic financial market is concerned, reform should include maintenance of debt to GDP ratio at manageable level, increase domestic savings, and promote domestic financial intermediation by removing systemic obstacles such as tax system increasing the cost of financial transaction.

III. Institutional changes and structural uncertainties

This section analyzes instability of the current Brazilian economy from different angle. The argument here is that the structural reform implanted in early 1990s by the Collor administration and deepened by the Cardoso administration has changed the rule of the game of the industrial sector, and firms by and large adapted defensive strategy during the transitional period.

Trade liberalization

Figure 9 Tariff reduction: 1986-2001



(Source) WTO, Brazil Trade Policy Review Secretary Report 1996 and 2000, Geneva and for 1997-2001 figures ALCA net

The process of trade liberalization was already launched in the late 1980s. According to Figure 9, the average import tariff was reduced from 51% in 1987 to 41% in 1988 and 36% in 1989. It was further deepened in the beginning of the 1990s under the Fernando Collor Administration by which the average tariff was brought down below 20%, coupled with abolishment of the import prohibition of 1,300 items listed in the Annex C of the Tariff Code. Tariff structure was also simplified as being shown by the decrease of standard deviation, implying reduction of the maximum tariff.

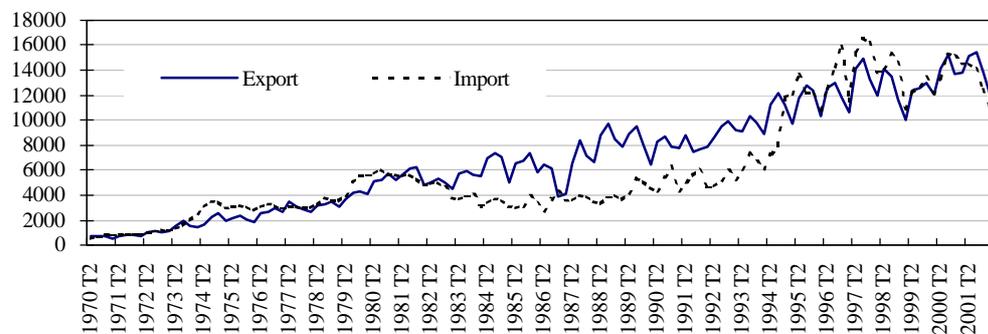
Brazil adopted Mercosur common external tariff (CET) in 1995. Initially, four categories of goods were excluded from immediate adherence to CET: sugar, automobile and its parts, capital goods, and informatics and telecommunication equipment. For the latter two, gradual conversion to CET, by 2001 for capital goods and 2006 for informatics and telecommunication equipment, was initially scheduled. Sugar and automobile are administered under special regimes leaving room for future negotiations.

As being hit by several emerging market financial crises, Mercosur countries agreed to levy 3% points of surcharge on most of items, increasing the average tariff from 12.6% in 1996 to 14.7% in 1997. Although the surcharge was originally planned to go off by the end of 2000, it is still partly maintained after being slashed 1.5% point by 2002. This makes the average tariff rate in recent years is higher than the 1995-96 level, yet the standard deviation continued to decrease owing to the reduction of tariff

on capital goods as the consequence of its conversion to CET (14%) and further reduction to 5% in 2001 for those which are not manufactured in Brazil.

Impact of the tariff reduction was rather dramatic. According the Figure 10, imports had been contained through high tariff and undervalued exchange rate since the occurrence of the balance of payment crisis in early 1980s, mainly to generate the capacity to repay external debt. The Real Plan introduced in 1994 brought strong local currency whose income effect coupled with the lowest tariff level in many decades boosted imports and created sizable amount of trade deficit. The level of imports was more or less equalized after the exchange rate was floated.

Figure 10 Exports and Imports



(Source) IPEADATA

Deregulation and internationalization of ownership

Another important aspect of the institutional changes during the FHC era was a deregulation. Most importantly, many public enterprises were privatized and investment opportunities were open to foreign capital. Likewise the trade liberalization, privatization was put into practice under the Collor administration by launching the National Privatization Plan (Plano Nacional de Desestatizacao: PND) in 1990. Cardoso administration amended the constitution to eliminate differentiation between national and foreign capital and opened formerly closed sectors such as distribution of gas, mineral exploration and extraction (including hydrocarbons), maritime coast liner and river and lake transport, telecommunication services, financial services, and reinsurance operations. Then the original PND was reformed with the approval of the Law No. 9491 of 1997 to add these sectors. As a related legal reform the Concession Law (Law

No. 8987 of 1995) institutionalize a general rule of the provision of concession of public service, complemented by the Law No. 9074 of 1995 for the electric power and Law No. 9295 of 1996 for a mobile telephone, and Law No. 9472 of 1997 (General Law of Telecommunication) for fixed telephone service. As for the banking sector, many banks were in deficit after the loss of the float revenue by the end of high inflation. The central bank had to make intervention to badly managed banks to consolidate the soundness of the financial system. These bad banks were recapitalized and cleaned the balance sheets, and then merged with, and acquired by other healthier banks. Such operation were initiated for private banks by PROER and then extended to state owned banks by PROES. In this process, foreign banks played major role as acquires.

Table 3 illustrates this profound ownership structure change. Among the large industries listed in the Gazeta Mercantil's Balanco Annual, the share of the government decreased from 52.4% to 33.8% in capital in equity and from 48.7% to 22.9% in net operational revenue in ten years between 1990-2000. On the other hand, both foreign companies and private national companies increased their share, while the increase was much more remarkable for the foreign companies.

Figure 11 Net Foreign Direct Investment Inflow

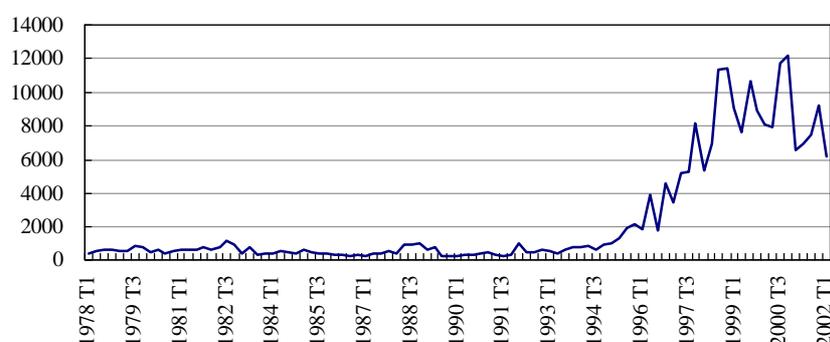


Table 3 Shares of state, foreign capital and national private

	Shareholders' equity		Net operational revenue	
	1990	2000	1990	2000
State	52.4	33.8	48.7	22.9
Foreign	8.5	21.0	10.1	27.9
Private	39.1	45.2	41.2	49.2

(Source) Gazeta Mercantil, Balanco Annual.

De Paula, Ferraz, and Iooty (2002) explains that under the trade liberalization and increasing presence of multinationals in the domestic market, Brazilian enterprises found themselves under-capitalized and lacking the technology necessary to maintain local market share and enter international markets. Then the financial fragility forced a large number of firms either to seek new partners or to sell-off assets to new entrants. Thus, in the last decade the Brazilian industry witnessed major ownership change

Kupfer and Rocha (2002) showed that the participation of multinational firms increased in every sector. It does not necessarily mean, however that the Brazilian market was captured by foreign companies and it became less competitive. On the contrary, Kupfer and Rocha (2002) showed that as the result of the break down of the state monopoly in several sectors and survival of local companies through defensive specialization strategy, the intensity of market competition actually has increased. In some sectors national private enterprises achieved notable growth through acquisitions.

Diversified reactions

It is still an open question whether this ownership structure change has led to expansion of productive capacity and improvement of technology at each industry level. Although it requires careful and in depth analyses, Ferraz, Iooty, and Kupfer (2003) analyzed the recent trend of investment and reached the following conclusion. There were some capacity expansion investment but specialization to limited type of production and market consolidation through M&A was widely seen. In general, interest in innovation has been low, with just one third of firms investing in any kind of innovative activities. Larger firms were more likely to innovate. Some sector specific characteristics were observed:

<Durable consumer goods> In automobile and parts, investment in capacity expansion and modernization of existing capacity of automobile assembly makers and consolidation in autoparts firms through M&A. In electronics, capacity expanded toward 1996, then most recently the sector concentrates in specialization and consolidation. M&A occurred and promoted concentration in home electrical appliances.

<Capital goods> Generally weakened competitiveness after the market liberalization. Telecommunication equipment industry expanded after the

deregulation of the telecommunication sector. Some multinationals entered the market through M&A which now has dominant position. Other industrial equipment industry did not invest.

<Intermediate goods> In both steel industry and petrochemical industry, privatization marked a process of asset ownership restructuring, which is not concluded yet and larger scale of consolidation is expected. Some investments were made for production of more noble line of products.

<Non-durable consumer goods> Footwear industry, export-oriented, made a scrap-and-build investment shifting production base to low wage area to gain competitiveness and maintained the production level. Such cost-effectiveness strategy was common to some extent for textile, but the latter lost production capacity due to the lack of competitiveness having obsolete technology.

In order to follow this characterization numerically, we constructed Table 5 and 6 from firm accounting data published in Gazeta Mercantil's *Balanço Anual*. Unlike Ferraz, Iooty, and Kupfer (2003), our data is not restricted to the manufacturing. Table 4 reports the evolution of total asset during 1994-2001. Based on this data we calculated increments of the total asset in two periods, 1994-98 and 1999-2001, corresponding to periods of controlled exchange rate and the floating regime. The total increments during the whole years are divided by the initial position in 1994 and the sectors are sorted by this index to identify the ranking of investment performance. Table 5 was thus created. Table 6 shows the evolution of profitability (net profit to equity ratio).

Table 5 identifies that home electric appliances, telecommunication, food, retail and petroleum & gas are most highly ranked sectors in investment performance in the 1990s. Among these, telecommunication and petroleum & gas are noticeable in terms of the volume of increments in asset. The high performance of the two sectors was a result of deregulation. Privatization of fixed telephone and mobile phone service formerly owned by Telebras, as well as the auction of the concession of so-called mirror providers (competitors in each privatized service area) were implemented in 1998. Petrobras has not been privatized but its monopoly over petroleum and natural gas was opened to competition. This resulted in not only new entrants' investment in petroleum exploration and distribution of fuels but also conveyed Petrobras itself to more aggressive finance and investment strategy. Home electric appliance industry, food

industry, and retail service were marked by significant number of acquisition of local brands by foreign firms enlarging market share in the Brazilian market.

Among the middle-high investment performance sectors with the index above the average, holding companies and banks were also driven by M&A including foreign investment⁴. It should be noted that the recent M&A wave gave rise to many holding companies controlling horizontal conglomerates, such as the case of AmBev resulted from the merger of Brahma and Antarctica.

In the following groups, the lower performance of the electric power sector noticeable, especially when it is compared with the telecommunication sector that also experienced privatization. It is commonly said that the privatization of the electric power did not contribute to investment increase⁵.

It should be also noted that, according to our indicators, technology intensive sectors such as informatics & information technology, electronics, and automobile were comparatively lower profile in invest performance. Consumer non-durables were differentiated between food and leather & shoes (high), beverage & tobacco (middle), and textile and furniture (low).

From Table 6, the following relevant observations can be drawn with regard to profitability:

- (1) Among the high investment performance group, bank, leather & shoes, petroleum, and pharmaceuticals continuously show high profitability⁶. Retail service and home electric appliance, and telecommunication apparently suffered a negative impact of low economic growth in the post-devaluation period.
- (2) Although not being outstanding in the investment performance, sanitary products, beverage & tobacco, mining, and non-metallic mineral products showed high profitability throughout the recent years.
- (3) Electronics and informatics & IT were influenced by the downturn of the telecommunication sector as being the main client. Electric

⁴ Another notable feature in this group is the quite contrasting performance of the construction industry before and after the exchange rate system change.

⁵ This problem is analyzed by Hamaguchi (2002).

⁶ Banks' negative profit in 1996 was influenced by a large loss of Banco do Brasil in that year. If we consider only private (national & foreign) banks, the profitability was 0.157.

equipment picked up in 2000-01 owing to the temporary surge of demand for power generation and energy saving equipment after the power shortage in 2000.

- (4) Profitability of automobile⁷ (including other transport equipment such as air craft) and paper & cellulose, and metal is recovering after the devaluation, partly due to higher exportability.
- (5) Low profitability coincides with low investment performance in such sectors as agribusiness related ones (agriculture and livestock, sugar and alcohol), plastic & rubber, and wood & furniture.

To summarize, we could confirm the argument by Ferraz, Iooty, and Kupfer (2003) regarding the discordance of the investment trend by sectors. Thus, it cannot be said that the macroeconomic uncertainty covering the whole economy affect all sectors uniformly. It is therefore important to take into consideration impact of institutional changes that may overwhelm the macroeconomic effect. Deregulation of unfulfilled demand and unexplored resource, such as the case of telecommunication (the former case) and petroleum & gas (the latter case) is certainly investment enhancing, although macroeconomic effect is becoming increasingly dominant in the case of telecommunication in the recent scenario. Otherwise, as the leather and shoe industry demonstrates, high degree of export orientation makes the sector rather prone to economic fluctuation in the domestic market. Having these exceptional cases, combination of macroeconomic and institutional uncertainties is conducive to defensive concentration. Consider that an expected shock is symmetric; i.e. fluctuation is expected but there are equal chances of good times and bad times in the future. In this case, by eliminating competition a dominant firm can capture the expanded market taking advantage of scale economy to deter entry of new competitors. In the bad times, the firm can avoid a war of price reduction and assure a profit. The interpretation leads us to understand the recent M&A boom in Brazil not as aiming at short-term monopolistic rent or as means to earn capital gains, but as a long-term strategy to cope with uncertainties of the economy. Whether the productive capacity expands still depends on the macroeconomic prospects but the institutional changes have promoted

⁷ The figure of the automobile sector cannot be considered representative because most of principal assemblers in the Brazilian market (Volkswagen, GM, Ford, Daimler Chrysler) are not reported in the original data source.

deep capital ownership restructuring in a number of sectors. Should a policy can enhance economic autonomy, it will enable to reduce external constraint contributing to sustained growth.

IV. Conclusion

This paper raised the question about the meaning of uncertainty for the current Brazilian economy. We first examined that economic growth has been doomed despite the achievement of price stability under the Fernando Henrique Cardoso administration. This was mainly due to low growth of capital stock which had been the main engine for the past fifty years. As the aggregate investment theory showed, investment might be discouraged by macroeconomic uncertainty. As sources of economic uncertainty, we paid particular attention to the fact that: (1) external financial linkage is weak; and (2) domestic financial market is shallow and conservative. With these factors sudden interest rate hike is likely under external shocks and the question of vulnerability is structural because of the lack of ability to implement anti-cyclical fiscal policy.

Although the stagnation of capital stock increase is observed at macro-level, we call attention to the fact that the trend of investment is discordance by sectors. This fact is attributable to heterogeneous impact of institutional reform and further uncertainties brought by the reform. The recent M&A wave is probably related to such economic environment.

Our analysis left many unanswered questions. Firstly, we did not discuss the impact of uncertainties on productivity and labor, being particularly important the case of the former and its relation to profitability. It is also of interest how uncertainty affects innovative activity of firms. Secondly, the issues of firm strategy should be more carefully discussed. Uncertainty should increase idiosyncrasy of firms' reaction, which in turn change the sectoral structure. Thirdly, the relation between uncertainties and concentration of ownership should be examined with more theoretical rigor. This, then, will pave the way to a question of impact of concentration on productivity and profitability, related to the first question above. Finally, the role of export is important for the policy analysis. Our analysis suggested that higher degree of export would make an industry less vulnerable and more conducive to investment. It was also pointed out that higher exportability would all wider slack of external finance constraint and reduces

the macro-level vulnerability. This should be however contrasted with the view on vulnerability on high dependence on external demand, like the debate on the case on Chile and Mexico suggests.

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Table 4 Evolution of total asset by sectors (Unit: R\$ billion)

Total Asset	1994	1996	1997	1998	1999	2000	2001
Petroleum & Gas	30.30	44.43	47.74	50.68	65.02	87.99	98.58
Automobile & parts	11.32	15.23	17.15	19.61	25.08	26.21	18.70
Metal	41.40	51.48	53.95	55.55	73.50	80.59	87.14
Chemical & Petrochemical	22.08	26.55	30.79	32.13	39.99	46.46	49.64
House electric appliances	2.10	3.50	3.74	6.59	4.38	8.55	10.68
Informatics & IT	5.33	3.68	3.13	5.75	6.91	9.43	9.23
Paper & Cellulose	13.40	22.60	20.71	20.98	26.88	30.37	32.60
Mining	17.02	22.06	23.03	24.84	26.19	30.86	35.67
Textile	10.08	14.90	13.32	12.43	14.14	16.44	16.56
Non-metallic mineral products	13.51	17.81	16.47	18.28	20.90	24.97	21.86
Machinery	5.46	7.97	6.79	7.57	9.68	9.72	11.57
Sanitary & cleaning product	2.48	1.87	3.20	4.74	6.37	7.04	5.31
Electric equipment	2.62	3.71	5.71	6.75	7.07	5.07	6.20
Pharmaceutics	2.32	2.70	2.51	4.12	6.26	6.42	6.19
Plastic & rubber	3.74	4.68	4.16	4.47	7.01	6.94	7.01
Electronics	4.46	12.91	12.71	14.23	17.24	11.18	7.64
Leather and shoes	1.46	2.12	1.78	2.51	2.69	3.40	3.87
Wooden products & furniture	4.21	6.65	6.66	7.12	9.24	6.58	7.08
Electric power	95.36	147.12	126.21	163.39	176.59	168.30	210.60
Telecommunication	26.96	45.04	50.13	64.49	77.64	105.95	119.64
Transportation & logistics	50.59	76.75	71.94	73.81	65.11	72.15	74.19
Construction	25.94	50.46	61.46	69.11	68.04	78.43	78.26
Retail	7.00	15.03	14.88	18.64	22.72	23.57	23.74
Wholesale	4.95	6.08	6.56	8.67	5.75	18.51	7.64
Food	9.24	17.27	17.50	19.89	25.76	33.56	37.01
Beverage & tobacco	10.03	16.94	16.11	18.79	21.89	25.76	21.59
Sugar / alcohol	9.20	14.36	8.09	13.33	14.55	18.72	19.35
Agriculture	7.01	6.16	7.66	13.19	11.16	6.95	7.85
Livestock	6.19	9.20	7.98	8.57	9.83	5.49	6.70
Banks	401.20	575.92	679.92	771.01	842.67	970.56	1107.16
Holding	140.92	210.83	188.27	249.77	307.68	369.47	404.43

(Source) Gazeta Mercantil, *Balanço Anual*, various years.

Table 5 Ranking of investment

Total Asset	Increments			(A)/(Position in 1994) Ave=1.574
	1994-1998	1998-2001	1994-2001 (A)	
Home electric appliances	4.49	4.09	8.58	4.09
Telecommunication	37.53	55.14	92.67	3.44
Food	10.65	17.12	27.78	3.01
Retail	11.64	5.1	16.73	2.39
Petroleum & Gas	20.38	47.9	68.28	2.25
Construction	43.17	9.16	52.33	2.02
Holding	108.85	154.66	263.5	1.87
Banks	369.81	336.16	705.97	1.76
Pharmaceutics	1.8	2.07	3.87	1.67
Leather and shoes	1.05	1.37	2.42	1.66
Paper & Cellulose	7.58	11.63	19.2	1.43
Electric equipment	4.13	-0.54	3.58	1.37
Chemical & Petrochemical	10.06	17.5	27.56	1.25
Electric power	68.03	47.21	115.25	1.21
Beverage & tobacco	8.75	2.8	11.55	1.15
Sanitary & cleaning product	2.26	0.58	2.84	1.15
Machinery	2.11	4	6.11	1.12
Metal	14.15	31.59	45.73	1.10
Sugar / alcohol	4.13	6.03	10.15	1.10
Mining	7.82	10.84	18.66	1.10
Plastic & rubber	0.74	2.54	3.28	0.88
Informatics & IT	0.42	3.48	3.9	0.73
Electronics	9.77	-6.59	3.18	0.71
Wood products & furniture	2.91	-0.04	2.87	0.68
Automobile & parts	8.29	-0.91	7.38	0.65
Textile	2.35	4.13	6.48	0.64
Non-metallic mineral products	4.77	3.58	8.35	0.62
Wholesale	3.72	-1.02	2.7	0.55
Transportation & logistics	23.22	0.38	23.6	0.47
Agriculture	6.18	-5.34	0.84	0.12
Livestock	2.38	-1.87	0.51	0.08

Table 6. Profitability (Net profit / shareholder's equity)

Profitability	1994	1996	1997	1998	1999	2000	2001
Petroleum & Gas	0,12	0,05	0,08	0,08	0,08	0,31	0,28
Automobile & parts	0,20	-0,02	-0,01	-0,01	0,12	0,06	0,15
Metal	0,05	0,00	0,02	-0,02	-0,04	0,13	0,06
Chemical & Petrochemical	0,08	0,00	0,01	0,05	0,02	0,07	0,04
Home electric appliances	0,13	0,17	0,04	0,01	-0,13	-0,06	-0,08
Informatics & IT	0,16	0,01	0,09	0,04	0,04	-0,03	-0,33
Paper & Cellulose	0,05	-0,05	-0,04	-0,07	0,03	0,13	0,07
Mining	0,07	0,05	0,07	0,08	0,08	0,16	0,18
Textile	0,11	-0,04	-0,04	-0,05	-0,05	0,03	-0,01
Non-metallic mineral products	0,08	0,08	0,04	0,04	0,06	0,12	0,17
Machinery	0,07	-0,02	0,06	0,02	-0,03	0,04	0,06
Sanitary & cleaning product	0,25	0,15	0,13	0,07	0,15	0,11	0,10
Electric equipment	0,07	-0,02	0,11	0,07	-0,09	0,08	0,20
Pharmaceutics	0,30	0,29	0,19	0,19	0,17	0,07	0,06
Plastic & rubber	0,08	-0,04	-0,02	-0,07	-0,05	0,00	-0,06
Electronics	0,17	0,10	0,09	-0,01	-0,16	0,08	-0,65
Leather and shoes	0,16	0,08	0,08	0,08	0,04	0,10	0,09
Wooden products & furniture	0,02	0,02	0,00	0,00	-0,08	0,03	-0,01
Electric power	0,01	-0,01	0,03	0,02	-0,03	0,00	0,02
Telecommunication	0,04	0,09	0,10	0,06	-0,03	0,01	-0,05
Transportation & logistics	-0,05	-0,03	-0,07	0,06	-0,07	-0,09	-0,10
Construction	0,04	0,05	0,03	0,04	0,04	0,04	0,04
Retail	0,10	0,13	0,06	0,08	0,03	0,03	0,04
Wholesale	0,15	0,09	0,03	0,08	0,02	0,12	0,06
Food	0,11	0,02	-0,03	0,05	0,01	-0,01	0,03
Beverage & tobacco	0,11	0,15	0,11	0,13	0,03	0,15	0,15
Sugar / alcohol	0,07	-0,04	-0,02	-0,03	-0,07	-0,01	0,07
Agriculture	0,01	-0,04	0,00	0,09	-0,11	-0,01	-0,01
Livestock	0,04	-0,01	0,03	0,01	-0,04	0,02	-0,03
Banks	0,09	-0,03	0,11	0,08	0,04	0,10	0,09
Holding	0,05	0,05	0,08	0,03	0,01	0,05	0,03

(Source) Gazeta Mercantil, *Balanço Anual*, various years.

Chapter 2

Made in Brazil: Industrial Competitiveness Ten Years after Economic Liberalisation*

João Carlos Ferraz, David Kupfer and Mariana Iooty

1. INTRODUCTION

In 1996, we published, in Portuguese, with Lia Haguenaer, the book “Made in Brazil: competitive challenges for the industry” (Ed. Campus). This was a major work where, departing from an analytical framework we developed at the Instituto de Economia, Universidade Federal do Rio de Janeiro, we analysed a massive amount of original data and articles produced by a large number of sectoral specialists, in a major research project, co-ordinated our partners from UNICAMP, headed by Prof. Luciano Coutinho, and us. This was an analysis of the competitiveness of the Brazilian industry in the turn of the decade. Made in Brazil had a major impact on specialised circles because of its wideness and thoroughness.

Since then we have been willing to follow the lead of the 1996 book, to further improve the analytical framework and to update the analysis of competitiveness. Now we have a unique chance to get close to our wishes, but relying, once more, on a major research co-ordinated in 2001/2 by our partner, Luciano Coutinho, and produced for the Brazilian Ministry of Development, Industry and International Trade (MDIC), with funding from FINEP, an agency from the Brazilian Science and Technology Ministry.

Sectoral reports for the project ‘**Estudo da Competitividade de Cadeias Integradas no Brasil**’ were used, once again, as the basic input for the present analysis. We used data and information on sectoral reports to provide our interpretation on the competitive changes in the Brazilian industry, between 1990 and 2003. The following sectors were analysed: in the commodity industrial group, steel, pulp and paper and citrus; in durable, consumer electronics and automotive; in traditional industries, shoe and textile and garments, in innovation carriers: mechanical engineering capital goods, telequipment and the computer industry.¹

During this period the Brazilian economy went through a major institutional change: rules governing relations among economic agents changed in two respects. First, and structurally most important, economic liberalisation is the central feature of the national regime of incentives and regulations. Secondly, price stabilisation has been, as never before, a major target of macroeconomic policies. To what extent institutional changes implied corresponding structural changes in industry? Are competitive pressures greater? The relative importance among industrial groups has changed? New activities emerged? Which ones cease to exist? Are firms more competitive? Which ones? Are they relying on those competences –i.e. innovation capabilities- that are widely known as conforming the basis for sustained or expanded market shares?

These are the questions guiding us in this article. In the first section we will update the 1996 discussion on patterns of competition and competitiveness. It will be seen that we still rely, strongly, on the very same analytical framework. Still, we believe that around the space of competition is where the dynamics of the

* This article is dedicated to our late partner, Lia Haguenaer. We will always miss her companionship, professionalism and personal integrity. Our writings will never again be so sharp and clear.

¹ We must thank Achyles Barcelos da Costa, Fábio Erber, Fernando Sarti, Germano Mendes de Paula, José Rubens Dória Porto, Márcia Azanha Ferraz Dias de Moraes, Marcos Fava Neves, Maria Graça Derengowsky Fonseca, Matheus Kfoury Marino, Mauro Thury de Vieira Sá, Rafael Oliva, Roberto Vermulm, Victor Prochnik for producing such a high quality material.

capitalist machine is fully revealed. The second section provides an account of the most important institutional changes and an aggregate overview of the industry's evolution between 1990 and the early 2000s. Following from there the next four sections analyse competitiveness in each of the four industrial groups of the early 1990s: commodities, durable goods industries, traditional industries and innovation carriers industries. The last section provides an overall balance, indicating commonalities and differences among them.

2. METHODOLOGICAL REMARKS: PATTERNS OF COMPETITON AS A TOOL FOR ANALYZING COMPETITIVENESS

2.1. ON THE NOTION OF COMPETITIVENESS

Traditional analysis of competitiveness can be classified into macro and micro approaches. The macro approach focuses on allocative efficiency: if an economy has the right prices, it would automatically produce the correct investment, leading to best advantageous specialisation. From a microeconomic approach, competitiveness is associated to technical efficiency: the adoption of best practices implies adequate productivity levels, which are automatically transferred into better market shares. As argued by Haguenaer (1989), these approaches are not sufficient; they assume automatic transmission mechanisms and lack of information failures, which are seldom found in the daily operations of businesses.

Market shares are conquered as a result of a productive performance that incorporates efficiency in product and process developments. These, in turn, are derived from accumulated resources mobilised by past strategic decisions. These are based on anticipating demand expansion and other economic expectations as well as similar actions taken by competitors. Thus, to overcome the weaknesses of traditional approaches while, at the same time, drawing on specific contributions that are valuable, such as the notion of efficiency and market shares, it is necessary to develop an approach closer to what is known as structural approach, where competitiveness is perceived as an interactive process between firm, industry and macro determinants. (Kupfer, 1993)

In this text, competitive firms are those capable of formulating and implementing strategies leading to sustained or expanded market position in the segment of industry where it operates. A couple of remarks on this basic definition are necessary.

Firstly, it is necessary to distinguish different aggregation levels of analysis. Competitiveness must be defined at firm level, referring to specific markets, which could be associated to segments of industries. A firm is competitive if its strategies, capabilities and performance are coherent with the critical factors of success in the activity it operates. Nonetheless, it is necessary to emphasise the notion of the space of competition. If the competitive process is fully revealed in specific markets, the aggregation proxy for segments of industrial sectors is formed by a set of firms operating in similar markets. This group of firms conforms an industrial segment and standardised sectoral industrial classifications aggregate them in a number of segments or sub-sectors. By aggregation, in a given moment of time, it is possible to consider a sector competitive if the majority of its production is derived from competitive firms, operating in the sector's various segments. At this level firms are aggregated by market similarity.

Secondly, competitiveness must be viewed as a dynamic concept in a double dimension. In the first dimension, competitiveness is related to a firm's accumulated capacity, in itself a dynamic notion, since present capacity results from past strategic decisions on where financial resources should have been allocated. The *ex-post* performance of a firm – higher or lower market-share – reveals whether past strategies and capacities were competitively adequate or not. Thus present market position does not necessarily ensure future competitiveness. The second dimension is related to changing market conditions, derived from strategies adopted by other firms that cause changes in relevant competitive drivers in that industry. This consideration leads to another central concept – patterns of competition or a set of competitive drivers. Competitiveness stems out of the adequacy of individual firms' strategies to the specific drivers prevailing in each market.

2.2. PATTERNS OF COMPETITION

Patterns of competition are defined as the collection of key factors (drivers) required for competitive success in each industry. Given the large number of possible intervening drivers, it is necessary to organise them under some type of criteria. A simple and operational criteria is one in which factors are organised according to the capacity of a single firm to influence their direction and evolution.

Thus, a collection of determinant factors, representing the results of its past and present strategies, lay within the boundaries of the firm (internal factors), where it has complete control. Another collection of factors is industry specific (structural factors). They have equal importance to firms operating in similar market segments. In general, individual firms have only limited and indirect control over structural factors. Finally, there is a collection of drivers (macro factors) that are associated to the political and economic environment of a country and placed well beyond the influences of individual firms. Thus, a competitive process has a systemic character, determined not only by individual firm's efforts, but also by the nature of the industry in which it operates and by economic/institutional aspects.

Internal factors refer to decisions, accumulated capacities and performance in the areas of management (entrepreneurship, strategic planning, finance), sales efforts (marketing), production (equipment and process technologies, organisational techniques, quality management), and innovation (product and process innovation, technology flows). In all these areas human resources are essential, requiring skills corresponding to specific functions. Firms must be efficient in most areas to be competitive but, in different patterns of competition, necessary skills, competences and specific drivers, critical for competitiveness, may differ.

Structural factors are those that shape competition rules and conditions under which every firm has to operate, within the same industrial segment. They can be divided into three categories: market and demand, industrial configuration and regimes of incentives and regulation. As in the case of internal factors, different industries define different competitive drivers at the structural level.

Demand/market drivers can be described according to volume and growth rates of demand; access to national and international markets; geographical and income descriptors of a market; price, quality, technological level and other attributes of products. Generically, growing markets and diversified consumer requirements in terms of price, quality, sophistication, technology and other attributes allow for greater market segmentation and lower tolerance against less competitive products.

An industrial configuration can be described in terms of technical and firm level economies of scale and scope; technological trajectories of products and processes; access conditions to equipment, inputs, services and technology, including the nature of relations between firms, clients and suppliers, services and infrastructure. Again, generically, an industrial configuration may contribute to competitiveness if size of firms and productive integration are sufficiently high, where horizontal and vertical clusters abound and where the available infrastructure and services allow for minimum external down time.

The regime of incentives and regulation defines specific institutional rules under which firms of a certain industry must operate. Incentives are those associated with lowering the cost of investments and running production (credit, taxes, fiscal incentives, etc). Regulations are related to rules that define for economic agents the degree of freedom of operations, including legislation on property consumer, environment, competition, etc. Generically a pro-competitive regime induces high levels of rivalry among competitors and is capable of lowering capital costs to levels similar to those prevailing in other markets.

The third level where competitive drivers are located refers to framework conditions. They can be divided into:

- **political-institutional:** political stability, institutional development;
- **economic:** exchange, interest and wage; tax and tariff policies, supply of credit, and other variables related to overall performance of the economy;
- **infrastructure:** availability, quality and cost of energy, transport, telecommunications,
- **social:** education and vocational training system, social security;

- **international:** capital, technology and trade flows.

Economic and institutional determinants of investment and production are a *sine qua non* condition of competitiveness; they define the contours within which firms are able to compete in markets for goods, services and capital. The potential competitiveness of a country's firms relies on its macroeconomic performance, on its institutional framework, on its insertion into international trade and finance, on the availability of adequate human resources.

Successful economies have combined a certain degree of openness with policies that are conducive to investment, macroeconomic stability and strong institutional arrangements. Stability facilitates the emergence of clusters of capabilities that are necessary to bring about coherence and consistency of pro-competitive actions by the private sector, in the long run. Likewise, competitive economies are likely to be those where public authorities have implemented a whole set of policies not only well but also simultaneously.

When the macroeconomic environment is unstable, usually firms and institutions follow adaptive strategies not conducive to competitiveness and sustained development. Unstable paths of fundamental macroeconomic variables, as for instance, low investment during long periods of time, influence the structure of production through the election of activities, technologies and assets by firms, operating in condition of limited valuation of economic risk and low capital efficiency. In such context, considerations about industrial linkages, technological opportunities, organisational practices and the introduction of new products and processes are left behind due to the burden of short-term economic instability and the unpredictability of future economic policies.

2.3. DEFINING PATTERNS OF COMPETITION AND COMPETITIVE DRIVERS

The analysis of competition requires the identification of competitive drivers in different market segments. Porter (1980), drawing on classical industrial organisation literature proposes two generic business strategies –cost and differentiation- with two other corresponding strategies for more focused business orientations. Drawing on the literature on industrial organisation and market structures, and on empirical evaluation undertaken in Brazil, it is possible to suggest the existence of four different orientations for competitive strategies, each associated with specific sources of advantages, at the level of the firm and the industrial structure.

Firms can be successful by offering: (i) cost advantages, (ii) product differentiation, (iii) responsiveness or, (iv) technologically sophisticated products. Very few firms can achieve excellence, simultaneously, in every source of competitive advantage. Competitive firms are those that focus and develop coherent strategies, capabilities and performance on the relevant factors concerning the pattern of competition that prevails in the specific industry they intend to operate.

As shown in Table 1, as firms focus specific strategies, they are bound to develop and rely on corresponding sources of competitive strategies.²

Price/cost competition is typically the case of standard commodity market segments. Since these commodities are intrinsically undifferentiated, competitive firms are those which manage to have low unit costs and high production volume, ensuring production efficiency, mainly by operating capital intensive plants that yield high economies of scale, as well as developing efficient logistics systems, thus reducing inputs and distribution costs.

Product differentiation can be achieved by technology, quality, price and marketing activities. It requires a wide span of capacities and resources. Most advanced firms try to concentrate in design and marketing functions while production is extensively sub-contracted. Thus the mobilisation and supervision of partners is an essential source of competitive advantage.

Responsiveness is a strategy strongly associated with production flexibility. Firms target market niches aiming at specific consumers, stratified by income, age, peculiar interests, customs, etc. Others direct their

² Macro determinants, being generic, were not considered in this classification, although it is possible to suggest that the impact of macro determinants is differentiated by sectors.

efforts toward delivery, taking advantage of their proximity to clients and/or suppliers and adopting techniques like quick response. Capacity requirements are less strict than in other patterns, but it is important to have management and supervisory skills, as well as product quality levels acceptable to a particular market niche.

Innovation is the source of competitiveness in technologically sophisticated market segments, like precision instruments or aeronautical equipment. Firms must have strong technological capacities, highly skilled R&D technicians and access to updated science and technology laboratories.

In summary, a pattern of competition arises from competitive rivalry, from efforts by competing firms. Once a pattern of competition and competitive drivers are established as standards, strategies of all firms must follow suit. In most industries a very finite or only one pattern of competition prevail. However, where geography and income differences abound or in industries where families of similar products may co-exist, firms pursuing different patterns of competition can survive and prosper.

TABLE 1
PATTERNS OF COMPETITION: STRATEGIES AND SOURCES OF COMPETITIVE ADVANTAGES

SOURCES OF COMPETITIVE ADVANTAGES	COMMODITIES (COST STRATEGY)	DURABLES (DIFFERENTIATION STRATEGY)	TRADITIONALS (RESPONSIVENESS STRATEGY)	INNOVATION CARRIERS (INNOVATION STRATEGY)
INTERNAL FACTORS				
MANAGEMENT	process control	organisational flexibility	workers and entrepreneurial skills	R&D-production-marketing integration
PRODUCTION	mass flow & energy efficiency	assembly and supply-chain co-ordination capabilities	quality control	design for manufacturing
SALES	access to distribution channels	brand image	market information	market creation & business to business marketing
INNOVATION	process technology	product & components design	embodied technology, learning by doing	R&D + <i>design</i>
STRUCTURAL FACTORS				
MARKET	standardisation price, technical conformity access to international trade	segmentation by quality and marketing price, brand, technological content, technical assistance regional & global trade	segmentation by levels of income & type of product price, brand, delivery times, customer orientation local & international trade	segmentation by technical needs attendance to client specifications local & regional trade
CONFIGURATION OF INDUSTRY	plant level economies of scale access to raw materials & transport logistics specialised technical services	firm and plant level economies of scale & scope articulation assembler-supplier, distribution metrology & standardisation	economies of agglomeration and networking horizontal & vertical networks metrology, standardisation, certification & accreditation; market & technical information; training	economies of specialisation interaction with users science & technology systems
REGIME OF REGULATION AND INCENTIVES	anti-dumping & commercial policy environmental protection cost of capital	property rights consumer legislation consumer credit fiscal incentives	anti-dumping competition & consumer policies support for SME tax system	intellectual property rights selective protection risk support credit for users state purchasing power

3. 10 YEARS OF INSTITUTIONAL CHANGE AND INDUSTRIAL PERFORMANCE

3.1. A BRIEF SKETCH OF THE MAIN INSTITUTIONAL REFORMS: THE BRAZILIAN INDUSTRY UNDER TRADE LIBERALIZATION PRESSURE

The 1980s were a period of great technological advance on the industrialised countries in general, and on the newly industrialised countries (NICs) in South East Asia in particular. Inversely, during the same period the Brazilian industry underwent significant tensions due to the macroeconomic instability and the institutional transition derived from the exhaustion of the import substitution model as the basic reference for its national development. As a result, the technological gap, once reduced by the catch-up of the 1970's, was again expanded. Although the Brazilian industry survived the lost decade, maintaining a complete and integrated industrial structure, by the end of 80s it presented significant deficiencies in terms of process and product technologies, and production organisation.

In the 1990s, the global context was delineated by a strong competition between firms and countries, by the commercial and cross-borders capital flows, and by the diffusion of new technologies, specially information technologies. The USA and Europe have both consolidated the liberalisation process of their foreign exchange policy and financial sector regulation, thereby enhancing the capital mobility between different economies.

In Brazil, the first years of the 1990s were a period depicted by two consecutive shocks on the competitive context – the economic liberalisation in 1990 and the monetary stabilisation resulted from the Real Plan in 1994. The subsequent changes were induced by structural reforms on the external sector, the international financial sector integration, and the state owned firms which implied the development of new growth strategies from the leading firms, and by a redefinition of the inter and intra relationship between those firms and the State.

The most relevant microeconomic features of these reforms were: (i) the economic deregulating process, which included the exclusion of price control mechanisms for goods and services and the removal of “protected market zones” and other regulatory requirements for investments in Brazil; ii) the trade and financial liberalisation process, trough the reduction of tariffs and non-tariffs barriers and the deregulation of the foreign capital flows; iii) the privatisation process, in order to redefine the State role in the economy. The Brazilian privatisation process had a double bottom line, the national industry modernisation, and the reduction of the fiscal debts.

The commercial liberalisation process of the 1990s was surely the most consistent of all the economic and institutional policies promoted in Brazil since the 1980s. Following a significant tariff reduction schedule, the mean value of the nominal tariff was diminished from 32,2% (with interval 0-105% and standard deviation of 19,5) to 14,9% (with interval 0-40% and standard deviation of 10,7) in July 1993 (Kume, 1996).

Although not so widely discussed, the measures concerning the patrimonial structure were also important to define a new institutional regime. The main target of these measures was to equalise the rules of the game between foreign and national firms, thereby stimulating the inflow of foreign capital. As a counterpart, it was expected that the foreign capital would increase the competitive pressure on the national scenario, and would ease the access to new technologies and open new investment financing sources.

Among the measures that equalised the rules between foreign and locally owned firms, the most outstanding are: extinction, in 1991, of the restrictions to the foreign firms entry in the technologies of information sector; elimination, in October 1993, on the imposed limits to the foreign capital participation in the privatisation process; elimination, by a constitutional emend of 1994, of the established legal differentiation between national and foreign firms, that made possible the access to official credit agencies, subsidies and incentives to foreign firms; exemption of income tax for profit and dividends remittances by the foreign affiliates in the country; elimination, decided by Congress vote in 1995, of several restrictions to industrial property, mainly the prohibition of patents registration of drugs and biotechnology based

products; extinction by an act, of the prohibition in remitting royalties payment for brands and patents in multinational firms; removal, by the constitutional reform of 1995, of the sector restrictions to the foreign capital participation in the services sector (more notably in the financial sector), extractive activities (end of the State monopoly over petroleum) and telecommunications; and financial liberalisation that created more favourable conditions for the transnational firms established in the country, eliminating the restrictions to the use of national financial system and thus access to the BNDES funding.

The macroeconomic changes were intimately associated with the monetary reform issued by the Real Plan in 1994 and also with the subsequent return of capital inflows. The Real Plan successfully decreased the inflation spiral³, and promoted a significant increase of demand due to the growth of real wages and the renaissance of consumption-credit of durable goods. On the other hand, the return of capital inflows was important to cover current account deficits and to finance fixed capital investment. The overvaluation of the national currency during the 1994-1999 period was a natural consequence, which was pushed even further by a set of specific policies defined by the Central Bank to reinforce it.

In fact, with the Real Plan in 1994, a new phase in the industry path began. Appreciated exchange rate and high interest rates, the two pillars of the macroeconomic stabilisation plan, together with bringing forward the end of the initial schedule of the tariff reduction to December 1994 and the adoption of the *Mercosur* External Tariff were the main characteristics of the new competitive environment established in the country. In practice, these measures are responsible to the deepening of the international exposure of the Brazilian industry, where began the effective openness of the economy, that continue up to the exchange rate devaluation in the early 1999. The impacts of the local currency evaluation and tariff reduction after the *Plano Real* exacerbate the competition with the imported goods, resulting in a rapid deterioration of the trade balance, in deficit from 1995. The resume of the external capital influx permitted the financing of the trade deficit, however, of short breath regarding the risk of vulnerability of the external accounts. The current trade maintained its expansion until 1997, where suffers a sudden reverse, indicating that the competitive regime implemented during this period become exhausted.

This internal and external environment posed new challenges to Brazil: the need to preserve the solvency of the financial system and to maintain sound macroeconomic foundations. During the 1990s, the Brazilian economy faced a positive net capital inflow, of unprecedented magnitude, which was extremely dependent on a particular set of favourable external circumstances. As a result, the foreign expenditure and the current account deficits increased to levels not compatible with macroeconomic stability. Actually, the abundant entry of financial resources exerted negative effects on monetary supply and on exchange rates. Exports were affected; imports expanded significantly and Brazilian economy became very vulnerable to possible changes in the international context. Therefore, the government was forced to sterilise the monetary effects of foreign capital, by increasing interest rates. Consequently, the counter face of external financial dependence was revealed not only in a weak growth of expansion-related investments, but also in an insufficient GDP growth during all the 1990s.

In this context, the next section analyse the Brazilian industry performance in the 1990s, focusing on four main dimensions: industrial production and employment; productive and ownership structures; external trade pattern; and fixed capital and R&D investments strategies.

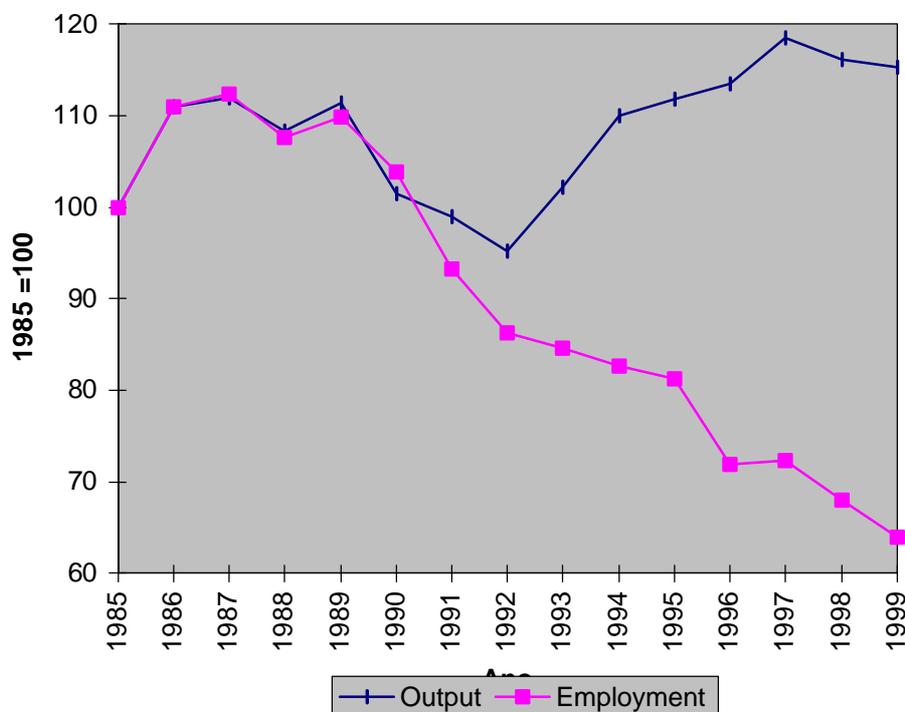
3.2. THE EFFECTS OF LIBERALIZATION AND DEREGULATION DURING THE 90'S

3.2.1. More production with less workers

In the 1980s, the employment level experienced fluctuations following the path of erratic production level changes. However, from the beginning of the 1990s, the productions and employment series start to follow opposite trends. The Figure 1 shows a clear divergence between these series, particularly after 1993.

3 Inflation rates decreased from more than 1000% in 1993 to 20% in 1995 and 5% in 1997.

FIGURE 1
OUTPUT AND EMPLOYMENT IN BRAZILIAN MANUFACTURING INDUSTRY, 1985-1999



Source: IBGE – Monthly Industrial Survey and Monthly Employment Survey

Many economists, as Gonzaga (1996), identify the beginning of the 1990s as a structural break point on the relation between production level and employment. Today, this interpretation is well accepted, but this subject was vastly debated after 1991. For authors as Gonzaga (1996), Amadeo and Soares (1996), Bonelli (1996), the clear divergence between product and employment series in the 90s could be regarded as evidence that significant technological changes – in production process and/or in production organisation – were carried out. This explanation tries to shed light on the microeconomic transformations developed inside the firms. The commercial liberalisation and the economic deregulation would have brought about new parameters on decision process of firms which was trying to achieve productive efficiency.

Other authors, such as Silva et alii (1994), sustained the interpretation that there was no evidence that the economy was coming through a general structural adjustment. For these analysts, the economy was simply facing a recessive adjustment.

It is important to remark that a significant part of the satisfactory performance of production must not be taken as a clear effect of a modernisation process, but as a statistical effect concerning the data, which was based on series of production value, not on ideal series of value added⁴.

Nevertheless, though there was not a consensual interpretation among the analysts on this point, all of them have recognised a clear trend of productivity growth, at least in the beginning of the 1990s. The growth of the industrial production level in 1993 was followed by an acceleration of productivity indexes. This productivity performance was regarded as a clear indication that a fast and general modernisation process

4 About the difficulties to compute productivity data in this period see, for instance, Salm, Sabóia and Carvalho (1997) or Amadeo and Soares (1996)

was being developed. At a first sight, it was these new facts, not new analysis that have finished the debate.

3.2.2. The same productive structure but with different owners

Several studies (e.g. Kupfer, 1998) conclude that no important change had occurred in the sector distribution of the industrial production during the 1990s. Considering all production activities, the participation of the industrial sector to the GDP remained unchanged from 1991 to 2001 (Table 2). The manufacturing industry, after the initial expansion during the first phase of the trade openness (until 1993) started a fast falling trajectory just after 1994, when the effects of the Real appreciation due to Real Plan deepened the degree of the real openness of the Brazilian economy.

TABLE 2
GDP STRUCTURAL COMPOSITION, 1991 A 2001, SELECTED YEARS, (%)

Sector	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Agriculture	7,8	7,7	7,6	9,9	9,0	8,3	8,0	8,2	8,2	7,7	8,0
Industry	36,2	38,7	41,6	40,0	36,7	34,7	35,2	34,6	35,6	37,5	35,8
Manufacturing	24,9	26,4	29,0	26,8	23,9	21,5	21,6	21,0	21,5	22,5	21,1
Services	56,0	53,6	50,8	50,1	54,3	57,0	56,8	57,1	56,2	55,0	56,2
Total	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,1	100,3	100,0

Source: IBGE/DECNA

From the data on the evolution of the different industrial groups output, showed in Table 3, can be evaluated the differences in the intra-industrial dynamics. Industrial commodities, durable goods industries, and food and beverages were the sectors that revealed a superior evolution to the mean of industry, and agricultural commodities, traditional industries except food/beverages and innovation carriers industries maintained almost the same production level through 1991 to 2000.

TABLE 3
INDEX NUMBER OF INDUSTRIAL OUTPUT (1991 = 100), 1991 A 2000

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Industrial Commodities	100,0	99,7	103,7	109,5	109,6	115,9	122,8	126,8	130,3	138,2
Agriculture Commodities	100,0	101,9	98,4	94,4	97,2	100,6	104,0	101,2	105,4	98,9
Traditional industry except Food/beverages	100,0	93,4	101,4	105,3	104,8	103,6	104,1	101,3	100,0	104,3
Food/beverages	100,0	95,7	98,9	107,2	121,6	127,0	127,3	128,9	128,9	130,5
Innovation Carriers	100,0	94,7	102,0	123,3	120,0	107,8	105,2	105,6	98,3	108,2
Durable Goods	100,0	89,8	115,2	133,0	147,6	153,4	165,8	133,9	123,1	148,6
Manufacturing Industry	100,0	96,3	103,5	111,4	113,4	115,4	119,9	117,4	116,7	124,2

Source: IBGE - Industrial Monthly Survey (Special Tabulation)

Contrary to sector distribution, the composition of the firms' revenue per capital origin suffered a deep transformation in the period under analysis. According to Rocha and Kupfer (2002), in a study with the 300 biggest Brazilian firms (in liquid revenue), the market-share of the leading state owned, multinational and private national firms evolve during the 1990s, as follows:

- State owned firms – reduce the participation from 44.6 per cent in 1991 to 24.3% in 1999, where the major part of that fall (15.2 per cent) occurred between 1991 and 1996 and a minor part (5.3 per cent) between 1996 and 1999.
- Multinationals - grew its participation from 14.8 per cent to 36.4 per cent between 1991 and 1999, homogeneously through the two periods (11.6 and 10 per cent, respectively).

- Private nationals – maintained the share without big changes between 1991 and 1999 (40.6 and 39.3 per cent respectively) albeit the small share increase of 3.5 per cent between 1991 and 1996 and a little higher through 1996 to 1999 (4.8 per cent).

Data suggests that changes in the ownership structure of the leading firms occurred in a two phase process. During first phase, corresponding to 1991-1996 period, there was transference of the revenues of the state owned firms to the private firms, independently from their nationality. This was the of privatisation phase. In the second phase, corresponding to 1996-1999 period, occurred revenue transference from national firms, independently if they were private or public run, to multinational firms. This was the denationalisation phase.

The analysis of the mergers and acquisitions processes and of the role of the foreign capital investments and the privatisation permit a better understanding of the extension of the changes that occurred during the decade.

Operations involving changes in the corporate control of firms increased through this period. According to KPMG Consulting, 2353 M&A transactions occurred between 1991 and 2000, where $\frac{3}{4}$ were concentrated after 1996. A significant part of these transactions, especially concerning the values involved, was associated to the selling of state owned firms. According to BNDES, the revenues from the privatisation process surpassed US\$100 billions from the beginning of 1991 through 2002, $\frac{2}{3}$ of which were federal government run firms and the rest state run firms. In the first phase of the privatisation process (1991-1995) the steelworks, mining and petrochemical sectors were exceptionally relevant and later the electrical power, finance services and telecommunications sectors. The last sector was, alone, responsible for US\$ 30 billions in government revenues.

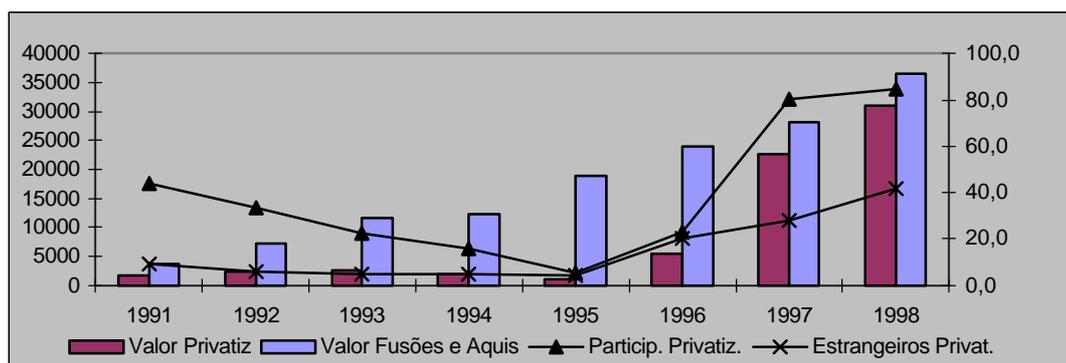
At the same time, inward foreign direct investments, that were minimal since the late 1980s, assist to an exponential growth from 1995 to 2000, as a result of a higher international liquidity and of the country attractiveness just after the stabilisation of the economy. A considerable part of this capital was re-directed to the acquisition of state owned assets, as shown in Table 4. Figure 2 shows the same trend. From 1996 on, the privatisation program had a new role with the entering of multinational firms, being responsible for an increase of the share of the take in operations.

TABLE 4
FLOW OF EXTERNAL CAPITAL FOR PRIVATISATION AND OTHER USES

Year	Inflow			Outflow	Net Flow
	Privatisation	Others	Total		
1995	...	5.475	5.475	1.237	4.238
1996	2.645	7.851	10.496	603	9.893
1997	5.249	13.512	18.761	1.944	16.817
1998	6.121	22.359	28.480	3.002	25.478
1999	8.786	22.586	31.372	1.389	29.983
2000	6.677	26.726	33.403	3.387	30.016
2001	1.079	20.193	21.272	2.328	18.944

Source: BNDES (www.bndes.gov.br)

FIGURE 2
 MERGERS AND ACQUISITIONS, PRIVATIZATION, AND SHARE OF EXTERNAL DIRECT INVESTMENT –
 US\$ MILLIONS AND %



Source: Sieffert Filho and Silva (1999) and KPMG in Diniz and Boschi (2001)

As a result of the privatisation program implemented by the Brazilian government in early 1990s, particularly for the commodities industry, there was a significant change of ownership of the leading firms. According to Rocha and Kupfer (2002), state owned firms, responsible for 42 per cent of the 1991 revenues, decreased their participation to 22.6 per cent in 1996, that is from the twelve state owned firms remained only Petrobras. This decline was followed by an increase of the share of the national firms that from 36.5 per cent share in the revenues were responsible for almost half of the total revenues for 1996. However, this share was not sustained after 1996. At the same time, is interesting to see that multinational firms move forward in the commodities production arriving to 1999 with a market share very close to that of national firms.

During the 1990s we assist to a confirmation of the considerable role of foreign capital to the industry responsible for technological diffusion. Multinational firms, that controlled 60 per cent of the total revenue in 1991, continue to growth its importance and achieved 86 per cent market share by 1999. National firms suffered a reverse tendency decreasing its participation from 40 per cent in 1991 to 13.1 per cent in 1999, revealing loss of competitiveness. State owned firms, through Embraer were responsible for a mere 1 per cent to total revenues in 1991, left this market completely.

Also in the traditional industry, the multinational firms grew its role, from half of the national firms' revenues in 1991 to achieving almost the same market share by the end of the decade.

As final statement, the observed pattern of changes suggests that the loss of competitiveness of national firms started in the period 1996-1999. Contrary some analysts' arguments, this was truth for the whole industry and not only for technologically intensive industries. In this period, we assist to transference of the activities of the leading national firms to infra-structure services activities. Certainly, the privatisation of that sector opened a new space and opportunities for those firms exit industrial activities.

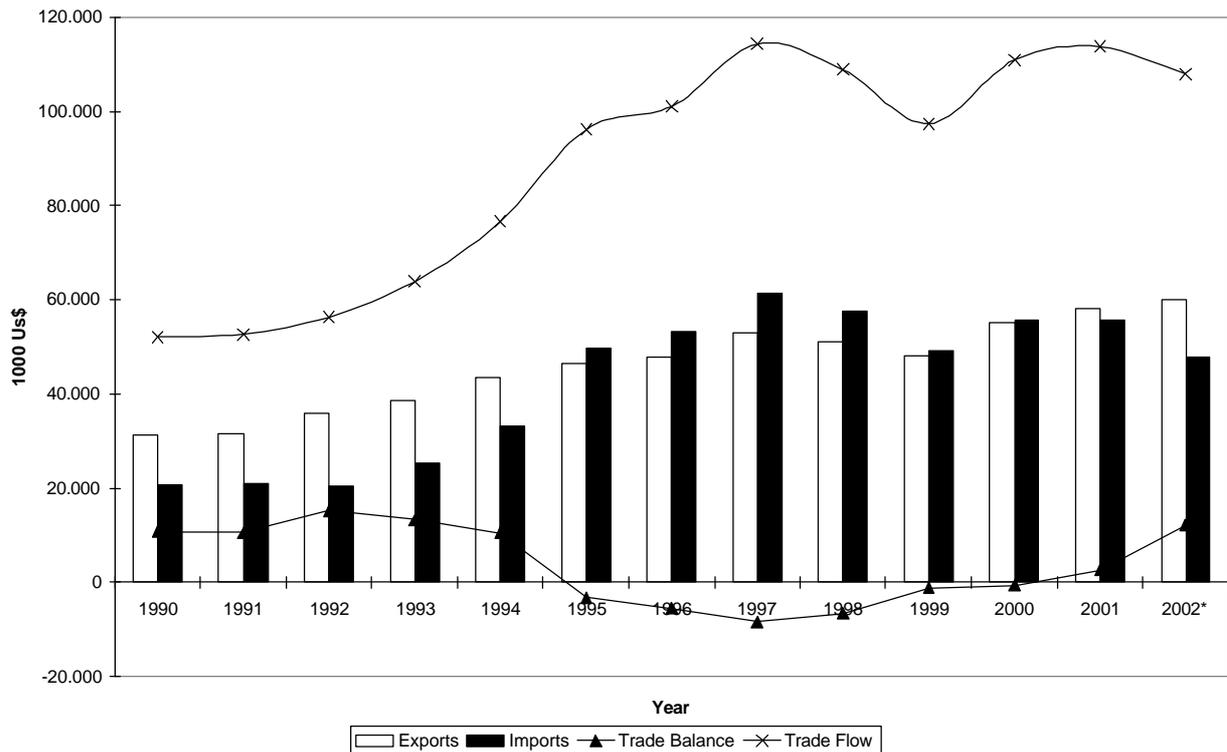
3.2.3. Regressive specialisation trend in the trade pattern

The external insertion of the Brazilian economy during the 1990s was characterised by a raise in the exports and imports. The imports rose faster than the exports provoking a reduction in the trade balance. Figure 3, shows the evolution of exports, imports, trade balance and trade flow for Brazil from 1980 to 2002, and permits to clearly verify the effects of the different competitive regimes on the trade balance, during the 1990s. Between 1990 and 1993 the trade flow and the trade balance remained unchanged. This behaviour suggests that the tariff reform had had small impact in the international insertion of the industry (Kupfer, 1998).

Immediately after the Real Plan in 1994, as has been said, went together with an acute overvaluation of the Real, comes into our attention the raise of the trade flow due to the rapid expansion of the imports. As the

exports rose at moderate levels, most of the times at a lower level than the world exports, the imports duplicate from 1993 to 1995 (or triplicate from 1990 to 1997). As result the trade balance deteriorate to deficit levels by 1995, after 14 years of superavit results, being in the red by US\$ 8.2 billions in 1997. Only after the predictable exchange rate crisis in January 1999, that result in a depreciation of the Real and the return to a fluctuate exchange rate system, started the reversion of this trade balance deficit. However, the trade flow remained stable, suggesting that the openness of the trade system achieve its limits.

FIGURE 3
BRAZILIAN FOREIGN TRADE: 1980-2002*



* Annualised from data until october/2002
Source: Alice Database

The changes in the external insertion of the industry were shown in different dimensions. First the increase of the Mercosul participation in the trade flow, but only until 1998. Table 5 shows the destination of the exports and the origin of the Brazilian imports for selected years during the 1990s. The growth of Mercosul role in the share of Brazilian exports is due to: (i) a certain diversification of export markets with the reduction of the EU weight in the exports and inversely (ii) a concentration of the imports from US and EU.

TABLE 5
DESTINATION AND SOURCE OF BRAZILIAN EXTERNAL TRADE
1990-2002 – SELECTED YEARS – %

	Exports Destiny					Imports Source				
	USA	Mercosul	EU	Japan	Others	USA	Mercosul	EU	Japan	Others
1990	24,6	4,2	32,5	7,5	31,2	20,4	11,2	22,6	7,2	38,7
1993	20,7	14,0	26,4	6,0	32,9	20,4	13,4	23,5	7,6	35,0
1996	19,5	15,3	26,9	6,4	31,9	22,4	15,6	26,7	5,2	30,1
1998	19,3	17,4	28,8	4,3	30,2	23,7	16,3	29,2	5,7	25,1
1999	22,6	14,1	28,6	4,6	30,1	24,1	13,6	30,5	5,2	26,5
2000	24,3	14,0	26,8	4,5	30,4	23,3	14,0	25,2	5,3	32,2
2001	24,7	10,9	25,5	3,4	35,4	23,5	12,6	26,7	5,5	31,7
2002	25,7	5,5	25,0	3,5	40,3	22,1	11,9	27,7	5,0	33,3

Source: Alice Database

Also, there was a divergent tendency in the evolution of the mix of export and import goods. From the exports side (Table 6) between 1990 and 2000 we can see a small reduction on the participation of basic products (e.g. iron, soya flour, row coffee beans, triturerated soya and tobacco leaves) and semi-manufacture products (e.g. pulp, row steel, row aluminium, soya oil, iron steel, crystal sugar) and to an increase of the manufactured products. After 2000, there was a reverse in this tendency, returning to the 1990 values. From the imports side (Table 7) there was a consistent increase of the intermediary products participation, as a consequence of natural adjustment in the productive processes (subcontracting, outsourcing) implemented by the a large number of firms almost in all industrial sectors. Regarding the other imported items, the weight of imports oscillated cyclically. The contraction of participation in the consumption goods in the imports share after 1999 reflects the change in the exchange rate regime.

TABLE 6
COMPOSITION OF EXPORTS
1990-2002 – SELECTED YEARS - %

	1990	1993	1996	1998	1999	2000	2001	2002
Basic Goods	27,8	24,3	24,9	25,4	24,6	22,8	26,4	28,1
Semi-manufacture Goods	16,3	14,1	18	15,9	16,6	15,4	14,2	14,8
Manufacture Goods	54,2	60,8	55,3	57,5	56,9	59,0	56,5	54,7

Source: Alice Database

TABLE 7
COMPOSITION OF IMPORTS
1994-2001 – SELECTED YEARS - %

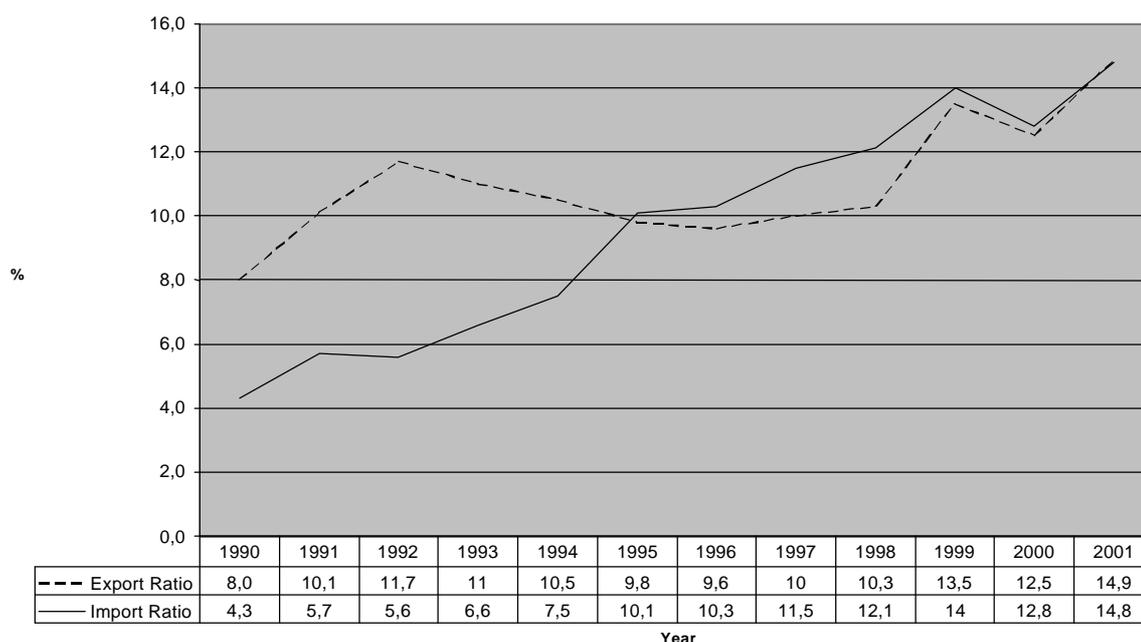
	1994	1995	1996	1997	1998	1999	2000	2001
Intermmmediate Goods	41,2	45,0	46,1	43,5	46,4	48,8	51,0	49,3
Consumer Goods	16,1	21,8	18,3	18,8	18,6	15,1	13,2	12,8
Oil and	13,1	10,4	11,7	9,7	7,1	8,6	11,4	11,3
Capital Goods	29,6	22,7	23,9	27,9	27,9	27,5	24,4	26,6

Source: Alice Database

A more accurate measure of the change in the pattern of international insertion of the Brazilian industry is the relation between trade flow and the variables associated to the country' size, such as production output. Two measures are defined: exports coefficient (ratio of value of exports to gross output) and imports coefficient (ratio of value of imports to gross output).

Figure 4 shows the evolution of the exports and imports coefficients during the 1990s, for transformation industry. The values confirm the previous analysis. Table 8 shows both coefficients for selected sectors, those of more business volume. Two features claim our attention: the rapid evolution of the imports coefficient for those sectors of more value added and technologically more advanced, as electronic and electrical equipment, auto-parts and pharmaceuticals; and of the exports coefficient in those sectors of low added-value and low technological incorporation as shoes and leather, sugar, wood and furniture, and vegetal oils, however, automobiles and auto-parts are also responsible for a rapid increase of the exports coefficient.

FIGURE 4
MANUFACTURING INDUSTRY: EXPORT AND IMPORT RATIOS (%), 1990-2001



Note: Export Ratio – export / gross output
 Import Ratio – import / gross output
 Source: Ribeiro e Pourchet (2002)

TABLE 8
MANUFACTURING INDUSTRY: EXPORT AND IMPORT RATIOS (%), 1990-2001

Industries	1990	1993	1996	1998	1999	2000	2001
Export Ratio							
Calçados, couros e peles	23,8	43,3	38,5	42,9	53,8	61,0	74,9
Açúcar	13,8	20,1	27,1	31,2	44,0	24,1	46,0
Peças e outros veículos	16,2	21,1	18,6	26,5	39,5	41,0	45,0
Equipamentos eletrônicos	5,7	8,9	5,9	9,4	20,8	29,2	38,5
Óleos vegetais	29,2	26,8	25,9	20,5	23,7	20,9	27,6
Madeira e mobiliário	4,4	12,1	10,5	11,8	19,5	19,6	24,1
Veículos automotores	9,3	15,8	7,2	17,2	18,5	18,9	23,1
Import ratio							
Equipamentos eletrônicos	13,9	31,0	40,1	57,5	98,6	103,8	122,7
Material elétrico	9,0	11,7	18,4	24,1	33,9	28,5	40,3
Peças e outros veículos	8,9	13,7	18,9	28,5	39,2	31,6	34,5
Farmacêutica e perfumaria	7,9	9,5	17,0	18,1	27,6	22,9	30,1
Máquinas e tratores	11,3	12,9	26,1	31,4	36,0	23,3	28,4

Note: Export Ratio – export / gross output
 Import Ratio – import / gross output
 Source: Ribeiro e Pourchet (2002)

The data presented in this section suggest that the international insertion of the Brazilian industry changed a lot after the post-openness period. The decisive years for this imports “explosive” trajectory were 1994 and 1995, concurrent with the transition period and the post- Real Plan. By the end of 1998, the financing model of the Brazilian balance of payments become unsustainable, inaugurating a new recession phase and successive local currency devaluation. After 2001 the balance trade recovered and presented positive values, reflecting a period of moderate exports increase and a contraction on the imports.

The depreciation of the Real occurred by the beginning of the 1999, brought expectations on a rapid growth returning of the Brazilian exports. However, after three years this did not occur. To some specialists, the feeble performance of the exports in recent years can be explained by the international unfavourable cycle of the prices of mining and agricultural commodities, establish in the international markets. To others, the explanations are less related to conjuncture factors but more with the trade restrictions to Brazilian products, as well issues related with the commercial policy, emphasising the importance of the negotiation strategies adopted by Brazil in the multilateral and regional efforts to a better positioning of country’ exports.

Although the above listed causes are pertinent, some structural factors should be incorporated to the analysis. The exports and imports dynamics of a country depend on two conjugated effects: the competitiveness effect that explains part of the variation of the trade flow which is related with the change in the market share of a country to the total of world trade flows; and the positioning effect, that explains the part of the variation of the trade flow which is related to the relative share of a sector in the world trade flows. Kupfer (2002) calculated the contribution of these effects in the EU and US markets, the more relevant markets for Brazilian exports for 1995-1999. In the case of US, only a third of the exports value presents competitiveness and positioning positive effects. For the EU market this number decreases to only 18 per cent.

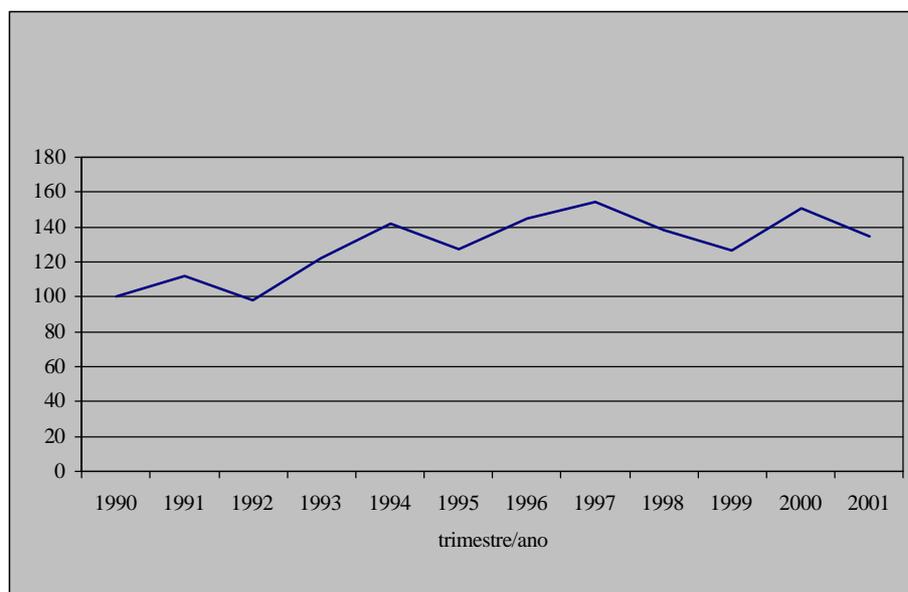
The 2002 US\$ 10 billions trade balance was close to the values of the 1984-1987 period. Although based on a similar list of exported products, the imported products list was quite different, and more intensive in dynamic products. So the commercial reforms were not capable of changing the competitiveness of Brazilian industry. By the way, the relative participation of Brazil in the international trade flows decreased from 1.4 per cent in the mid 1980s to the current 0.7 per cent.

3.2.4. Capital and R&D investment strategy are still the same:

One of the most critical conditions to the sustainable evolution of industrial competitiveness is the investments in fixed capital. These investments can congregate new productive capacity, and become an important factor of generating economies of scale and scope and incorporation of new technologies.

However, during the 1990s this was not the case for the Brazilian economy. The period is characterised by a lack of any tendency of expansion of the gross fixed capital accumulation, as we can see in Figure 5.

FIGURE 5
GROSS CAPITAL ACCUMULATION IN BRAZILIAN ECONOMY
INDEX NUMBER 1990=100



Source: IBGE/DECNA

Albeit this general tendency, from the mid 1990s it is possible to observe some recovery in the rates of investment in the Brazilian industry to the GDP, surpassing the rates of the early 1990s, that were the lower of the last decade, as we can see in Table 9.

TABLE 9
INDUSTRIAL INVESTMENT / GDP RATIO
CONSTANT PRICES OF 1980

1972-1980	4,5
1981-1988	3,2
1988-1993	2,2
1995-1997	3,2

Source: Bielschowsky (1998)

According to Bielschowsky (1998) forecast, the yearly investment level for 1995-97 would be, in absolute terms, 82 per cent above the mean for 1992-93. Nevertheless, these rates are far below those registered for the investment peak reached in the 1970s and are closer to the values observed during the 1980s. These comparatively low investments can show a resume on the investments in the industry, during the 1990s. Bielschowsky (1998) presents a basic argument to justify the superior quality of the recent investments in the industry. According to a research conducted by CNI/ECLAC with 730 firms (see Table 10), the goals of the firms fixed investments planned and that took place during the 1990s, besides being related with the productive modernisation (especially concerned with costs reduction) was possible to detect an expressive growth of the expansion investments (particularly those related with new products launch in the market).

TABLE 10
 MAIN GOALS OF FIRMS' CAPITAL INVESTMENT 1992-94, 1995-96 E 1997-98
 (% OF FIRMS BY GOAL INDICATED AS DOMINANT)

Goal	1992-94	1995-96	1997-99
Cost reduction	52,2	61,9	54,0
Equipment substitution	57,3	55,2	49,0
Unbottlenecks	30,2	43,4	32,9
Plant expansion	33,3	41,7	47,4
New products	27,1	39,2	57,3
New plants	11,4	20,4	32,9

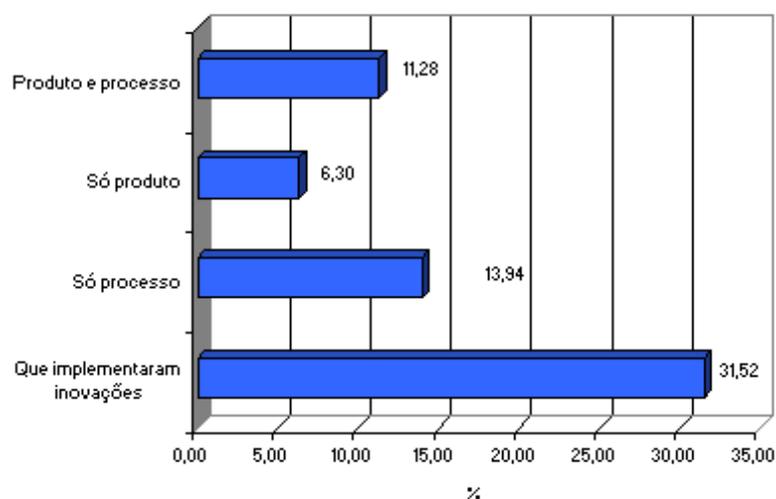
Source: Bielschowsky (1998)

The tendency related with the resume of the pace of investment in the industry observed in the past years, must be, however, better defined regarding industrial sector specificities. The industry has been having a different reaction to the impacts of these investments in the transformation of the competitive environment.

The second issue to be analysed is the technological behaviour of the Brazilian firms during the 1990s. Even if working with aggregated data, it is possible to characterise quite precisely the local innovative efforts achieved by the industry (PINTEC/IBGE – Industrial Survey on Technological Innovation, 2000). This recent research, scrutinise the innovation efforts of the Brazilian firms as: (a) external acquisition of R&D and other knowledge; (b) launch of technological innovations in the market; (c) internal activities of R&D; (d) development of industrial projects or other technical procedures; (e) training of its members and (f) acquisition of machinery and equipments.

In this enlarged view, the Brazilian firms showed an active but budding innovation effort. By the end of 1990s, as shows Figure 6, only a third of the industrial Brazilian firms implemented some type of innovation. From a total of 70 thousand firms (with ten or more employees) for the period 1998-2000, merely 31.5 per cent implemented product and/or process innovations - 22.7 thousand firms. This 31.5 per cent innovation rate can be divided as: 6.3 per cent of firms only introduced product innovations, 13.9 per cent process innovations and 11.3 per cent both product and process innovations.

FIGURE 6
 SHARE OF INNOVATING COMPANIES IN THE TOTAL SAMPLE, 1998/2000

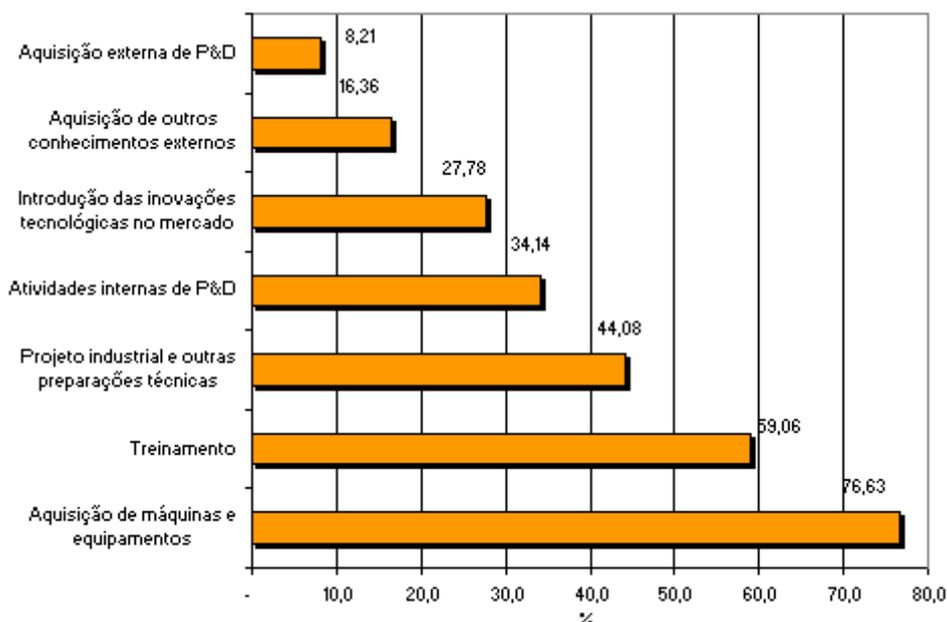


Source: IBGE, Industrial Survey on Technological Innovation, 2000

Figure 7 shows firms' perception of the scale of importance of several types of innovation efforts. Clearly, the majority perceives innovation through acquisition of machinery and equipment as the most innovative activity (76.63 per cent) and through training (59.06 per cent). The first category is associated to

technologies incorporated in the machinery thus, a sign of process modernisation. The second category of innovation efforts - training – can only be considered indirectly. Although, workers competencies improve by training, not all training activities end up in innovation activities. The most important fact is that a third of the Brazilian industrial firms consider vital the engagement in internal R&D activities.

FIGURE 7
DEGREE OF IMPORTANCE OF INNOVATIVE ACTIVITIES EFFORTS, 1998/2000



Source: IBGE, Industrial Survey on Technological Innovation, 2000

Table 11 shows of what is been said. From the 72 thousands industrial firms, with total sales of R\$ 582 billions in 2003, just 19 thousand spent R\$22 billions on innovation expenditures, that is 3.8 per cent of total income. From this value, 2 per cent was allocated to machinery and equipment by 15 thousand firms. In 2000, this value corresponded to R\$ 11.6 billions, which is half of the innovation expenditure. As for R&D expenditure, merely 7.412 firms spend 0.64 per cent of its liquid income, R\$ 3.7 billions. In these R&D activities, 31.4 thousand professionals work full time and another 32.9 thousand professionals work part-time.

TABLE 11
NET REVENUE AND EXPENDITURE IN INNOVATIVES ACTIVITIES, 2000

Number of Firms	Net Revenue (R\$ 10 ⁶) (1)	Expenditure in Innovative Activities					
		Total		Internal R&D Activities		Acquisition of Equipment	
		Number of Firms	Value (R\$ 10 ⁶)	Number of Firms	Value (R\$ 10 ⁶)	Number of Firms	Value (R\$ 10 ⁶)
72.005	582.406,1	19.165	22.343,8	7.412	3.741,6	15.540	11.667,3

Source: IBGE, Industrial Survey on Technological Innovation, 2000

Even among the restrict group of firms that are engaged in innovation efforts, prevail important differences. Table 12 clearly shows that the bigger the firm, the greater is its innovation engagement. Less than half of the firms that have R&D expenditures do it in a regular base. However, this group is responsible for 90 per

cent of national expenditure in R&D. In the same way, the bigger the firm, the bigger are its efforts in R&D, only 27.78 per cent of the small firms showed R&D expenditures against 79.88 per cent for firms with more than 500 employees.

TABLE 12
DISTRIBUTION OF NUMBER OF FIRMS AND EXPENDITURES IN PERMANENT AND EPISODIC R&D ACTIVITIES BY SIZE, 2000

Size (in Number of Employees)	Permanent R&D Activities		Episodic R&D Activities	
	No. of Firms %	Expenditures %	No. of Firms %	Expenditures %
Total	42,87	90,04	57,13	9,96
10 to 29	27,78	31,96	72,22	68,04
30 to 49	31,56	53,9	68,44	46,1
50 to 99	45,26	65,67	54,74	34,33
100 to 249	55,31	78,47	44,69	21,53
250 to 499	65,56	86,95	34,44	13,05
500 or more	79,88	96,12	20,12	3,88

Source: IBGE, Industrial Survey on Technological Innovation, 2000

The innovation efforts have been incipient and of low qualification and besides that, firms do not consider partnerships to increase their technological efforts intensity. Table 13 shows that only 11.04 per cent of the Brazilian firms co-operate with other firms. Again, the collaboration intensity increases with firm's size: from 7.43 per cent of firms with 10 to 29 employees to 37.80 per cent for bigger firms.

TABLE 13
SHARE OF NUMBER OF FIRMS WITH COOPERATIVE R&D EFFORTS IN THE TOTAL NUMBER OF INNOVATIVE FIRMS BY SIZE, 1998/2000

Size (in Number of Employees)	Share of Firms with Co-operative R&D Efforts (%)
Total	11,04
10 to 29	7,43
30 to 49	8,78
50 to 99	11,19
100 to 249	16,52
250 to 499	20,25
500 or more	37,80

Source: IBGE, Industrial Survey on Technological Innovation, 2000

3.3. SHIFTS IN THE PATTERNS OF COMPETITION DURING DE 90'S: SOME STYLISTED FACTS

The institutional transition towards a new paradigm "lead by the market" – trade liberalisation, deregulation and privatisation - was very difficult, taking in account the low credibility of the role of government and absence or inappropriate use of the structural and systemic pre-conditions (technological and physic infra-structure, loans, etc). Probably, the most important source of uncertainty was the unknown effects of the open market regarding the potential of penetration of imported goods into the Brazilian market. The result of this uncertainty, is the loss of capacity by firms to forecast the real size for its current markets, leading to a reduction on the pre-existent microeconomic degree of confidence.

The environment structurally hostile to competitive restructuring faced additional constraints due to the recession trend experienced in the Brazilian economy that restricted the investment decisions. It is not clear the extension of the openness effects in promoting an acceleration of the investments in expansion or

industrial modernisation. However, conjoined with the recession effects we could not expect a lot from the response capacity of firms.

Looking forward, some stylised facts can be derived from the Brazilian recent institutional transition, each of them implying important changes in the patterns of competition of the local industry. There are:

- Trade liberalisation in an unstable macroeconomic environment led the Brazilian industrial sector to a regressive specialisation, that is, the adjustment was concentrated on downsizing and outsourcing products and services.
- There was a once-for-all increase in productivity indexes instead of an increase in productivity growth. The lack of favourable structural conditions for long-run investment in R&D and output expansion led to a concentration on cost-minimising strategies and mergers and acquisitions.
- Trade liberalisation without efficient export-promoting policies resulted in structural trade deficit, which in its turn tended to intensify the foreign-exchange constraint on economic growth.
- Multinational enterprises increased their market share in industrial sectors of high technological content. As a consequence, intra-firm trade and sub-contracting increased in importance in these sectors and the degree of domestic competition decreased.

The next sections will explore this implication through a more detailed analysis of the restructuration of some of the main branches of the Brazilian industrial structure.

4. COMMODITIES: A DUAL TRACK STRATEGY: LOW COST FOR EXPORTS, DIFFERENTIATION FOR THE LOCAL MARKET

4.1. PATTERN OF COMPETITION NOW AND THEN: WIDENING AND DEEPENING THE SEARCH FOR LOW COSTS

Commodity related industries are engaged in producing intermediate inputs to industrial or final consumption, through large-scale production processes. The reference driver for commodity-based industries is cost competition. Cost minimisation strategies mattered in 1990 and are still prevalent in 2003. (See first two columns in Table 14) The search for and exploration minimisation drivers at company level, as well as in markets and industrial configurations was enhanced. This is most noticeable on regimes of incentives and regulations of developed nations, where markets were defended for local firms by means of explicit protectionist measures.

Since commodity products are intrinsically undifferentiated, competitive firms sustain and expand access to all sources of low unit costs and high production volume. Production efficiency and economies of scale are still ensured by three different but complementary sources: high capital intensive plants, preferential access to inputs –raw materials and energy sources- and transport logistics. In such a context, large, multi-plant, companies, operating internationally are capable of expanding the frontiers of low cost. During the last decade, simultaneously with similar operations in other sectors, more aggressive firms have deepened up their leadership positions, becoming larger and more internationalised by means of mergers and acquisitions transactions.

At the level of the firm, core competences are still related to four sources of competitive advantages: knowledge to effectively manage, acquire or access process technology, inputs, transportation, product distribution networks and preferential clients. The diffusion of information systems based on microelectronics technologies has provided the technical base for co-ordinating large-scale operations and logistics.

The pattern of competition among firms has remained closely associated with homogenous oligopoly; firms have knowledge on market perspectives and the behaviour of competing firms on a global basis. Thus, for competitive success, it is of fundamental importance to anticipate demand growth or to effectively respond to changes in price and quantity demanded from local and international markets.

Aggressive firms are those implementing two types of investment strategies –through green field but preferably M&A operations: expanding capacity ahead of demand growth of current products and virtualisation. Virtualisation expands the frontiers of cost minimisation, through economies of scale, and provides complementary sources of revenue. Revenue possibilities have expanded significantly in the past 10 years, by means of widening product portfolio (product grading in petrochemicals), exploring transportation assets for third parties or selling-off energy surplus.

The preferential access to capital markets is of vital importance for the competitiveness of investment-driven strategies. On this matter, large and internationalised companies have considerable advantages over firms operating single plants or in a limited number of national markets.

International competition in a context of liberalised national economies has strengthened a particular and historical trend: although prices of most commodities fluctuate along world economic cycles, relative prices have showed a declining trend, imposing problematic terms of trade for commodity dependent exporting nations.

TABLE 14
Patterns of competition (POC) and competitiveness in Commodities: now and then

SOURCES OF COMPETITIVE ADVANTAGES	PoC COST RELEVANT DRIVERS 1990	PoC COST RELEVANT DRIVERS 2003	BRAZILIAN COMPETITIVENESS 1990	Brazilian COMPETITIVENESS 2002
INTERNAL FACTORS				
MANAGEMENT PRODUCTION SALES INNOVATION	Process control Mass flow & energy efficiency Access to distribution channels Process technology	NO CHANGE	Efficient Efficient Efficient Incipient local efforts	More efficient Efforts placed in energy control More efforts Incipient local efforts
STRUCTURAL FACTORS				
MARKET	Standardisation	NO CHANGE	Prominence in low value added segments	Dual track more visible: low value added for exports and higher value added for local consumption
	Price, technical conformity Access to international trade		Low growth of demand	Cyclical with worsening terms of trade
CONFIGURATION OF INDUSTRY	Company and plant level economies of scale	NO CHANGE	Efficient plant size but low size of companies; prominence of SOE; low internationalisation efforts	Inside trajectory with important ownership change, prominent role for local capital and State as partner; low internationalisation efforts
	Access to raw materials & transport logistics Specialised technical services		Good access to inputs and deficiencies in logistics Reasonable efforts	More efficient Reasonable efforts
REGIME OF REGULATION AND INCENTIVES	Anti-dumping & commercial policy	INCREASED IMPORTANCE	Trade restrictions	Stronger pressure
	Environmental protection	INCREASED IMPORTANCE	Existing	Stronger pressure
	Cost of capital	NO CHANGE	High Tax distortions Risk of cartelisation, infant privatisation	Still high Tax distortions, Cartelisation yet to come, privatisation completed but not consolidated

4.2. COMPETITIVENESS IN 2002: SUCCESSFUL CATCHING-UP BUT OWNERSHIP CONSOLIDATION AND PRODUCT UPGRADING MUST BE FURTHER STRENGTHENED

Steel, pulp and paper and concentrated orange juice, among other commodity industries like soy and iron ore, are considered to be pillars of Brazilian international competitiveness. In these industries, in 2002, Brazil held a significant market share in international export markets: 80% in concentrated orange juice, 37% in sugar, 34% in soy grains, 32% in coffee and 16% in the meat industry. In 1990, the relatively small size of leading companies and the low levels of product value-added were the relevant competitive challenges facing Brazilian commodity producers. Since then these challenges were only partially addressed, while other sources of competitiveness were strengthened out. (See last two columns in Table 14)

Companies placed considerable emphasis on actions closely associated to direct input costs like ensuring access to raw materials and transport infrastructure. Lowering energy costs was an important investment item, given its high burden on total costs and the supply crisis the country faced in 2001. Also they consolidated capabilities to efficiently operate technically updated plants but still relying on capital goods suppliers to define the technological possibilities of improving processes.

Privatisation of the steel industry and private mergers and acquisitions have changed ownership structure of most industries, providing the opportunity for the emergence of larger firms. However, this process has not ended, meaning that market structures are still to be further consolidated. Even so, leading Brazilian firms, when compared to their international counterparts, have remained relatively small and oriented towards the local market. Leading international corporations were particularly active in acquiring competition and/or complementary assets in the 1990s.

In terms of product portfolio, Brazilian firms still supply international markets predominantly with low value added products, although they have invested in directly accessing distribution networks and large clients. For the local market, however, firms have evolved towards widening and upgrading product portfolio. This dual track behaviour has been consolidated throughout the years. Remains to be seen whether the experience in the local market may prove useful for conquering new and more valuable segments in international markets, in the years to come.

4.2.1. The steel industry

In the steel industry two outstanding processes were in place: the unfolding of the privatisation process initiated in the late 1980s and a substantial but localised investment drive in stages of the production process associated with the generation of new, higher unit value products to be sold in the local market.

Local capital prevailed in the privatisation process. Financial institutions accounted for 33.6%, pension funds for 15% and industrial corporations process for 21.8% of the value of privatisation transactions. Six large steel companies and six small ones were privatised in Brazil, for a consideration of US\$ 5.7 billion. Due, to a great extent, to the privatisation technique – auctions – an outstanding feature of the 1990s was the post-privatisation ownership instability and changes.

After privatisation was completed, 20 private M&A transactions were carried out. Between 1990 and 2000, only 17% of production units (measured in physical capacity) were not subject to at least one change in ownership. Concentration was increased in flat steel business, remembering that as USIMINAS acquired COSIPA, the plate segment became a virtual monopoly. The Gerdau group was the most active in acquiring private companies in Brazil and abroad. Throughout the 1990s it purchased 4 steel enterprises in Brazil and 7 abroad. It is focused on long steel business. Progressively the ownership structure of the industry has been consolidated, as shown in the Table 15.

TABLE 15
2002 OWNERSHIP STRUCTURE OF THE BRAZILIAN STEEL INDUSTRY

Special Steel	Acesita	Arcelor (39%), Previ (19%), Sistel (12%)
	Villares	Sidenor (58%), BNDESPAR (29%)
	V&M	V&M (93%)
Long Steel (Carbon)	Barra Mansa	Votorantim (100%)
	Belgo-Mineira	Arcelor (60%), Bradesco (11,5%)
	Met. Gerdau	Gerdau (73%)
	Açominas	Gerdau (79%)
Flat Steel (Carbon)	Cosipa	Usiminas (92%)
	CSN	Vicunha (46,5%), Valia (10%)
	CST	Acesita/Arcelor (44%), CVRD (20,5%), Kawasaki (20,5%)
	Usiminas	CVRD (23%), Nippon Steel (18%), Previ (15%), CIU (10%)

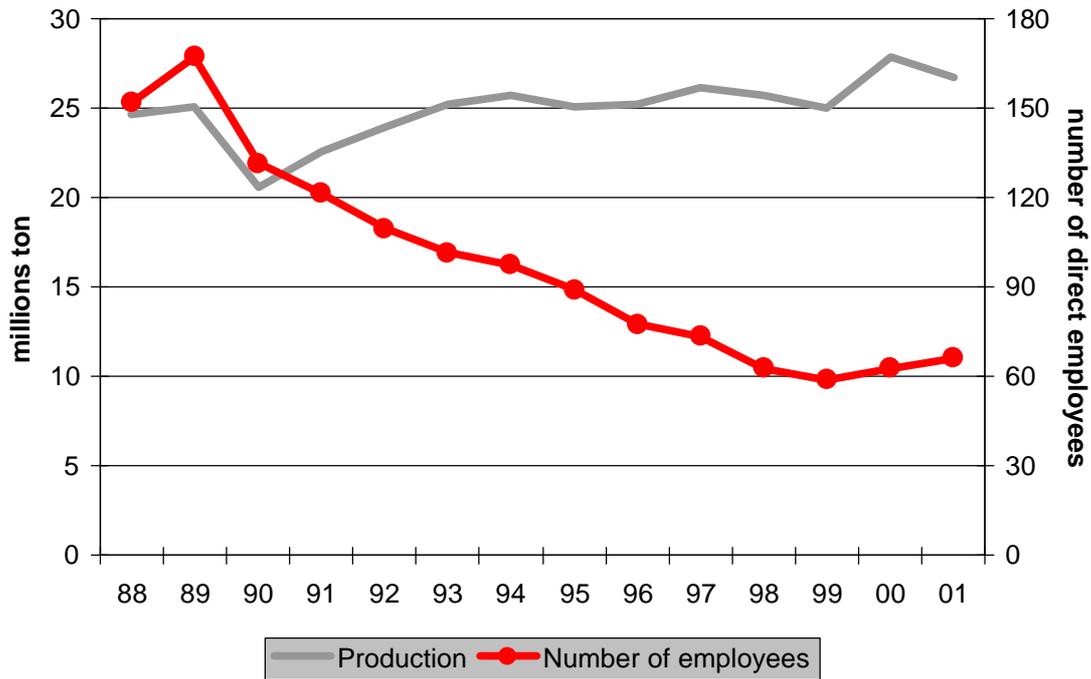
Source: Paula (2002)

The investment drive of the 1990s was very unexpected given the country's macroeconomic uncertainties and those arising from the privatisation process. As leading firms actively engaged in fixed capital spending, together with the automobile industry and telecommunications equipment suppliers, the steel industry was an exception to the low investment context of Brazil. What is even more surprising is that the investment drive took place in a context of strong ownership instability that normally would prevent corporations from capital immobilisation. Between 1994 and 2000 average annual investment was US\$ 1,450 billion. More important was the dual track destination of investments: large investments in rolling area, enabling product upgrading for the local market. On the other hand, the country's steel exports became more and more dependent on semi-finished products.

In 1999, in value terms, the world share of Brazilian production in semi-finished products was 14.1% and in galvanised sheets only 0.4%. The share of semi-finished in total Brazilian steel exports increased from 39.2% in 1990 to 68.4% in 2001, in physical production or 28.6% to 47.3% in value terms, respectively. This expansion was attained even in a context of increasing protectionist barriers, as the case of the USA demonstrates. Conversely, in the local market, between 1992 and 2001 total steel consumption increased 89% and galvanised sheets 402%. Above 50% of total demand came from the auto and civil construction sectors. The auto industries were responsible for 70.6% of special long steel products; the civil construction for 49.25 of carbon long steel products.

The investment drive had direct impact on efficiency levels. Even though output levels remained around 25 million tons per year, modernisation of installations and sharp cuts in employment levels – at an annual average of 7.6% between 1989 and 2000- resulted in corresponding sharp increases in productivity levels - from 11 to 5.4 man-hour per ton, between 1991 and 2000. (Figure 8) Most technologies associated with the investment drive was not developed in-house but incorporated in capital equipment.

FIGURE 8
 OUTPUT AND EMPLOYMENT IN THE STEEL INDUSTRY, 1988-2001



Source: Paula 2002

The strength of competitiveness in low value added products can also be found in the industry’s cost structure, As shown in Table 16, competitiveness of the Brazilian steel industry also relies on the low level of labour and iron ore costs. Financial costs and the costs of coal still constitute the basic source of competitive disadvantage.

TABLE 16
PRODUCTION COST OF BOBINAS LAMINADAS A FRIO, SELECTED COUNTRIES, APRIL 2001 (US\$ /
DISPATCHED TONS)

	USA	Japan	Germany	UK	S. Korea	China	Brazil
Raw materials	115	106	109	105	112	118	103
Coal	27	27	26	24	28	28	37
Iron Ore	55	56	62	58	59	75	40
Scrap / DRI	33	26	21	23	25	15	26
Other raw materials	172	150	148	153	134	152	135
Labour costs	154	142	136	113	62	26	57
Hourly wage	38	36	34	27,6	13	1,25	10,5
Total operational costs	441	398	392	371	308	297	295
Financial costs	39	60	40	46	42	50	67
Depreciation	29	40	30	26	30	30	32
Interest	10	20	10	20	12	20	35
TOTAL COST	480	458	432	417	350	297	362

* in man-hour per ton
Source: Paula (2002);

4.2.2. Pulp and paper

In 1990, competitive challenges facing the pulp and paper industry were very similar to those of the steel industry: lack of company level economies of scale and a product portfolio based on low value added. Since then the industry has evolved towards facing these competitive challenges, but at a slower rate when compared to its international counterparts. Thus, successful competitive catching up still require those challenges to be addressed to.

Brazil produces around 7 million tons of pulp and another 7 million tons of paper. This output places the country as the 7th largest producer of pulp (first in short fibre pulp) and 11th in the production of paper. But internal consumption per capita –at 40kgs- is very low, even compared to other countries at similar levels of development.

Two basic sources sustain competitiveness of the Brazilian industry: privileged and low cost access to the basic input – eucalyptus used for the production of short fibre pulp- and technically updated plants. Backward integration, towards rationalised eucalyptus forests is certainly a major source of competitiveness, given its important contribution to total costs and the high levels of efficiency attained in plantations. Industrial efficiency is particularly observed in pulp production but there has been considerable efforts also in increasing productivity levels of paper production. Efficiency in production has been accompanied by increasing levels of environmental compliance. As a result, the competitiveness of Brazilian products in export markets has been consolidated. However, much remains to be done in terms of expanding company size and updating product portfolio in the paper industry.

Eucalyptus forests have taken up space in Brazil. In 1990, out of 64 million hectares planted, 42 were eucalyptus forests and 20 million pinus forests. Ten years later, the extension of pinus plantation remained constant while 100 million hectares of eucalyptus forests were planted.

As shown in Table 17, in 2001, Brazilian industry leads world short fibre production, with a 19.4% share of total supply. Leadership has been consolidated as, in 1990, that share was 11.7%. Between 1990 and 2001 Brazilian industry expanded at 9.5% annually, inferior only to that of Indonesia, a late comer to the industry. In value terms, exports increased from US\$ 556 million in the beginning of the 1990s, to US\$ 1.3

billion in 2000.

TABLE 17
WORLD SUPPLY OF SHORT FIBER PULP (IN THOUSAND/TONS)

Country	1990	1992	1994	1996	1998	2000	2001	share 2001	Annual growth
Brazil	1,380	2,215	2,260	2,700	3,285	3,615	3,740	19.4%	9.5%
USA	2,590	3,215	3,235	15	2,840	2,780	2,935	15.2%	1.1%
Indonesia	90	130	250	1,220	1,850	2,150	2,915	15.1%	37.2%
Canada	1,025	1,285	1,780	1,830	1,820	1,990	1,985	10.3%	6.2%
Spain	735	950	885	910	940	1,040	1,050	5.4%	3.3%
Finland	1,030	775	770	800	810	850	905	4.7%	-1.2%
Others	4,930	4,695	4,790	5,065	5,350	5,845	5,790	30.0%	1.5%
TOTAL	11,780	13,265	13,970	12,540	16,895	18,270	19,320	100%	4.6%

Source: Fonseca (2002)

To a great extent, competitive success in pulp production relies on the capacity of companies to operate at low costs. Table 18 shows a picture very similar to that found in the steel industry. Compared to other leading pulp producers, direct production costs are very low, at US\$ 302 per ton while interest rates are the highest, among leading producing nations.

TABLE 18
COMPARATIVE PULP PRODUCTION AND FINANCIAL COSTS (US\$ TON/CIF NORTH EUROPE) 1995

	Argentina	Canada	Chile	Portugal	Spain	Sweden	USA	Brazil
Production costs	974	452	371	349	370	424	374	302
Depreciation	40	41	56	33	21	50	40	45
Interest	35	36	37	65	59	55	40	70
Total cost	449	528	454	444	450	529	454	417

Source: Fonseca (2002)

In paper production the picture is very different both, in terms of volume of production and share of world markets. In 2000, Brazil produced 7,188 thousand tons of paper, while international counterparts produced 323,295. Although in the 1990s the 4.3% annual rate of growth of Brazilian industry is higher than the rest of the world (3.3%), its international market share is very small and has remained unchanged - 2.0% in 1991, 2.2% in 2000-, for all types of papers.

Five types of papers respond to more than 50% of 2000 exports –printing/writing, non-coated paper, sanitary paper, cardboard e kraftliner-; ten years before this concentration was higher, at 70%. But, since 1990, in value terms, paper exports have remained below US\$ 1 billion for most years. Thus, in 2000, 62% of total paper production was sold in the local market; 22% represented self consumption of the producer and only 15% was exported.

According to the trade association, Bracelpa, 220 companies produce pulp and/or paper in Brazil; 2000 sales reached US\$ 7.5 billion; sales of the largest 11 integrated companies reached 2/3 of this total, revealing, for this industry, the importance of plant and company level economies of scale. During that year, the 4 largest producers of pulp – Klabin, Aracruz, Suzano, Votorantim- were responsible for 70% of total production. In paper production, concentration levels are smaller, but have been increasing since 1990. In that year, the 5 largest producers were responsible for 39.5% of total production; ten years later this share increased to 51.4%. In different segments of the paper industry, concentration levels are higher, and

similar to those prevailing in pulp production. Three companies control the production of printing paper; in packing paper, one company, Klabin, dominated 40% of the market in 2000. These concentration levels were increased by means of a very active process of mergers and acquisitions, as shown in Table 19. This process is very similar to international trends.

TABLE 19
MOST RELEVANT M&A IN THE BRAZILIAN PULP AND PAPER (1992-2001)

Company Sold	Commanding Company	Date	Share	Product	Annual Capacity 1000 t
Simão	Votorantim	1992	100%	CFCB + Printing paper	250
Kimberly Clark	Melhoramentos	1994	100%	Tissue	25
Iguaçu Cel.Papel	Sonoco Do Brasil	1995	100%	Kraft low gramature	20
Nicolaus Papeis	Ahlstrom Papeis	1995	100%	filter	4
J.Bresler	Orsa	1996	100%	Packing	35
Mad. Sguário	Orsa	1996	100%	Packing	90
Nicolaus Papeis	Md Papeis	1997	100%	Special Paper + Cardboard	70
Pirahy	Schweitzer Mauduit	1998	100%	Special Paper	48
Fab.Papel Guaiba	Santher	1998	100%	Tissue	20
Klabin Tissue	Kimberly Klabin	1998	50%	Tissue	155
Inpapel	Champion / International Paper	1998	100%	LWC	185
Celpav	Votorantim	1988	100%	Printing paper	100
Trombini*	Igaras	1998	100%	Packing	
Igaras	Suzano	1996		Packing	360 / 460
Igaras	Klabin/Riverwrod	2000	100%	Pulp / kraftliner	360 / 460
Salto	Arjo Wiggins	1999	100%	Safety Paper	27
Veracel	Aracruz +Storaenso	2001	100%	Acquisition of 10% da Oderbrecht	
Conpel	Grupo De Pauli	1999	100%	Packing/bags	28
Bacraft	Klabin / Kimberly	1999	100%	Tissue	15
Lalekla	Klabi7n	1999	100%	Tissue	
Klabin	Joint Venture until 2002 Norske Skog	2000	50+50%	Newsprinting Paper	120
Jarcel	Orsa	2000	100%	Pulp	300
Bacell	Klabin Lenzig	Nd		Pulp	100
Cataguases	Grupo Ibéria	Nd		Packing	50
Iberkraft	Grupo Ibéria	Nd		Packing	25
Pisa	Norske Skog	2000	100%	PAR + Newsprinting Paper	270 / 190
Champion L.	International Paper	2000	100%	Pulp + Printing Paper.	305 / 365
Ind.Papel Sto.Amaro	Ipb-Ind.Pap.Da Bahia	2000	100%	Long Fibre Pulp + Packing	42 / 56
Agaprint	Rigesa	2000	100%	Packing	
Bahia Sul	Suzano	2001	100%	Pulp + Paper	600 / 250
Cenibra	Jbp	2001	100%	Pulp	830
Portucel	Suzano + Sonae	2001	28%	Pulp + Paper	400 BEKP
Aracruz	Votorantim Acquisition of 26% of Mondi	2001	26%	Pulp	
Pisa	Norske	2001		Paper	

Source: Fonseca (2002)

4.2.3. Citrus

Some of the 1990s competitive challenges facing the industry, like the need to close relations with distribution channels have been dealt with and presently the industry is stronger than before. Others

challenges remain. Most firms are still distant from final consumers; they are specialised in trading and producing to specifications for corporations that aggregate value to the product, selling them to shops, supermarkets or directly to the final consumer. Curiously, even in this relatively homogenous industry, the dual track pattern observed in the steel and in the pulp and paper industries are also present. In the Frozen Concentrated Orange Juice – FCOJ- segment, Brazil is an efficient exporter; in the Pasteurised Orange Juice –POJ-, segment, sales are directed to the local market. The latter requires more sophisticated industrial operations and it is very close to the final consumer market, requiring significant marketing efforts.

During the past 10 years, the Brazilian industry has consolidated its leading international position in the FCOJ segment and is facing an expanding local market in the POJ segment. Market perspectives are very reasonable, especially in the POJ and natural juice segments; in the US, annual consumption levels of POJ reach 40 litres; in Brazil total orange juice consumption is around 20 litres/year; only 1 litre is POJ but annual rates of growth in this segment are very high, at around 30%.

Brazil still is the most important international player in this industry; during most of the 1990s 50% of total world orange juice and 80% of FCOJ were produced in Brazil, generating, in average, US\$ 1 billion in annual exports. Similarly to other commodity producers, Brazil is very dependent on fluctuations of international prices; while total exports of FCOJ expanded from 785 million tons in 1990, to 1,030 million tons in 1995 and 1,234 million in 2000, export revenues, that have reached a peak of US\$ 1.3 billion, decreased to US\$ 800 million in 2001.

The industry’s high market share has brought about reactions from important consumer/producer countries that have imposed important trade barriers to the Brazilian like the USA 56% ad valorem tariff. The most important markets are the US, Japan and Europe. The most developed markets are stagnating; it is estimated that West Europeans consume 24 litres of fruit juice per year, while East Europeans consume 5 litres per year. However, this market is very promising, having expanded 80% between 1995 and 2000.

The competitiveness of this industry is to be found in efficient industrial operations, in privileged access to inputs and in mastering and accessing a sophisticated transport infrastructure. The relevant transport infrastructure is related to specialised orange juice carriers, requiring a technical sophistication similar to a chemical vessel. In relation the agriculture base of the industry, Table 20 below informs how productivity has expanded, due to increases in plantation intensiveness and greater use of fertilisers, while total plantation area has decreased in the last decade. There has been considerable technological efforts to improve the industry’s agricultural base; the most significant achievement was the DNA sequencing of genome of the bacteria *Xyllela Fastidiosa*, that provokes diseases to crops. Even though these figures suggest a worrisome trends for agriculture productivity, orange plantation is still economically attractive; its price per hectare is five times greater than those observed for soy and 70 % higher than coffee prices.

TABLE 20
THE AGRICULTURE OF BRAZILIAN ORANGE

Year	Area (ha 1,000)	Box/tree	Box/ha	Fertiliser (kg/ha)
1985		2.0	452	
1990		1.9	419	
1995	856	2.0	519	75.73
2001	821	1.8	532	116.36

Source: compiled from Neves & Marino (2002)

In the FCOJ segment, the processing industry is the coordinator of the associated logistics: from providing technical and financial support to orange plantations to the timely delivery to distribution channels or directly to the packaging industry. Their co-ordinating capabilities is so developed that important clients, like Coca-Cola, have transferred the managing of their juice production units, in the USA, to a Brazilian company. This is an important change from the early 1990s; to by pass import restrictions, the most active firms have moved to the south of the USA, acquiring or investing in new processing units and even some plantations. The largest corporations have also increased their economic power; if in the early 1990s very few firms dominated Brazilian exports; in 1997 the share of the largest four producers was 70%; in 2001

this share had increased to 90%. But, even so, these firms remain distant from final consumers; they are typically commodity producers, relying competitiveness on the low cost of their undifferentiated product.

In the segment of pasteurised orange juice, a segment that has been expanding at high rates in Brazil, the market structure is relatively different. As shown in Table 21, searching for economies of scale, a dual verticalisation strategy is implemented by different corporations, along the production chain. In one extreme, close to the resource base, processing firms are verticalised towards packaging operations. On the other extreme, close to the final consumer, selling companies, including supermarkets exploring their own brands, incorporate distribution activities. The relations between these two extremes are mediated, in most cases, by supply contracts among different companies. The exception is Parmalat, a highly verticalised corporation and Yes, that contracts to Paulista their distribution activities. It is worth mentioning that the three leading FCOJ producers – Sucocitro Cutrale, Citrosuco Paulista and Coinbra-Frutesp do not participate in supply contracts of POJ to the major selling companies, contrary to the dual market segment strategies of Citrovita (the 4th largest) and Cargill (the 7th largest).

TABLE 21
VERTICALIZATION AND SUPPLY CONTRACTS IN THE PASTEURIZED ORANGE JUICE PRODUCTION CHAIN

1- Selling company	2- Distribution company	Relation 1x2	3- Packaging company	Relation 2x3	4- Processing company	Relation 3x4
Nestle	Nestle	Vertical	Cargill	Contract	Cargill	Vertical
Dan' Fresh	Danone	Vertical	Citrovita	Contract	Citrovita	Vertical
Leco	Leco	Vertical	Citrovita	Contract	Citrovita	Vertical
Yes	Paulista	Contract	Cargill	Contract	Cargill	Vertical
Parmalat	Parmalat	Vertical	Parmalat	Vertical	Parmalat	Vertical
Carrefour	Carrefour	Vertical	Cargill	Contract	Cargill	Vertical
Sendas	Sendas	Vertical	Nova América	Contract	Nova América	Vertical

Source: compiled from Neves & Marino (2002)

5. DURABLES: INWARD INTERNATIONALIZATION AND CACTHING UP IN MIDDLE INCOME SEGMENTS

5.1. PATTERN OF COMPETITION NOW AND THEN: INTERNATIONALIZATION AND DIFFERENTIATION

The market structure of durable industries, like consumer electronics and automobile industries, is characterised by few firms, implementing aggressive strategies towards a global market. Intense product renewal through continuously incorporating greater technological content prevails. To a large extent, competitiveness is defined by the capability of firms to differentiate products and to impose new consumer standards, associated with the intra and inter-firm co-ordination for the assembly of a wide number of components, in large scale. Thus, leading firms in this group are those capable of successfully exploiting economies of scale and scope. Accordingly, a differentiated and concentrated oligopoly is the prevailing market structure, meaning that firms must master competitive advantages by large-scale production of differentiated goods. These trends already successful competitive drivers, in the early 1990s were further stressed since then. (see first two columns of Table 22)

For competitive firms, the emphasis on product differentiation imply the promotion and the attraction of demand, through constant introduction of new products with sets of desirable – from a consumer perspective- attributes, such as price, brand, technology, and technical assistance. To achieve these product attributes, firms must invest in product development and in post-sales assistance, through authorised retailers' network. Firms are constantly trying to create or expand market segments, in order to amortise investments costs associated with product development and new or renewed installations.

Durable industries assemble products in large scale. To be competitive, it is mandatory to respect

minimum requirements of technical and management scales. The large minimum efficient scale becomes, then, a significant barrier to entry: incumbent firms must implement investment strategies that anticipate market growth and have to try to expand market shares through constant product differentiation. It is also relevant to operate production systems with increasing ratios of technical efficiency and quality. Guided by principles established by Japanese firms many years ago, leading players have entered a trajectory of “slim” production, composed by a set of techniques that combine increasing process flexibility with the most favourable aspects of traditional Fordist model of production. Such strategy implies an increasing intensiveness in the use of microelectronic based automation and organisational techniques, devoted to continuous improvement of production processes, including production organised around cells. Relative to Fordist systems, production systems of this nature require less but highly qualified workers.

Due to the high ratio of components to production value, since the early 1990s, there has been a clear trend towards vertical disintegration, combined with new forms of articulation between assembler and suppliers. In relation to suppliers, essential competitive factors are: delivery times; price; technical conformity; stable industrial contracts incorporating the transfer of stock administration costs to suppliers; and, joint development of components that must be designed to fit in assembling units of final products. Under a global trade liberalisation context, firms have been developing global sourcing systems.

Investments carried out in these sectors normally induce dynamic effects in a host economy, directly or indirectly, including changing and upgrading the nature of employment and the modernisation of a region. In any part of the world there is always a fierce competition by local authorities to attract companies announcing new investment plans. That is the reason why these authorities provide generous fiscal incentives to attract these set of activities.

TABLE 22
PATTERNS OF COMPETITION (POC) AND COMPETITIVENESS IN DURABLES: NOW AND THEN

SOURCES OF COMPETITIVE ADVANTAGES	PoC DIFFERENTIATION RELEVANT DRIVERS 1990	PoC DIFFERENTIATION RELEVANT DRIVERS 2002	BRAZILIAN COMPETITIVENESS 1990	BRAZILIAN COMPETITIVENESS 2002
INTERNAL FACTORS				
MANAGEMENT	co-ordination capabilities	NO CHANGE with increasing importance of information technologies	Lack of capabilities	Closing gap with international practices
PRODUCTION	organisational flexibility		Organisational rigidity	Closing gap with international practices
SALES	Brand image		Brand image	Closing gap with international practices
INNOVATION	product & components design		Local design capabilities but outdated products	Demobilisation of local capabilities but outsourcing of updated products
STRUCTURAL FACTORS				
MARKET	Segmentation by quality and marketing	INCREASED	Low segmentation	Specialisation in middle range segments
	Price, brand, technological content, technical assistance	INCREASED	High price, low technological content	Increased competition but instability remains
	regional & global trade	INCREASED	Distant from international networks	Regionalisation of markets; less threat of competition from imports
CONFIGURATION OF INDUSTRY	firm and plant level economies of scale & scope	INCREASED	Scale deficiencies in most product lines	Optimisation through specialisation
	articulation assembler-supplier, distribution	INCREASED	Infant articulation	Closing relations with suppliers
	metrology & standardisation	NO CHANGE	Adequate	Adequate
REGIME OF REGULATION AND INCENTIVES	Property rights Consumer legislation Consumer credit Fiscal incentives	NO CHANGE NO CHANGE NO CHANGE NO CHANGE	Low levels of compliance Infant legislation Inexistent Inexistent	Enforcement of property rights Stricter legislation Variation according to macroeconomic conditions Extensive use of local incentives

5.2. COMPETITIVENESS IN 2002: EXPANSION, MODERNISATION AND PRODUCT UPGRADING. BUT, DEMAND CONSTRAINTS STILL IMPOSE LIMITS TO FURTHER GROWTH

The consumer electronics and the automobile industries were strongly impacted by the Real plan in 1994, associated with trade liberalisation. On one hand, price stabilisation, anchored in local currency overvaluation, provoked an “income effect” that sharply expanded demand levels; on the other hand, the late 1980s trade liberalisation was reinforced, imposing new benchmarks for product attributes, like price and technical specification.

During the 1990s, firms in Brazil not only demonstrated the capacity to resist competitive pressure but, in fact, a significant number of them implemented pro-active strategies to exploit demand expansion, through investment in new plants and products. (see last two columns in Table 22) New entry was also observed, by means of green field investment or the acquisition of existing businesses. By 2003, the internationalisation of ownership, already a structural feature in these industries, was practically completed. Representatives of most international leading players do operate in Brazil.

Overall, in respect of durable industrial group, it is possible to identify a reasonably homogeneous feature, in terms of product and investment strategies. Regardless they are TV or car producers, along the past decade, the presence of transnational affiliates, with similar capabilities and performance, has increased. Firms have fiercely disputed market shares through investment in modernising and expanding productive capacity – acquiring local firms in the consumer electronic and autoparts industries and building of new production units in the automotive sector-. Given these investments, in the international scenario, Brazil has become an important production platform of middle range, but technically upgraded products, like sub-compact cars. But, given the oscillating and low growth trends of the Brazilian economy throughout the decade, most firms have yet to make full use of new installations.

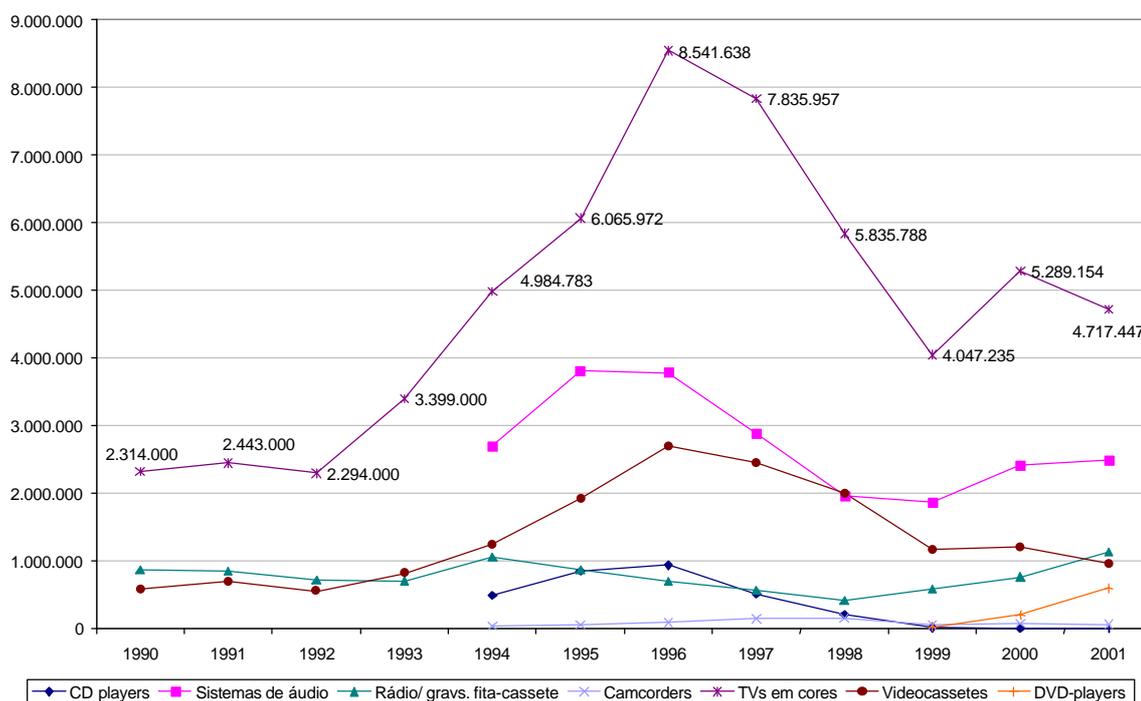
For firms from this industrial group, current competitive challenges are related to the consolidation of their relevance as producers of middle range but reliable products, for the local, regional and international markets. This involves expanding their presence in international, especially intra regional trade flows and the further exploitation of opportunities in global sourcing. This is especially true in a context of low growth of the Brazilian market. But, given existing idle capacity, even in a scenario of an expanding local demand, most firms are well placed to sustain competitiveness, especially from imports, in the years to come.

5.2.1. The consumer electronic industry

The Brazilian consumer electronic industry, is located mostly at the “Zona Franca de Manaus” (a duty-free assembling zone). During the last decade it has faced different periods of adaptation and change. After a recessive beginning, in the early 1990s, leading manufacturers of audio and video segments improved their economic performance, due to a significant increase in consumption levels, mostly from lower social classes. As a result, in 1996, sales of TV sets amounted to an unprecedented level of 8,5 millions units. But, as shown in Figure 9, just as production expanded, it has quickly contracted, during the second half of the 1990s.

This inverted V shape of domestic sales reveals two main features of consumer electronic goods: firstly and most important, these trends are a good proxy of uncertainty levels prevailing in the Brazilian economy since the 1980s, a period of frequent oscillating cycles of growth levels; secondly, the vitality of local producers, capable of responding to demand expansion by quickly promoting new investment.

FIGURE 9
INDUSTRIAL SALES IN DOMESTIC MARKET OF BRAZILIAN ELECTRONIC INDUSTRY (UNITIES)



Source: Sá (2002)

That is, the market expansion of the first half of the 1990s has induced the entry of new players and growth of incumbent competitors, both seeking to move into markets other than where they were placed at. It is worth emphasising that leading international players, such as Phillips, Panasonic, Sanyo and Toshiba have been operating in Brazil since the 1980s, thus, reproducing the international oligopoly structure in the Brazilian domestic market .

Sony, and the national firms CCE and Gradiante, which have been traditional players in the audio segments, strived to expand sales by diversifying into TV and video markets. Another national firm, Cinerál, signed a joint-venture agreement with Daewoo to enter the audio and video markets. Moreover, the Koreans Samsung Electroncis and LG entered the country through new investments in the video segment.

However, in the end of the 1990s, this favourable environment started to change. A new and difficult macroeconomic scenario emerged. High levels of credit default of low budget consumers damaged sales of major shopping outlets, leading to the bankruptcy of leading chains, thereby reducing revenue sales of most electronic manufacturers. The consumer electronic industry went through a reorganisation process. Daewoo closed their operation plants, the Brazilian subsidiary of Sharp defaulted, and Samsung Electronics decided to focus their activities on mobile telephony. In this aspect, due to privatisation of the national telecommunications sector, the expansion of the mobile market quickly became a really attractive option to diversification. This explains why Gradiante, in association with Nokia, moved into this market.

Meanwhile, on the freezers, fridges, cookers and washing machines segments, an unprecedented entry of foreign players through mergers and acquisitions (M&A) operations was observed. Eletrolux acquired the Brazilian group Refripar; Whirlpool bought a majority position in the largest national group, Brasmotor; Siemens-Bosch acquired Continental; Seb bought Arno; and, Tsann Kuen has settled a joint venture with Sector, a Brazilian company. These foreign firms used M&A operations not only as a way to quickly access market-share and distribution networks of national firms, but also as a mode to move themselves into markets which was growing more rapidly than their traditional ones.

Its is relevant to acknowledge the product strategy adopted by international players. In Brazil they

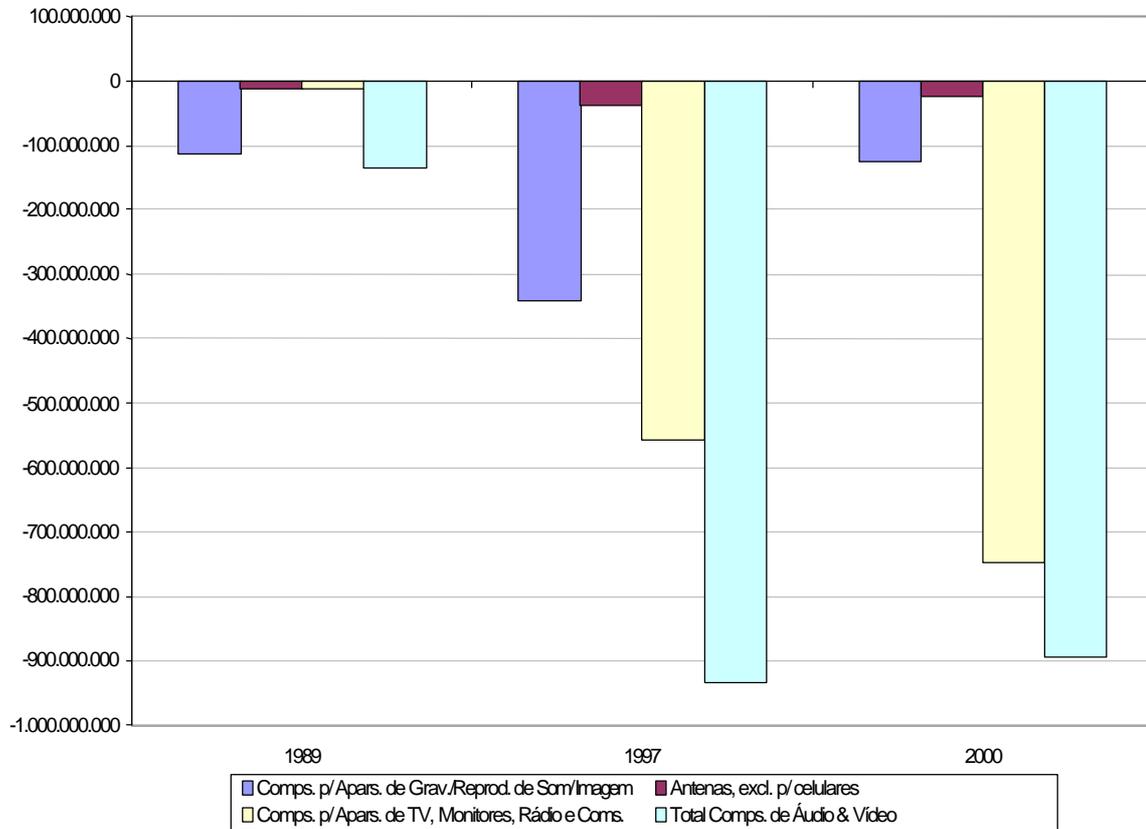
implemented policies different from those employed in their original countries – or original markets – where they compete by trying to assume a leading role in defining technological standards. In the Brazilian market, firms implemented a market segment focused strategy, upgrading quality and other product attributes levels, but, at the same time, relying on internationally established technology standards. This option can be explained by three factors: firstly, competitive pressure from imports impose minimum levels for product attributes; secondly, the focus on middle range products is associated with the structural features of local demand and the most promising market segments, that is, low-budget consumers; thirdly, their inability to compete with low-end products, produced in very large scale and imported from Asian countries.

By the end of the 1990s, the Brazilian consumer electronic manufacturers faced a new challenge: the devaluation of the national currency. Devaluation had an immediate effect in raising debt levels of firms, which had borrowed in foreign currency. Devaluation was also followed by a slower rate of economic growth. In 2000, sales revenue of audio and video markets plummeted to US\$3.5 billion, well below the US\$ 8.1 billion reached in 1996.

The Brazilian industry has yet to compensate these trends with a greater exposure to international trade; exports in the audio and video segments have remained at around US\$ 350 million since 1990, representing a very small proportion of local sales; imports of final goods are around US\$ 150 million, increasing to US\$ 450 million, when local demand expands.

The main destinations of these exports were Argentina, Hungary, Italy and Spain. Nevertheless, this good performance has not been able to compensate the significant increase on the value of imports of electronic components that came from South Korea and Japan. As shown in Figure 10, although the industry has reduced its trade deficit, from US\$ 1.56 billion in 1997 to US\$ 1.06 billion in 2000, the lack of production capacity in components constitute a structural weakness of this industry.

FIGURE 10
 TRADE DEFICIT IN ÁUDIO & VÍDEO COMPONENTS
 (US\$ FOB)



Source: Sá (2002)

5.2.2. The automotive industry

Competitive catching up, in the relevant segments where it operates, is the main feature of the Brazilian automotive industry during the 1990s. This process was undertaken by four sets of interrelated investments in: i) new and renewing existing industrial plants; ii) launching of new products; iii) improving the productive-chain organisation mode and, iv) promoting intra regional trade, particularly between Brazil and Argentina. Moreover, new firms have entered the country, adding up capacity and competitive pressure in the local market. Similarly to the consumer electronic industry, Brazil has consolidated an important international position in middle range segments of this industry.

Three basic conditions were of fundamental importance: the regional integration that reduced intra-firm costs, expanded potential gains derived from economies of scale and induced specialisation; economic liberalisation – inducing imports and entry by new firms- that brought about competitive pressures for established firms to update products and modernise installations; economic incentives for firms and consumers that were vital for expanding local demand.

Thus, the most relevant fact that marked the industry in the 1990s is the significant increase in annual average investments: from US\$ 500 million in the 1980s, to US\$ 1.3 billion between 1990 and 1995 and US\$ 2 billion during the second half of the 1990s. During the decade, investments in the assembly industry amounted to US\$ 16.5 billion and, in autoparts, to US\$ 12.1 billion. Table 23, below, informs new added

capacity to the car assembly segment.

TABLE 23
AUTOMOTIVE INDUSTRY - NEW ASSEMBLY PLANTS, 1996-2000

Firm	Type of Good	Location	Year
Volkswagen	Engines	São Carlos-SP	1996
Volkswagen	Lorries and buses	Resende-RJ	1996
Honda	Cars	Sumaré-SP	1997
Mitsubishi	Light commercial vehicles	Catalão-GO	1998
Renault	Cars and engines	São José dos Pinhais-PR	1998
Toyota	Cars	Indaiatuba-SP	1998
Daimler Chrysler	Cars	Campo Largo- PR	1999
GM	Components	Mogi das Cruzes-SP	1999
Volkswagen-Audi	Cars	São José dos Pinhais-PR	1999
Fiat	Cars	Juiz de Fora – MG	2000
GM	Cars	Gravataí-RS	2000
Iveco	Engines	Sete Lagoas-MG	2000
Ford	Cars	Camaçari-BA	2001
Nissan	Light commercial vehicles	São José dos Pinhais-PR	2001
Peugeot-Citroen	Cars and engines	Porto Real-RJ	2001

Source: Sarti (2002)

While new entrants in car assembly increased competitive pressure, in the autoparts investment trends also brought in new firms but not via green field. Following an international trend, mergers and acquisitions (M&A) was the relevant mode of entry of newcomers into the Brazilian autoparts. Hence, only a small part of these investments were devoted to increase productive capacity. As a result, higher rates of internationalisation and market concentration were observed. In 1994, local capital was responsible for at least 50% of total capital, sales and investment. By the end of the decade, the share of locally owned firms was down to approximately 25%.

Regardless of ownership changes, investments were significant and the Brazilian competitive gap was significantly shortened, in terms of product attributes and efficiency levels of installations. As an example, GM's plant in the southern city of Gravataí operates with a high degree of automation (113 robots) and it is organised in modular systems, involving first degree suppliers. Assembly times are at around 13 hours, compared to average 22 hours in other GM plants. In other words, these investments brought about expansion of capacity, new machinery, new organisational formats, new product portfolio and changes with in relations with suppliers. In aggregate terms, as shown in Table 24, there were significant increases in productivity - the number of cars produced by worker has grown three times in the period 1990-2001, reaching 21.3 units in 2001.

TABLE 24
EMPLOYMENT AND PRODUCTIVITY IN CAR ASSEMBLY

	1990	1992	1994	1996	1998	2001
Employment	117,396	105,664	107,134	101,857	83,049	85,257
Labour productivity*	7.8	10.2	14.8	17.7	19.1	21.3

* units per worker

Source: Sarti (2002)

It is clear that the 170% accumulated growth in productivity was related to increases in production levels coupled with decreases in employment. In average, production expanded at 6.4% while employment levels fell by 2.9% in average, during the 1990s. During this period while production levels doubled, 32 thousand work positions were eliminated, outsourced or transferred between firms along production chains.

At this point, it is important to call attention to changes in the organisation of production and in the mode

of relations prevailing between assembly and suppliers. Firstly, they were called to operate very close to assembly units, to enable just in time operations. Every new installation in Brazil was designed under the concept of condominium, where specific areas were designed to be occupied by selected autoparts corporations that would enjoy exclusive relations with assemblers but, in compensation, would also bear and share investment costs. Secondly, in order to deal with these new mode of relations, auto parts companies – now, for most part subsidiaries of key international players – developed an intense intra-firm trade, thereby expanding auto parts imports from their original transnational corporations. From 1989 to 2001, imports increased 300%, reaching US\$ 4.3 billions in 2001 and a trade deficit of US\$ 445 million.

Against this context of expansion, modernisation and ownership change, auto sales in Brazil presented a clear growing pattern during the first part of the 1990s, departing from 713 thousand units in 1990 to 1.9 million in 1997 and 1.6 million units in 2001. Most auto assemblers operating in Brazil have strongly specialised in the subcompact segment, with engines on the 1000 to 2000cc range. In 2001, 71% of domestic production was related to this segment. While specialisation may have positive effects in terms of economies of scale, potential profitability levels are low and acceptability of national production in foreign markets is narrow. On the other hand, concentration of production (and sales) in this particular segment provides a protection to the Brazilian auto industry against foreign competition. International trade of the Brazilian auto industry was marked by a strong complementarity with Argentina. Firms operating in each country tried to take advantage from complementarity between their product lines. After a brief expansion in the post-trade liberalisation years, the level of cars imports in Brazil was reduced, having equalled the average level of US\$ 2 billions in the biennium 2000/2001, while in the period 1995-1998 the average value was equivalent to US\$ 3.3 billions. Almost 66% of these imports came from Argentina. By the same token, 44% of the imports made from Argentina comes from Brazil.

In short, the Brazilian auto industry has managed to significantly close down the technological gap accumulated throughout the 1980s. The industry has been enlarged, by existing producers and new comers; product portfolio and production systems have been updated to international levels. However, its relative size and mode of international insertion is, still, relatively modest. Established affiliates are not economically expressive world-wide; only Fiat, Volkswagen and Scania have local operations amounting to more than 5% of total corporate business. Moreover, local demand levels never fulfilled new added capacity, remaining, in 2001, at 40%, much above the international average of 25%. Therefore, two possible scenarios can be drawn; on one hand, local industry has the supply resources, if demand levels expand. The export potential of the industry is also significant and Brazil can further explore international markets in the subcompact segments; on the other hand, if demand levels remain low, rationalisation, closing down of operations and even the exit of producers is a strong possibility in the years to come.

6. TRADITIONAL INDUSTRIES: COMPETITIVE CONSTRAINTS ARE STILL DEFINED BY UNEQUAL INCOME LEVELS

6.1. PATTERN OF COMPETITION NOW AND THEN: MARKET SEGMENTATION CUM NETWORKING

Final consumption is the common destination of products generated in traditional related industries. Market segmentation is extensive and an inherent feature of these industries. Thus variety prevails, in terms of number and technical specifications of products, nature of production processes (assembly, flow and batch production) and minimum size of technical economies of scale, verticalisation and outsourcing levels and organisational format of companies.

Industries are very sensitive to oscillations in demand and responsiveness is the key competitive driver of these industries. (see first two columns in Table 25) Sensitivity is expressed by two means, both with direct implications over production capabilities. Firstly, with considerable marketing efforts, companies constantly have to introduce new product designs, creating niches or imposing themselves in their markets. If successful, immediate demand expansion follows. Thus, they must increase production levels to corresponding growth of demand, while keeping delivery times under control. Secondly, demand levels are subject to seasonal oscillations, imposing adequate adaptation to production levels. Compliance to these

two sources of oscillations in demand is facilitated by the relatively technical easiness and low investment costs in expanding production in short time. In fact, regardless the importance of imposing new consumer habits, investment by firms in these industries are reactive to changes in demand levels.

The extent of market segmentation is defined by the size and income levels of a given consumer population. In such a context, the degree of importance for competitiveness of product attributes like price, brand and adequacy to use will be directly related to income levels of those consumers groups aimed at by corporations. The higher the income levels, the less relative importance the price attribute will have and the greater the value of attributes associated with attending particular specifications of clients. Nationwide, if high income levels prevail, similar competent firms will co-exist but operating in different market segments. Otherwise, where income differentials are significant, firms with very differentiated competences but operating in similar markets, will survive. It is important to remark that, given the relatively low unit value of traditional products in consumer baskets, high levels of product renovation and differentiated competences among firms may prevail, even in a context of very unequal income levels, but where the absolute size of the market is expressive, as in the case of Brazil.

Entrepreneurial skills to promote product renovation and to keep updated organisational formats - especially in relation to design, marketing, quality systems and relations with suppliers- are essential for competitive success in these industries. The basic sources of technical change for these industries come from equipment and input supplier industries; in the past 10 years an increasing role has been played by information technology related equipment and chemical plus biotechnology related inputs. Those corporations capable of accessing these inputs in better terms will definitely enjoy competitive advantages.

In general privileged access is related to size: smaller companies can survive in specific market niches, but they may face economic and financial difficulties in mobilising the necessary resources to fully enjoy equipment and input sources of competitive advantage. Given the inherent economic variety of this industry, this may be the basic reason behind an increasing trend towards companies organising themselves around local productive clusters –organised horizontally and/or vertically-. Through local clusters companies can benefit from another source of competitive advantage: economies of agglomeration, through which they share costs associated with any and every kind of their economic activity: infrastructure, labour and other inputs, design and marketing, information systems, etc.

6.2. COMPETITIVENESS IN 2002: INCREASING RESPONSIVENESS BUT HETEROGENEITY STILL PREVAILS

Traditional industries are among the oldest industrial activities in Brazil and competitive heterogeneity was and still is their relevant structural feature. The co-existence of very differentiated levels of competences among firms in each sector –and even among stages of production, within a given firm – can be directly associated with the country's remarkable uneven income distribution profile. In 1990 competitiveness was directly associated with size: large firms were likely to be more competent than their smaller counterparts.

Larger firms were able to explore different market segments, to invest in modernisation and to export. The analysis of textile, shoe and furniture industries indicate that, in 2003, the 1990 basic structural feature of these industries –their competitive heterogeneity- still prevails. But, as shown in the last two columns of Table 25, some progress has also been observed. The rate of product renovation has increased, through explicit and increased design efforts. Production modernisation has been facilitated by the incorporation of more efficient. Local clusters have emerged in increasing number and are being consolidated in different industries and regions of the country. Companies have further explored low labour cost opportunities, by transferring installations to the Northeast of the country.

TABLE 25
Patterns of competition (POC) and competitiveness in Traditional Industries: now and then

SOURCES OF COMPETITIVE ADVANTAGES	PoC RESPONSIVENESS RELEVANT DRIVERS 1990	PoC RESPONSIVENESS RELEVANT DRIVERS 2002	BRAZILIAN COMPETITIVENESS 1990	BRAZILIAN COMPETITIVENESS 2002
INTERNAL FACTORS				
MANAGEMENT	Entrepreneurial skills	More importance of creating new market segments	Existence of a core group of competitive firms; size and nationality heterogeneity	Increased heterogeneity: leaders close to the international frontier; reliance on outsourcing and low labour costs
PRODUCTION	Quality control	Increasing trends towards greater flexibility and outsourcing	Incipient	Increased competence
SALES	Market information	Increasing importance of marketing	Incipient	Increased competences
INNOVATION	Embodied technology, learning by doing	Increasing importance of design	Copying strategy	Similar, improvements in few segments and products
STRUCTURAL FACTORS				
MARKET	Segmentation by levels of income & type of product	INCREASED	Limited segmentation due to inequalities in income levels	Inequalities remain but segmentation increased
	Price, brand, delivery times, customer orientation	INCREASED	Low use of product attributes	Higher use of price attributes, increased competition
	Local & international trade	INCREASED importance of insertion on international supply chains	Potential large size of national market but reliance on local trade; threats from imports	Demand fluctuation due to economic instability; incipient international exposure
CONFIGURATION OF INDUSTRY	Economies of agglomeration and networking	GREAT INCREASE	Limited to few segments	Some dissemination of local arrangements; relocalisation due to labour costs
	Efficient supply of equipment	NO CHANGE	Deficient supply of equipment	Expansion of equipment imports with better price/efficiency ratio
	Metrology, standardisation, certification & accreditation; market & technical information; training	NO CHANGE	Low efforts and lack of co-ordination	Improvements restricted to medium and large companies
REGIME OF REGULATION AND INCENTIVES	Anti-dumping	INCREASED, due preferential access in bilateral agreements	Low use	Increased use in local markets
	Competition & consumer policies	NO CHANGE	Infant, unfair competition from informal sector	Increased but still incipient importance; unfair competition from informal sector remains
INCENTIVES	Support for SME	INCREASED in size and scope	Lack of effective instruments	Improvements in support for management but lack of financial instruments remain
	Tax system	NO CHANGE	Anti-competitiveness bias	Bias remain

6.2.1. The shoe industry

The geography of shoe production is dictated, to a great extent, by labour costs. International competitiveness is defined by wage levels as well as the relation between exchange rate and wage rate. Thus, to a great extent, this is a nomad industries, moving toward regions where labour costs are more attractive. This is a labour intensive industry and because of its technical “easiness”, in terms of knowledge and capital inputs, this industrial activity may be found in most nations, around the world. Employment in selected countries can be found in Table 26. It is worth mentioning that between 1980 and 1997 world employment fell by 13%, reaching 1.7 million.

TABLE 26
SHOE INDUSTRY EMPLOYMENT IN SELECTED COUNTRIES, 1998

Relative position	Countries	Number of employees (1.000 workers)
1	China (*)	923.0
3	Brasil	147.5
4	India	134.7
6	Italy	79.0
15	USA	42.7

(*) 1994

Source: Compiled from Costa (2002)

As shown in Table 27, in Brazil, during the 1990s, the industry produced, annually, at least 500 million pairs of shoes, 70% of them delivered to the local market. Imports are very local, at around 1% of national production.

TABLE 27
BRAZILIAN SHOE PRODUCTION –SELECTED YEARS

Year	Production (million of pairs)
1990	509
1995	543
1999	500
2000	530

Source: Costa (2002)

Until the 1990s, Brazilian most exports were directed to market segments where the price attribute is relevant. International clients would define technical specifications and brand names and sell them worldwide. In despite of competitive pressure from Chinese producers –that occupy similar market segments -, export performance has evolved positively during the 1990s. As shown in Table 28, exports increased from US\$ 1.1 billion in 1990 to US\$ 1.6 billion, in 2001 and unit prices have increased, indicating that the local industry is upgrading its product portfolio. It is necessary to bear in mind that since the 1999 devaluation may have helped exports.

TABLE 28
BRAZILIAN SHOE EXPORTS, SELECTED YEARS (VALUE, QUANTITY AND AVERAGE PRICE)

Year	Value (US\$ million)	Pairs (millions)	Average price (US\$)
1990	1,107	143	7.74
1995	1,414	138	10.25
2000	1,547	163	9.52
2001	1,615	171	9.43

Source: Costa (2002)

Other factors also helped the industry’s international performance: fiscal incentives and export credits; the consolidation of gains from economies of agglomeration, especially in the southern state of Rio Grande do Sul, the accumulated export experience. Nevertheless, labour costs still make up an important difference. In 1993 labour costs in Brazil were US\$1 per man-hour, In Spain it was US\$8, in Korea US\$2.5, in China

US\$0.5.

The importance of the exchange/wage ratio can be seen in Table 29. During the 1994/98 period, when the Real was overvalued, total employment fell by 56 thousand. But, as demand expanded – between 1999 and 2000 exports increased by US\$ 270 million or 26 million pairs of shoes-, companies quickly contracted 29 thousand extra workers. No apparent differences seems to exist in employment generation capacity, among different sizes of firms.

TABLE 29
EMPLOYMENT IN THE SHOE INDUSTRY ACCORDING TO SIZE OF FIRMS, SELECTED YEARS, (1,000 WORKERS)

Size	1990	1992	1994	1996	1998	2000
Very small	23.1	21.4	18.9	16.9	19.6	24.2
Small	36.9	37.0	43.8	38.7	34.6	47.9
Medium	89.8	95.0	92.4	68.4	61.3	75.6
Large	76.6	82.9	85.3	78.6	69.1	92.5
Total	226.6	236.4	240.6	202.7	184.7	240.3

Source Costa 2002

In terms of industrial organisation, this is an industry where local capital is prevalent. In 2000, large size firms owned 1.3% of establishments, employing 38.5% of shoe workers while very small firms accounted for 77% of establishments and 10% of total employment. Exports concentration is also significant: in that year shoe exports (US\$1.6 billion) were undertaken by 821 firms; 53% of this value was generated by 18 firms.

During the 1990s company strategies followed two directions. On one hand, firms implemented modernisation of production processes and product portfolio, including the introduction of automated equipment, new organisational techniques associated with increasing quality and decreasing waste and down time. There were also concerted efforts to increase product lines, associated with higher process flexibility. On the other hand, a significant number of companies migrated from Rio Grande do Sul to the Brazilian Northeast, especially Ceará and Bahia.

In the Northeast firms enjoy lower labour costs and the benefit of special and generous incentives. These include: VAT exemption for fixed and running capital and municipal tax exemption, the supply of physical infrastructure, like land and electricity and partial but automatic export credits. Most important, not only relative labour costs are lower than those prevailing in the South. Most labour contracts are intermediated by co-operatives, providing exemptions from social overheads. The organisation of co-operatives, as well as most of the training costs are undertaken by local governments. Thus, by the late 1990s, the international competitiveness of the Brazilian shoe industry was ensured by the opening up production capacity in the Northeast. Curiously the, to a great extent, in this industry, the country's structural heterogeneity has helped the survival and growth of firms in local and international markets.

6.2.2. Textiles and garment

Economic differences among the three most important segments –textiles, fibre and garment- of this industry can be found in Table 30. Combined sales of 22 thousand establishments, that employed 1.5 million workers, amounted to US\$ 45.2 billion, in 2000.

The production of chemical fibres is technically more sophisticated and the size of operations is higher, in general, controlled by foreign owned firms. On the other extreme, in the garment industry, small and medium size, locally owed firms prevail, employing 1.2 million workers in 18.000 establishments.

Contrary to the shoe industry, the international performance of the textile Brazilian industry, as shown in Table 31, was never economically significant, in despite of the fact that in some segments, like garment, competitiveness drivers are similar to those prevailing in shoe industry. Thus, Brazilian textile industry is, to a great extent, oriented towards the local market.

TABLE 30
NUMBER OF ESTABLISHMENTS, EMPLOYMENT AND REVENUE SALES IN TEXTILE, FIBER AND
GARMENT INDUSTRIES, 2000

	Chemical Fibres	Textiles	Garment
Establishments	25	3,305	18,797
Employment (1,000)	15	339	1,233
Production (1,000 ton/year)	640	1,750	1,287
Sales/ year (US\$ billion)	1.4	16.6	27.2

Source: Prochnik (2002)

TABLE 31
TEXTILES AND GARMENT WORLD TRADE AND BRAZILIAN SHARE, 1995/2000

Textiles	1995	1996	1997	1998	1999	2000
World trade (US\$ billion)	111.1	113.6	119.3	112.5	113.0	126.1
Brazil export share (%)	0.90	0.89	0.86	0.79	0.73	0.71
Brazil import share (%)	1.23	0.98	1.01	0.95	0.79	0.88
Garment						
World trade (US\$ billion)	124.0	128.7	141.9	149.3	150.0	165.5
Brazil export share (%)	0.24	0.19	0.15	0.12	0.12	0.17
Brazil import share (%)	0.30	0.29	0.32	0.25	0.14	0.11

Source: Compiled from Prochnik (2002)

There is not a generic pattern of industrial organisation in this industry; firms may operate in a specific segment of textile production or may be vertically integrated, incorporating all stages of production, including garment. During the 1990s, as most other sectors, leading and especially large size firms went through an active process of modernisation, by means of machinery acquisition, introduction of new organisational techniques and, as in the shoe industry, migration to the Northeast of Brazil.

Investment in modernisation was stimulated by three sources of dynamism. Firstly, during the first half of the 1990s, the Real Plan induced positive expectations in relation to growth of demand; secondly, starting in 1995, the national development bank, BNDES, financed a US\$2 billion modernisation program for machinery acquisition, especially for larger firms; thirdly, import liberalisation and an overvalued Real on one hand, and advances in technology, on the other, resulted in the possibility of importing updated machinery at decreasing prices. (Table 32)

TABLE 32
TEXTILE MACHINERY: LOCAL PRODUCTION AND IMPORTS (US\$ MILLION)

Year	Local production	Imports	Total
1990	307	377	684
1995	316	738	1.054
1999	185	373	558
2000	185	453	638

Source: Prochnik (2002)

Investments in new machinery implied changes in production processes with negative impact on employment levels. As elsewhere in the Brazilian industry, employment levels in the textile and garment industries fell substantially along the 1990s, as shown in Table 33.

TABLE 33
EMPLOYMENT IN TEXTILES AND GARMENT, 1990/2000, SELECTED YEARS (1,000 WORKERS)

	1990	1995	1998	2000	%
Textile	893.8	449.4	326.3	339.3	- 62,0
Garment	1,755.8	1,468.1	1,237.2	1,233.2	- 29,8
Total	2,649.6	1,917.5	1,563.5	1,572.5	- 40,7

Source: Prochnik (2002)

Finally, as in the shoe industry –for the same reasons and benefiting from similar incentives-an expressive process of relocation to the Northeast was undertaken (Table 34), especially by large size firms.

TABLE 34
SHARE OF DIFFERENT REGIONS IN BRAZILIAN TEXTILE PRODUCTION, 1990/2000

Industry	Northeast		Southeast		South		Total
	1990	2000	1990	2000	1990	2000	
							-
Fibre	24.9	35.4	55.2	42.6	17.2	21.7	100
Fabric	17.6	21.5	65.6	62.0	12.8	13.7	100
Knitted Garment	2.8	10.0	39.9	35.2	55.7	53.5	100
Garment	8.0	11.3	66.6	56.1	21.6	25.4	100
Total	13.3	19.6	56.8	49.0	26.8	28.5	100

Source: Prochnik 2002

7. INNOVATION CARRIERS: MOVING AHEAD, LAGGING BEHIND, COMPETITIVENESS IS STILL VERY WEAK

7.1. PATTERN OF COMPETITION NOW AND THEN: THE INCREASING ROLE OF INNOVATION

The innovation carriers industrial group brings together sectors that have in common the ability to induce technical progress to other economic activities, through the provision of equipments or components.

The segmentation of markets demand is the main feature of the demand for these sectors. Since their products have specific applications, in general, each firm competes directly with very few other firms. The most competitive firms have evolved from equipment producers to providers of technical solutions and services to clients. Leading firms are notable in terms of high levels of expenses in R&D activities, reflecting the sectors' most relevant competitive driver: the capacity to implement product innovations and to address particular demands of clients, in specific market segments. (see first two columns in Table 35)

Innovation capability defines the most important barrier to entry in these sectors. For that reason, companies place significant resources to R&D activities. Their growing costs has led to the emergence of different forms of strategic alliances, mostly devoted to dilute technological risks of partners involved. These features define an important relationship between firms and research centres, of public or private nature.

Due to its strategic role in any industrial matrix, nations with strong production capabilities have always implemented active industrial policies to promote and consolidate the competitiveness of their firms in local and international markets. Besides an active support to technological development, imports restrictions, favourable financing conditions, the purchasing power of governments, fiscal incentives are mechanisms used by nations.

TABLE 35
Patterns of competition and competitiveness in innovation carriers: now and then

SOURCES OF COMPETITIVE ADVANTAGES	PoC INNOVATION RELEVANT DRIVERS 1993	PoC INNOVATION RELEVANT DRIVERS 2002	BRAZILIAN COMPETITIVENESS 1990	BRAZILIAN COMPETITIVENESS 2002
INTERNAL FACTORS				
MANAGEMENT	R&D-production-marketing integration	NO CHANGE	Low capabilities	Low capabilities with increasing marketing efforts
PRODUCTION	Design for manufacturing	NO CHANGE	Some capabilities in mechanical engineering	Reliance on imported design
SALES	Market creation & business to business marketing	INCREASED due to the diffusion of IT	Low capabilities	Infant
INNOVATION	R&D + <i>design</i>	NO CHANGE	Low capabilities	Increasing reliance on imported technology
STRUCTURAL FACTORS				
MARKET	Segmentation by technical needs Attention to client specifications	NO CHANGE INCREASED	Capabilities in lower end segments Excessive standardisation	Increasing segmentation Increasing responsiveness Increasing imports of components from OECD and exports of final goods to Latin America
	Local & regional trade	INCREASED	Exports of standard and technologically simple equipment	
CONFIGURATION OF INDUSTRY	Economies of specialisation	Related diversification	Excessive diversification and verticalisation	No clear emerging pattern
	Interaction with users Science & technology systems	INCREASED INCREASED	Low interaction Incipient	Increasing interaction Low technological investment
REGIME OF REGULATION AND INCENTIVES	Intellectual property rights	INCREASED	Nationalistic oriented regulations	Enforcement of property rights and stabilisation of rules
	Selective protection	DECREASED	Nationalistic oriented regulations	Excessive liberalisation
	Risk support	NO CHANGE	Inexistent	Limited
	Credit for users State purchasing power	NO CHANGE DECREASED	Limited Few attempts towards articulation	Limited Disarticulated

7.2. COMPETITIVENESS IN 2002: ECONOMIC LIBERALISATION IMPOSED CONTRADICTIONARY SIGNS. INNOVATION IS STILL GENERATED ABROAD

Among all industrial groups, the Brazilian innovation carriers suffered the worst consequences from the economic liberalisation of the 1990s. Until then firms presented reasonable levels of production capacity and well-qualified human resources were available (mainly in the mechanical sector). This was a result of a long learning process carried out since the 1970s, partially as a result of an expanding market, partially as a result of active industrial policies. But, even then, most producers of mechanical engineering and electronic based equipment were not competitively strong. Their main features were high levels of verticalisation and diversification and dependence on foreign technological suppliers and fragile relations between manufacturers and the R&D sector.

Along the 1990s, producers of mechanical engineering and telecommunication equipments and computers reveal a common feature: an increase of production capabilities. However, this was not enough to resist foreign competitive pressures which is mainly based on intra-firms imports. (see last two columns of Table 35)

Apart from that, given very different framework conditions surrounding each of these sectors, a considerable competitive heterogeneity prevails. Suppliers for the telecommunications sector considerably expanded production capacity. Firms from the mechanical engineering sector promoted a modernisation process strongly associated with a significant decrease in production capacity. The performance of the computer manufacture sector was characterised by ownership internationalisation, substantial increases of component imports and by the implementation of new methods of labour management, which has lessened employment levels.

As a way to counterbalance competitive pressures from imported equipments, the competitive challenges most corporations of this industrial group are facing is related to expanding assembly capacity and export performance and accessing foreign technology while increasing local innovation capabilities.

7.2.1. Mechanical equipment

The mechanical engineering industries were affected by the low levels of investment prevailing in the country, and trade liberalisation that significantly reduced non-tariff barriers and other duties related to the imports of capital goods. These conditions have clearly restricted the domestic market for mechanical goods made in Brazil, favouring imports.

While apparent consumption decreased from US\$17.2 in 1990 to US\$14.4 billion in 2000, imports increased and local production local decreased substantially. Exports and import coefficients remained relatively stable, after 1995. (Table 36)

TABLE 36
MECHANICAL EQUIPMENT: PRODUCTION AND INTERNATIONAL TRADE -1980-2000 (US\$ BILLION)

Year	Production	Exports	Imports	Trade balance	Apparent consumption	Export coefficient %	Import coefficient %
1990	16.7	2.6	3.2	-0.5	17.2	15.9	18.5
1995	14.3	3.8	6.9	-3.1	17.4	26.6	39.8
1996	12.4	3.8	7.4	-3.6	16.0	31.2	46.6
1997	12.3	4.1	9.6	-5.4	17.7	33.9	54.2
1998	11.5	3.9	8.8	-4.8	16.4	34.0	53.6
1999	10.2	3.4	7.3	-3.8	14.1	33.3	51.7
2000	11.5	3.5	6.4	-2.9	14.4	30.5	44.7

Source: Vermulm and Erber (2002)

Facing hardship, firms implemented an important restructuring process. As shown in Table 37, between 1990 and 2000, employment levels were cut by 50%.

TABLE 37
CAPITAL GOODS: SALES PER EMPLOYEES (R\$ 2000) AND ANNUAL AVERAGE TOTAL EMPLOYMENT
1990/2000

Year	Revenue/employee	Employment (1,000)
1990	92.4	331.9
1995	119.9	218.2
2000	131.6	160.2

Source: Vermulm and Erber (2002)

To sustain restructuring company level efforts focused on the introduction of new managerial methods to ensure efficiency of production processes and the reduction and specialisation of product portfolio. The results of implementing new methods of productive organisation were important. Through the adoption of just in time methods and subcontracting some activities, the mechanical engineering sector was able to improve efficiency and maintain minimum levels of production, without corresponding increases in expenses on the purchase of new machinery.

The competitiveness of Brazilian mechanical engineering capital goods is higher in product lines of low and medium technological intensity, where product cycles have matured. Price competitiveness is decisive and company advantages lie on privileged access to low cost inputs and labour costs. Brazilian industry also occupies certain niches where equipments are technically more sophisticated, requiring strong interactions between suppliers and clients, especially if local and regional demand is economically relevant and relatively high.

However, some of the structural features of this industry, especially in relation to the division of labour between local and foreign producers have not changed. On the contrary, past trends were reinforced: locally owned companies tend to participate in the low technology segments while foreign companies produce more sophisticated capital goods. Concentration levels are lower than the manufacturing industry's average; in 1997 the four largest corporations shared 18% of the sector's revenue, compared to an average of 30% in the manufacturing industry.

These features indicate that companies that have managed to survive the hardships of the 1990s are, probably, in better competitive shape than before; they are leaner in terms of production processes and product portfolio; most probably there has been an increase in specialisation levels which may constitute the basis upon which to grow in the years to come. Even so, most of the competitive challenges of the early 1990s remain, especially those related to a weak technological base.

7.2.2. Teleequipment industry

The scenario in the telecommunications equipments sector is very different from the mechanical engineering sector, due to the high intensity of technical progress in the industry and its close relationship with the Brazilian privatisation process, undertaken in the second half of the 1990s. A recent estimate by Oliva (2002) indicates that, under strict rules of concession, that imposed investment targets, expenditures by privatised companies amounted to US\$ 20 billion, between 1998 and 2000.

As a result, as shown in Table 38, sales revenue in 2000 were 124% higher than the 1995 level. These figures indicate that, most probable, the growth of the local market was sufficient to attract new assembly units to Brazil. It is important to take into account that being an assembly operation, it is likely that these new production units relied on global sourcing to ensure delivery times to clients. That is the reason behind the constant trade deficit of the industry that reached, in 2001, US\$ 2 billion, with US\$ 3.5 billion of imports (43% from the ALCA region, 26% from UE) and US\$1.5 billion of exports (90% to the ALCA region).

TABLE 38
TELEQUIPMENT INDUSTRY SALES, 1995-2000 (US\$ MILLION)

	1995	1996	1997	1998	1999	2000	Δ 2000/1995
Sales	2,442	3,553	5,107	4,698	4,044	5,471	124%
Annual rate of growth	16%	45%	44%	-8%	-14%	35%	-

Source: Oliva (2002)

Even so, to a great extent the sharp increase in demand could be supplied from local sources because of its previous consolidated existence in the country; most of the major international players were already established in the country and some local firms were equally active.

But the expansion of demand brought into the country new foreign firms that acquired locally owned ones. Out of the 10 largest international producers, only two do not have production plants in Brazil. As a result of this situation, the domestic market of telecom equipments has faced an intense process of inward internationalisation. According to Oliva (2002), of the 42 main firms operating in this market in 2000, 26 were foreign firms. As shown in Table 39, out of a total revenue of US\$ 8.8 billion, the share of foreign owned corporations amounted to 91.3%.

TABLE 39
THE MARKET SHARE OF LOCAL AND FOREIGN CAPITAL IN 2000

Controlling capital	Sales (US\$ million)	Market share
Foreign	8,054.2	91,3%
Local	762.9	8,7%
Total	8,817.1	100%

Source: Oliva (2002)

More important, locally owned firms are, in general, of medium size, supplying simple and standardised inputs and components to major international telequipment producers. These foreign firms relied on the strategy of combining local production expansion and imports of components to be locally assembled. This has decisively influenced the trade-flow scenario. Indeed, sectoral growth can be largely attributed to the expansion of imports. Thus, although the industry has expanded production capacity, there are still very clear deficiencies concerning the lack of supply capacity of components.

As in the past, for the years to come, the evolution of the industry will depend on investments carried on in the country's telecommunication infrastructure. Since 2001 as investments slowed down supply firms contracted production just as fast as capacity was expanded.

7.2.3. Computer industry

The computer sector has been expanding steadily in the country but, contrary to the national ownership oriented regime of incentives and regulation of the 1980s, during the 1990s barriers to foreign firms and to imports were not relevant. Thus framework conditions changed and this had a direct impact on performance and market structures.

The most important change was the increasing market dominance of foreign firms. From 1996 to 2000, the share of sales of foreign firms on total sectoral sales increased from 48% to 66%. Among the largest 15 firms in the sector, only one, Itautec, is controlled by local capital. Another change was the increasing role of larger firms, relatively to small and medium size ones. As Table 40 shows, SMEs were responsible for 17.1% of sales revenue in 1996; in 1998 sales from SMEs reached 21.1% but, in 2000, their share had receded to only 5.2%.

TABLE 40
SALES REVENUE OF HARDWARE, SERVICES AND SOFTWARE INDUSTRIES

	1996		1997		1998		1999		2000	
	US\$	%								
Hardware	8.821	53.1	10.654	49.4	14.976	55.7	13.709	53.9	16.310	53.4
Software	1.327	8.0	1.928	8.9	2.361	8.8	2.160	8.5	2.527	8.3
Services	6.453	38.9	8.969	41.6	9.546	35.5	9.564	37.6	11.721	38.4
Total	16.602	100	21.552	100	26.884	100	25.434	100	30.558	100
Total SMEs	2.838	17.1	3.375	15.7	5.665	21.1	2.929	11.5	1.591	5.2

Source: Porto (2002)

Table 40 also shows that, the relative importance among various industrial segments has not changed; sales from hardware producers still predominate in this industry, with at least 50% of total share, followed by service suppliers, with an average of 38% of total sales, during the second half of the 1990s.

Table 41 below indicates an important expansion of the industry (computers and components), departing from US\$ 6 billion in 1990 to reach US\$ 10.7 billion in 1998. Since then growth has slowed down. These figures also indicate that the computer industry has managed to outgrow component production. This, to a large extent, is the increasing reliance of this industry on imported inputs.

TABLE 41
REVENUE SALES IN THE BRAZILIAN COMPUTER INDUSTRY - 1990/2001 (US\$ MILLION)

	1990	1992	1994	1996	1998	2000	2001
A) Computers	3,719	4,169	5,274	7,407	8,311	7,047	5,892
B) Components	2,336	1,361	2,179	2,783	2,456	2,587	2,105
A/B	1.59	3.06	2.42	2.66	3.38	2.72	2.80

Source: Porto (2002)

Indeed, when contrasting imports of components and imports of final computer goods (Table 42), there is a clear disparity: from 1997 to 2001 the average annual value of components imports equalled US\$5.1 billion, while the average annual value of computer goods imports amounted to US\$1.02 billion. More important, when computer sales decreased, after 2000, and the Real was devalued -after 1999-, computer imports remained relatively stable but imports of electronic components remained substantial.

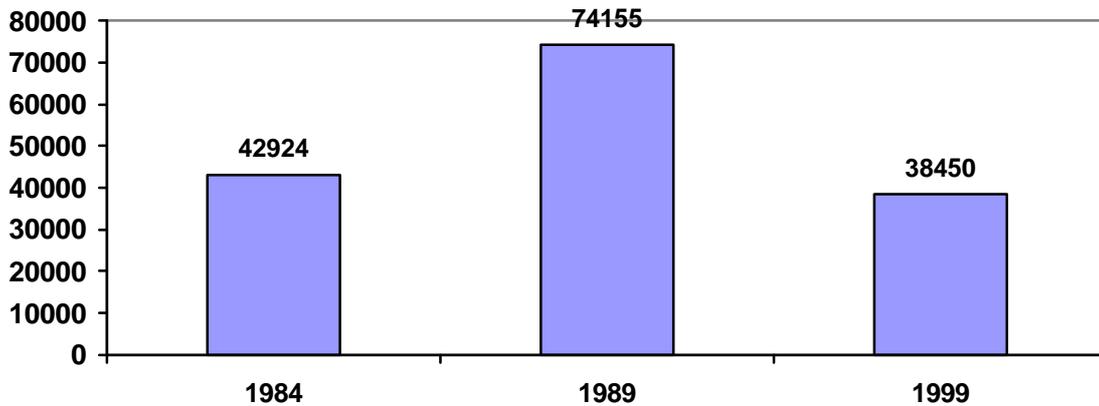
TABLE 42
COMPUTER INDUSTRY, IMPORT/EXPORTS 1997/2001, US\$ MILLION

Year	1997	1998	1999	2000	2001
Exports (1+2)	1,331	1,458	1,587	1,865	1,809
1- Computer	255	235	323	346	251
2- Components	1,076	1,223	1,264	1,519	1,558
of which, components for computers	91	124	151	144	146
Imports (3+4)	6,406	5,840	5,874	7,690	6,793
3- Computer	1,232	1,090	855	1,080	1,032
4- Components	5,174	4,750	4,839	6,610	5,761
of which, components for computers	562	671	665	856	782
Trade Balance	5,075	4,382	4,287	5,825	4,984

Source: Porto (2002)

Computer producers also went through major adjustment in their production processes. Following a well established pattern in other industries, computer firms initially outsourced administrative activities, followed by the introduction of new organisational techniques that implied lower employment levels. New methods of labour organisation and reengineering process resulted in a sharp reduction of employment levels. As shown in Figure 11, employment expanded between 1984 and 1989. Since then and until 1999 the total number of employees was cut by 48,1%.

FIGURE 11
EMPLOYMENT LEVELS AMONG THE LARGEST 50 MANUFACTURERS OF INFORMATION TECHNOLOGY



Source Porto (2002)

8. MADE IN BRAZIL 10 YEARS LATER. AND AFTER?

Between 1990 and 2002 the Brazilian economy went through a process of radical institutional change, towards economic liberalisation. During the same period, the economy accumulated low rates of growth, with frequent annual oscillations. Internationally, the diffusion of information technologies was very expressive and a wave of mergers and acquisitions swept the planet.

These are not minor processes, having induced, in other industrialising Latin American countries, major structural changes, but with very specific national idiosyncrasies. Within the NAFTA context, Mexico became a specialised supplier (of low labour costs) to the US as it entered into and sustained very high rates of growth in assembling electronic goods. Chile modified its industrial matrix, shifting towards exploiting and transforming its natural resource base, generating products for exports, supported by sophisticated logistics. Argentina found and lost direction; for some time it seemed that the country would constitute an important industrial base for the Mercosur market. But, after the Brazilian devaluation and the break up of the Argentinean convertibility plan, relatively to its past, an economically significant portion of its industrial activities became idle or was dismantled.

In Brazil, the most striking feature of the period was the lack of structural transformation. That is, international changes and, in the local front, economic liberalisation and low but oscillating growth did not induce shifts in the specific trajectory the Brazilian industry was already evolving along, since the late 1980s. Then, modernisation and inward internationalisation were emerging processes, high in the agenda of leading firms, in most industrial groups. Along the years these two processes were accentuated, assuming economically significant proportions.

Were external changes not sufficient for changing the industry's trajectory? Or, alternatively, has the accumulated size and competences and the complexity of Brazilian industry been so high that previous trajectory would not have changed, regardless the size of exogenous shocks? These are questions with no possible answer. It is more reasonable to proceed to a careful balance of industrial production Made in Brazil, 10 years after our early, but thorough investigation on the perspectives of competitiveness, in order to examine the extent of evolution and change. By doing that, it may be possible to draw out perspectives for the years to come.

The lack of structural change can be confirmed by simple but strong evidence. The most important is: during this period, very few genuinely new economic activities were added to the country's industrial matrix. Similarly, very few previously existing activities ceased to exist. More important for industrial

progress is the fact that, between 1990 and 2002, only in very few sectors a set of firms responsible for most part of production were engaged in investments directed towards capacity expansion. Substantive investment only occurred in steel, automotive, consumer electronics and telequipment. These are good examples of reactions to a combined phenomenon of positive perception on demand expansion together with pro-active response to competition. These examples may be useful in indicating a potential vitality, pro-growth, in the Brazilian industry.

Competitive industrial activities – where competent firms represent a large proportion of production-remain so, essentially those associated with the commodity group. Weak competences still prevail among activities associated with innovation carriers, although firms demonstrated ability to deliver equipment where demand expanded –telequipment-. Heterogeneity is still an important feature of traditional industries, even though responsiveness has increased, alongside with the formation of local clusters of productive systems. As an industrial group, perhaps, changes were more pronounced in durable industries, through expansionist investments and increasing rates of product differentiation.

Imports and exports increased along the years, but they are originated from expected industrial segments: inwards, electronic components and chemical inputs are still a burden on the country's international trade; outwards, the commodity industrial group still generates most of the country's foreign exchange. Of course these exports should be further expanded, alongside with others that should have higher income elasticity. Indeed, new exports, from high technological opportunities, have taken roots. The aircraft industry is the outstanding example. On the same token, imports of electronics and chemicals are very important to the modernisation of the Brazilian industry. But, certainly, the size of their trade deficit induce serious thoughts on how to internalise production, at least in some segments of these industries.

As mentioned above, from an economic perspective, the most significant active processes were the continuation of modernisation and ownership change. In the early 1990s, there were already signs of modernisation and inward internationalisation, especially among leading firms, in most industrial groups. Between 1990 and 2002, modernisation provided the technical basis upon which firms could sustain competitive pressure from imports. Inward internationalisation reached levels that imposed changes to market structures, in segments where firms controlling a large proportion of sales change ownership, in a short span of time.

Modernisation was a process in play in very economic activity in the country, reaching organisations, production processes, products and suppliers. Supported by a wide diffusion of labour saving techniques and without sustained growth in demand levels, the negative impact of modernisation on employment was extremely high. Between 1990 and 2002, in most industrial activities, at least 30% of the labour force was dismissed. Thousands of work places simply disappeared or were outsourced.

But, as a result, surviving firms became more efficient and capable of sustaining competitive pressures from imports and from newcomers to local production. More interestingly though, the recent process of change has not induced modifications in the relative position among different firms. Those that were relatively stronger in the period pre-crisis have shown better adaptive capacity and vice-versa. In other words, the relative position of players –in terms of size, origin of capital, sector and location of corporations- did not change. Large firms, from commodity or durable industrial groups, located in the southern part of the country not only actively engaged in the process of modernisation and inward internationalisation but , more important, they have increased their relative distance from those situated down below the competitive ladder.

Mergers and acquisitions changed the ownership landscape of Brazilian industry, reinforcing the role of foreign capital in it. As a result the Brazilian economy is now even more internationalised than before even though this is a long term and structural feature of the country. However, the country may face a development paradox in the years to come. History tell us that local capital and local innovation capabilities have been outstanding features of countries successful in sustaining economic and social development. If ownership internationalisation is to remain and local innovation capabilities must be pursued, then Brazilian private and public policy makers are facing challenges associated with how to attract investments of this nature. To a great extent, this will mean an important departure from established

policy practices, to new ways of regulating and inducing firms towards local value creation.

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Chapter 3

Mergers and Acquisitions and Changes in Industrial Concentration in Brazilian Mining and Manufacturing Industries: 1996-2000

Frederico Rocha

I. Introduction

This paper aims at studying the role played by Mergers and Acquisitions (M&A) on changes in market concentration that took place in Brazilian manufacturing and mining industries between 1996 and 2000. More specifically, the paper attempts to: assess changes in average market concentration from 1996 and 2000; and determine the importance of M&A in explaining changes in concentration.

During the 90's, the Brazilian economy went through profound changes in ownership structures. Mostly, these changes were the result of the privatization of formerly state-owned enterprises and of the opening of the economy to competition. According to Thomson Financial Securities Data, 582 companies went through ownership changes in the 90's. These companies represented about one-quarter of the value added in the manufacturing and mining industries and ten percent of the employment. Furthermore, ownership changes have affected most sectors in manufacturing and mining industries. In the 90's 86 of the 106 three-digit sectors in manufacturing had at least one company transacted. These figures go down to 68 sectors when data is limited to 1997-1999 years. Motor vehicles' parts and accessories (45 transactions), integrated primary metals (33), other food products (30) and organic chemicals (30) were the sectors with more frequent transactions.

The literature on industrial organization has stressed the importance of M&A in the determination of market structures. Actually, the whole idea that M&A transactions provoke concentration was considered far from challenging. In fact, the capacity to capture changes in concentration emerging from M&A is a criterion to assess the adequacy of concentration indexes. Therefore, the debate focused on the assessment of

the level of impact on concentration changes. Hannah and Kay (1977) have shown that M&A were the driving force of industrial concentration in British industries from the beginning of the century to the 60's. Muller (1976) has obtained similar results in the analysis of a few industries in Germany. Pryor (2001, 2002) has argued that M&A are the main explanation for the increase in industrial concentration in US industries from the 80's to 1997. Nissan (1997, 1998) has followed similar steps explaining the increase in aggregate concentration. In both cases (Nissan 1997,1998 and Pryor 2001,2002), authors have stressed the importance of changes in antitrust legislation to explain the increase in concentration.

However, the impact of M&A transactions on concentration may vary according to the type of transaction taking place, the firms involved and the dynamic effects of concentration:

- (i) Transactions may involve mergers of firms in the same industry. In this case, adequate concentration indexes should capture the increase in concentration;
- (ii) Transactions may involve conglomerate mergers. These situations should imply increase in aggregate concentration but be neutral in respect to sectoral concentration;
- (iii) Acquiring firms may be new entrants into the industry. Once more, these transactions should be neutral in respect to sectoral concentration;
- (iv) Acquired firms may be spin-offs from bigger companies and acquiring firms may be fringe companies. In this case, M&A transactions may have negative effect on concentration; and
- (v) Furthermore, dynamic effects may change the static results. Transactions may be followed by divestments, closures and losses of competitiveness and therefore have negative dynamic consequences over concentration levels. On the other hand, they may be accompanied by addition in productive capacity and thus they will deepen changes in concentration.

The work of Liebeskind, Opler and Hatfield (1996) attempts to cope with some of these effects. Using more appropriate data for US industry in the 80's, they classify organizational changes according to changes in the status of industry establishment and changes in the status of industry incumbent firms. They conclude that concentration

effects of industry restructuring are positive only when incumbent firms add capacity to the industry.

M&A transactions in Brazil during the 90's have many features stressed in the above paragraphs. As has been shown in Rocha and Kupfer (2002), one of the most important characteristics of the M&A wave of the 90's, in Brazil, was the major participation of multinational enterprises. In fact, 218 out of the 292 transactions that took place between 1997 and 1999 had multinational companies as acquirers. As a consequence, Rocha and Kupfer (2002) working with very high levels of aggregation – they divided the manufacturing and mining industries into three sectors named as commodities, traditional manufacturing and technology intensive industries – have found that during the 1990-1996 period there was a reduction in concentration in all sectors. From 1997 to 1999 the trend is unclear. They have found a slight increase in the concentration ratios of traditional manufacturing and commodities industries while the technology intensive industry presented a small decrease in concentration.

However, the high level of sectoral aggregation and the limited scope of the company sample used to calculate the level of concentration in Rocha and Kupfer (2002) suggest that a deeper investigation is necessary in order to capture the adequate direction of concentration indexes and the influence of M&A transactions in the process. This paper will attempt to add information on these features, measuring industrial concentration in specific markets and estimating the relevance of M&A transactions in structural changes. The next section will show the data set used in the paper, determine its main virtues and limitations and define the methodology used in the analysis. Section three presents the main empirical results of the analysis, comments on possible biases and speculates on possible sources of explanation of the results. The concluding section discusses the direction of the main conclusions obtained from the analysis carried out in this paper and suggests some possible extensions of this work.

II. Methodology

2.1 Database

This paper uses three data sources:

- (i) Annual Industrial Survey – Companies (PIA), published by Instituto Brasileiro de Geografia e Estatística (IBGE) for the years 1996 and 2000. PIA has supplied data on sales, employment, number of companies and four, eight and twelve firms concentration ratio;
- (ii) Technology Innovation Survey 2000 (PINTEC), also published by IBGE. This survey has supplied data on number of innovating firms, number of firms executing product innovations, R&D expense levels for 2000;
- (iii) Thomson Financial Securities Data provided information on ownership changes from 1990 to 1999.

2.2 The Period

The paper analyzes concentration changes from 1996 to 2000. The choice of this period limits the analysis in two aspects:

- (i) Five year periods may be short to capture structural changes; and
- (ii) The M&A wave began in the early 90's. The coverage of the whole period would have been more adequate.

However, there are good reasons to make this choice. First, there are data limitations. Though Thomson Financial provides M&A information for the whole decade, the use of information from PIA for the early 90's may be inadequate. The sample of firms and sectoral classification used in PIA changed in 1995. Therefore, estimates of sales and employment follow different methodology. Furthermore, the number of transactions that took place between 1997 and 1999 are far from irrelevant. Table 1 shows that 292 out of 582 transactions took place in the 1997-1999 period.

2.3 Transactions

The paper takes into account only those transactions that involved the exchange of over 50% of stock. This includes 71% of the transactions that took place between 1990 and 1999 and 75% of the transactions that occurred between 1997 and 1999 (see table 1). The

reason of this choice was to avoid including transactions that did not involve strategic control of the acquired company. For instance, some Brazilian banks have bought minor participations in company's share in order to diversify their portfolio or to have access to internal information, however, no attempt is made by these banks to control the market behavior of these companies neither do they have control over capital accumulation capabilities.

The ideal way to measure the direct effect of M&A on concentration would be to calculate the concentration index before the transaction then to add sales of the acquired firm to the sales of the acquiring firm and finally to recalculate the concentration index. This procedure was used by (Hannah and Kay 1977). The most important shortcoming of this method is the lack of ability to capture indirect effects, such as the addition of productive capacity, closure of plants, etc.

An alternative way to approach the problem would be to measure concentration levels in the beginning and the end of the period. Afterwards, one would calculate the size of the transaction phenomena by adding sales of acquired companies in a specific type of transaction and dividing the result by sector's sales and then to control for strategic variables that may affect firms' competitiveness and concentration levels. This procedure was adopted in Liebeskind, Opler and Hatfield (1996).

However, in order to follow either procedure one should have access to adequate data. In the case of this paper, a number of obstacles have been found that make impossible to follow either approaches:

- (i) In order to obtain information on individual firm size from IBGE, one should have access to firm's fiscal codes. This procedure was attempted with a rate of success of only 50% of the acquired companies;
- (ii) IBGE does not provide information at the company level. Therefore, sales of acquired companies would only be provided whenever over three companies would be transacted. This would require the use of a very high level of aggregation, which would be inadequate; and
- (iii) Other data sources did not show higher success rate.¹

¹ We have tried capturing information from Gazeta Mercantil – Anuário da Gazeta Mercantil, for many years.

Therefore, the only reliable information is the number of transactions. However, the use of the number of transactions as indicator for intensity of M&A faces a major shortcoming. Transactions involving very large companies and small companies are equally considered. However, they play very different roles in respect to market concentration. One way to overcome this deficiency would be to weigh the number of transactions using the value of each transaction. However, Thomson Financial provides information for less than half of the transactions. This paper has chosen to use a dummy variable that takes value 1 in all sectors where at least one transaction has been identified. In this sense the coefficient will be capturing the aggregate impact of all transactions that took place in that sector.

2.4 Market Definition

The use of official statistical sources limits the choices one can make with respect to market definition. Usually, national standard classifications follow the criterion of similarity at the production side and do not consider demand substitution as a key variable. The CNAE² (Classificação Nacional de Atividades Econômicas) is no exception. The CNAE has been in use by IBGE since 1995 and it was elaborated in order to adequate Brazilian sectoral classification to the ISIC.

The CNAE allows sectoral classifications at the two, three and four digit levels. This paper uses the three-digit CNAE classification. At this level of aggregation, the CNAE is divided into 106 sectors. For two sectors – natural gas exploration and fabrication of nuclear material – the PIA does not provide information due to the small number of firms in activity in these sectors. This choice takes into account two key arguments:

- (i) The level of diversification of Brazilian companies is quite low. According to IBGE, in 1994, about 2% of companies in manufacturing had activities in more than one three-digit sector. This group of companies was responsible for 18% of total sales. If the paper took into account lower levels of aggregation

² The CNAE can be viewed at <http://www2.ibge.gov.br/pub>.

- the risk of considering a sales outside its original sector would increase, though it would be more closely related to the relevant market; and
- (ii) The number of companies in some four-digit sectors would be small. This could create obstacles for IBGE to reveal concentration ratios in some cases.

An additional limitation of this study is the failure to account for the external sector. Exports and imports are not considered in the elaboration of concentration ratio. This can lead to two kinds of miscalculations:

- (i) The failure to add imports to the denominator of concentration ratios would imply the overestimation of concentration; and
- (ii) If imports are mainly derived from subsidiaries of multinational enterprises that are also market leaders in Brazil, the bias can be reversed.

2.5 Concentration Indexes

The debate on the influence of M&A over concentration stresses the importance of biases created by wrong choices of concentration indexes.³ Hay and Morris (1991) state that the choice of concentration indexes should obey some properties:

- (i) If the size distribution of firms is maintained constant, the inclusion of an additional firm should decrease concentration;
- (ii) Taking the number of firms as constant, an increase in the inequality of size distribution should augment concentration;
- (iii) If the concentration curve of market A is higher than the concentration curve of market B in all points, then concentration indexes should reproduce the phenomenon; and
- (iv) Mergers should increase concentration.

The choice of concentration indexes is nonetheless restrained by data availability. This work had access to concentration ratios. Concentration ratios are subjected to two main shortcomings:

³ See Hannah and Kay 1981, Hart 1981 and Prais 1981.

- (i) They analyze only one point in the concentration curve. In this sense the choice of the right point in the concentration curve would be crucial. For instance, an industry may have lower concentration than other industry according to the four firm concentration ratio;
- (ii) However, it may have higher concentration at the eight firm concentration ratio. Which measure is more appropriate would depend on competition conditions of each industry; and
- (iii) It does not take into account the number of firms in an industry. For instance a four firm concentration index will not capture changes in concentration by the entry of a new firm that does not belong to the CR4.

In order to overcome some of these problems, the paper uses three concentration ratios: four-firm (CR4), eight-firm (CR8) and twelve-firm (CR12). This option helps to attenuate some of the shortcomings of concentration ratios:

- (i) It covers more than one point in the concentration curve; and
- (ii) Lowers the probability that new entries won't be covered by the index.

2.6 Organization of the Results

The results of this paper are organized in two different parts. First, the paper makes an analysis of the evolution of concentration in the Brazilian manufacturing and mining industries and its relation with the occurrence of M&A transactions. Second, the paper uses a ordinary least square equation to control results for structural variables. The equation is represented by:

$$dCR_i = a + b_1rgr + b_2reentry + b_3INTTEC + b_4INOVPROD + b_5F \& A + b_6CR_i 1996 + b_7DPROD + e$$

where

- (i) dCR_i is the change in concentration ratio at the i^{th} firm level in the 1996/2000 period, obtained from PIA;

- (ii) *rgr* is the rate of growth of the market sales, represented by the rate of change in the sector's share of total manufacturing and mining industry sales, between 1996 and 2000, supplied by PIA;
- (iii) *reentry* is the rate of entry of new companies in the period, also obtained from PIA;
- (iv) *inttec* is the industry's technology intensity, represented by the rate of R&D to total sales, for the year 2000, obtained from PINTEC 2000;
- (v) *diffprod* is a measure for product differentiation, represented by the number of companies that have performed product innovation, vis-à-vis the total number of companies in the industry, for the year 2000, obtained from PINTEC 2000;
- (vi) *M&A* is a dummy for the occurrence of mergers and acquisition transactions; *Cri1996* is the concentration ratio at the i^{th} firm level for the year 1996, obtained from PIA; and
- (vii) *Dprod* is the change in productivity, represented by the rate of change in labor productivity between 1996 and 2000.

The introduction of control variables follows the works of Pryor (1994) and Liebeskind, Opler and Hatfield (1996). The descriptive statistics for the variables and their Pearson correlation indexes can be seen at tables 2 and 3, respectively.

III. Results

3.1 Changes in Industrial Concentration

Table 4 provides information on weighted and arithmetic average for four, eight and twelve firm concentration ratios at the year 1996. By both criteria, the average CR4 of the manufacturing and mining industries is around 0,42. This is higher than the weighted average CR4 of the US manufacturing industry for at the *four-digit*⁴ level for 1992 and similar to the CR4 for 1997. The CR8 also has the same comparative terms.⁵ Therefore, due to the differences in the aggregation level – *three-digit* for the Brazilian case and

⁴ Resulting in three hundred and sixteen sectors.

⁵ US comparative data obtained from Pryor (2002).

four-digit for the US – the Brazilian manufacturing and mining industries appear to be quite concentrated.

Table 4 has also information on changes of concentration ratios by three different criteria:

- (i) The weighted average by the share of sales of each sector in 1996;
- (ii) The weighted average by the share of sales of each sector in 2000; and
- (iii) The arithmetic average.

Changes in the arithmetic average of concentration ratios are positive, though quite small, and do not appear to be statistically significantly different from zero. Changes according to weighted average are also positive and larger. This suggests that sectors with higher increases in concentration ratios have in average larger markets in terms of sales.

Furthermore, changes in average concentration ratio are larger when they are weighed by 2000 sales than when they are weighed by 1996 sales. This may indicate that, in average, sectors with higher rates of growth had higher increase in their concentration level. In fact, table 3 shows that the rates of growth of revenue are positively and significantly correlated to changes in concentration ratios. It is also interesting to note that in absolute terms the greater change in concentration occurs at the eight-firm concentration ratio for all three averages. This may suggest that market shares of firms situated between the ninth and the twelfth rankings are being shrunk on behalf of the eight largest firms.

Pryor (2001, 2002) show a change in concentration ratios in the fifteen years period from 1982 to 1997 of about 5 percentage points. The maintenance of the trend verified for the Brazilian economy for the next ten years would point to a structural change similar to the one suffered by the US in the period evaluated by Pryor. This means that the continuation of this pattern of change would imply an enormous transformation in Brazilian market structure.

Changes in concentration ratios are far from uniform across sectors. Table 4 and table 3 shows that standard deviations of changes in concentration ratios are quite high. For instance, the minimum value of changes in CR4 is $-0,40$, in the case of Shipbuilding, and the maximum value is Office Machinery, which increased CR4 in $0,3763$. Therefore, sectors are quite heterogeneous with respect to changes in concentration ratios. It would therefore be interesting to explain some of these differences.

Table 4 also shows the comparison of changes in concentration ratios of two sub-samples. One sub-sample is represented by those sectors that had at least one M&A transaction. The other sub-sample is represented by sectors without any transaction. For all concentration ratios, in the case of the former 68 sectors sub-sample, the arithmetic average is positive and statistically different from zero. For the sub-sample of sectors with no transaction, the arithmetic average is negative though not significantly different from zero. When the averages of the two sub-samples are compared, the difference is statistically significant at the 1% level for all concentration ratios. It seems thus that concentration may be explained by the occurrence of M&A transactions. In fact, the evidence suggests that *ceteris paribus* concentration would decrease if M&A transactions were absent. However, the presence of other variables affecting concentration as well, as can be exemplified by correlation indexes in table 3, recommends the introduction of controls.

3.2 M&A and Changes in Industrial Concentration

Table 5 shows three equations that present results of the test of the equation showed in subsection 2.6. Equation (1) has dcr4 as dependent variable, dcr8 is the dependent variable in equation (2), and dcr12 is the dependent variable in equation (3). Though R-square levels are not so high, F statistics is adequate.

The change in the productivity (DPROD) is the variable with the highest explanatory power in all three equations. The higher the rate of growth of productivity is, the higher the change in concentration ratios will be. It should also be stressed that as concentration ratios rise along the concentration curve, the coefficient for DPROD lowers and so does t-statistics. This may be indicating that companies with greater size are more likely to present increases in productivity and that this feature explains the gains of market share of leading companies. Furthermore, the evolution of the coefficient in the three equations suggests that the four leading companies squeeze the market shares of their immediate competitors, situated in positions from fifth to twelfth.

One can infer from this evidence that at least in the productive context there is a positive correlation between increase in concentration and efficiency. This result may have implications for antitrust policies. However, some doubts still hold with respect to allocative efficiency.

In order to address allocative efficiency, one should also evaluate changes in quantities and prices. It should be noted that the rate of growth of sales is positively correlated to changes in concentration (see table 3). This may be a consequence of changes in prices or quantities. On the other hand, in equation (1) through (3) the *rgr* changes sign though it is not significant. This is the result of the introduction of *dprod* variable. As it is shown in table 3, *dprod* and *rgr* are positively and significantly correlated.⁶

The second most significant variable in equation (1) is the concentration level. The negative correlation between concentration and changes in concentration is a well-known stylized fact (Liebeskind, Opler and Hatfield 1996). However, in table 5, as the concentration ratio moves along the concentration curve, the module of the coefficient for the concentration ratio in 1996 radically decreases and the variable loses significance. Therefore, the initial concentration ratio would be explaining changes in market share of companies situated in the upper rankings, but does not explain changes in the market share of companies located in the ninth through twelfth position in the sales rankings.

The dramatic decrease in the coefficient along the concentration curve may suggest that in less concentrated markets the four leading companies are increasing their market shares at the expense of companies situated in intermediary rankings. It should be made clear however that these changes may be a consequence of changes in the rankings and that such features are not object of this analysis.

The dummy for the occurrence of M&A transactions has the exact opposite behavior to the initial concentration ratio. The dummy is positive in all three equations but it is statistically significant only in equations (2) and (3). The coefficient increases along the concentration curve. This suggests that M&A transactions are a more important

⁶ Therefore, contrary to Pryor (1994) and Liebeskind, Opler and Hatfield (1996), the rate of growth does not show significant correlation to changes in concentration.

explanatory variable for changes in the market share of companies positioned between the ninth and twelfth position than in explaining changes in CR4. Once more, the analysis does not address turnover in companies' rankings.

One should observe that there is a clear correlation between concentration ratios in 1996 and M&A. Table 3, shows that this correlation is significant at the 1% level for CR4 and at the 5% level for CR8 and CR12. In fact, if CR_i is excluded from equations (1) through (3), M&A becomes significant at the 5% level in all equations. One possible explanation for the lack of significance of M&A in equation (1) would then be that the expansion of top four firms are mainly conditioned by the level of concentration in markets. If levels of concentrations are sufficiently low, they expand their market shares through many ways. This could include M&A transactions but it would comprise expansion using internal resources as well. On the other hand, the expansion of market share of firms situated between the fifth and twelfth positions in sales rankings would be more likely whenever there was the possibility of acquisition of smaller firms.

The latter argument allows an important parallel with existing literature on other countries' experience. It suggests that it is not obvious that M&A transactions will have a concentrating effect on markets, as it is argued by Hannah and Kay (1977, 1981) and Hay and Morris (1991). On the contrary, it indicates that depending on firms involved in the transaction, market structures may be less affected by M&A transactions. The argument is close to Liebeskind, Opler and Hatfield (1996) that suggest that the M&A wave of the 80's in the US involved the acquisition of divisions or plants – spun-off by bigger firms – by smaller companies. In the Brazilian case, in the 90's, the M&A wave seems to be associated with the acquisition of smaller companies by firms of intermediary size.

Some questions still remain. First, turnover of firms in the sales ranking is not covered by the analysis. It should be interesting to verify if firms that are more M&A intensive strategies have increased their market shares vis-à-vis firms that have not acquired. Second, the analysis does not allow an understanding about size of acquired firms. This weakens some of the conclusions.

IV. Conclusion

This paper suggests four main conclusions with respect to the process of productive concentration of the manufacturing and mining industries in Brazil:

- (i) The analyzed period has witnessed a small increase in average market concentration. All concentration indicators used in the paper confirm this tendency. This helps to clarify the rather blurred tendency presented in Rocha and Kupfer (2002);
- (ii) However, as suggested in Rocha and Kupfer (2002), though average concentration increases, there is great dispersion of the results. Some sectors have negative changes in concentration, others have quite huge changes towards the increase of concentration.
- (iii) The effect of M&A on concentration is far from striking. M&A seems to affect market shares of firms of intermediary size. The market shares of top four firms do not appear to be influenced by M&A transactions. This could be a consequence of some characteristics of the M&A wave presented in Rocha and Kupfer (2002), such as the strong participation of multinational enterprises that could be using acquisitions to enter the Brazilian market; and
- (iv) Increases in concentration do not seem to be associated with loss of economic efficiency. Though the behavior of prices and quantities is not addressed in this paper, the paper shows some evidence that increases in concentration are positively correlated with productivity gains.

The results presented may also render some policy suggestions. More specifically, the paper indicates that there should not be special concern with efficiency losses caused by increases in concentration. However, the results do not allow general conclusions and due to the aggregated and unspecific character of the analysis, deeper analyses for specific cases are recommended.

Finally, the paper suggests some recommendations for future research:

- (i) A detailed analysis of the effect of different modes of industrial restructuring on concentration in line with Liebeskind, Opler and Hatfield (1996) should be undertaken;

- (ii) A more detailed analysis of the import structure of industries should be made in order to correct for possible biases due to the exclusion of foreign market from the concentration analysis. In this sense a study of the origin of imports and its association with subsidiaries of multinationals that are market leaders in Brazil would help to understand the direction of changes if imports were included into the analysis;
- (iii) An analysis of impacts of concentration changes on profit margins would help to deepen knowledge about the effect of changes in concentration on efficiency; and
- (iv) Some analysis about companies involved in transactions would help to understand the role played by M&A in firms' market shares.

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Table 1 – Number of Transaction by Period and Percentage
of Shares Acquired, Brazil, 1990-1999.

Percentage of Shares	Period		Total
	1990-1996	1997-1999	
0-25	25	21	46
25-50	47	32	79
50-75	39	49	88
More than 75	156	170	326
Not Informed	23	20	43
Total	290	292	582

Source: Thomson Financial.

Table 2 – Descriptive Statistics

	N	Minimum	Maximum	Average	Standard Deviation
CR41996	104	0,079	1,000	0,418	0,238
CR81996	104	0,122	1,000	0,530	0,250
CR121996	104	0,155	1,000	0,592	0,247
CR42000	104	0,084	1,000	0,427	0,242
CR82000	104	0,121	1,000	0,544	0,258
CR122000	104	0,148	1,000	0,602	0,253
DCR4	104	-0,400	0,376	0,010	0,096
DCR8	104	-0,318	0,287	0,014	0,086
DCR12	104	-0,270	0,233	0,011	0,079
DPROD	104	-0,142	3,965	0,670	0,622
DIFPROD	104	0,000	0,677	0,235	0,143
INTTEC	103	0,002	0,038	0,015	0,010
RGR	104	-0,472	8,344	0,719	0,980
RENTER	104	-0,552	1,691	0,131	0,355

Source: Own elaboration from Thomson Financial, IBGE – PIA, 1996-2000, IBGE – PINTEC, 2000.

Table 3 – Correlation Matrix

	CR41996	CR81996	CR121996	DCR4	DCR8	DCR12	DPROD	DIFPROD	INTTEC	RENTER	RGR
CR81996	0.974***										
CR121996	0.948***	0.993***									
DCR4	-0.164*	-0.118	-0.091								
DCR8	-0.102	-0.080	-0.058	0.918***							
DCR12	-0.105	-0.094	-0.082	0.857***	0.976***						
DPROD	0.401***	0.413***	0.422	0.384***	0.376***	0.325***					
DIFPROD	0.283***	0.319***	0.346	0.034	-0.018	-0.072	0.370***				
INTTEC	0.333***	0.358***	0.379	-0.111	-0.100	-0.133	0.224**	0.640***			
RENTER	0.038	0.019	0.000	-0.123	-0.134	-0.152	-0.092	-0.214**	-0.185*		
RGR	0.235**	0.218**	0.212	0.209**	0.200**	0.171*	0.738***	0.296***	0.255***	0.185*	
MA	-0.285***	-0.246**	-0.216**	0.208**	0.235**	0.246**	0.018	0.041	0.012	-0.126	-0.098

Source: Own elaboration from Thomson Financial, IBGE – PIA, 1996-2000, IBGE – PINTEC, 2000.

* Significant at the 10% level.

** Significant at the 5% level.

*** Significant at the 1% level

Table 4 – Concentration Level and Changes of Concentration in the Brazilian Manufacturing and Mining Industries, 1996-2000

	Number of Sectors	CR4	CR8	CR12
Arithmetic Average of Concentration Ratio in 1996	104	0,418	0,530	0,592
Weighted Average of Concentration Ratio in 1996	104	0,415	0,521	0,583
Weighted Average by 1996 Sales of Changes in Concentration Ratios, 1996-2000	104	0,012277	0,019371	0,015658
Weighted Average by 2000 Sales of the Changes in Concentration Ratios, 1996-2000	104	0,015757	0,023461	0,018871
Arithmetic Average of Changes in Concentration Ratios, 1996-2000	104	0,009558	0,013552	0,010694
Standard Error		0,009145	0,008475	0,007778
t-Statistics of Hypothesis Ho=0		1,015	1,599	1,375
Arithmetic Average of Changes in Concentration in Sectors with M&A Transactions	68	0,023992	0,028269	0,024797
Standard Error		0,009776	0,009355	0,008888
t-Statistics of Hypothesis Ho=0		2,457**	3,022***	2,79**
Arithmetic Average of Changes in Concentration in Sectors without M&A Transactions	36	-0,017708	-0,014256	-0,015947
Standard Error		0,019397	0,016139	0,014061
t-Statistics of Hypothesis Ho=0		-0,913	-0,883	-1,134
t-statistics for Mean Difference Test between Sectors with and without Transactions		2,144**	2,443**	2,558**

Source: Own elaboration from Thomson Financial, IBGE – PIA, 1996-2000.

* Significant at the 10% level.

** Significant at the 5% level.

*** Significant at the 1% level.

Tabela 5 – Least Square Regression Estimates

Dependent Variable Equation	dcr4	dcr8	dcr12
	(1)	(2)	(3)
(Constant)	0,009 (0,323)	0,008 (0,293)	0,015 (0,604)
F&A	0,016 (0,855)	0,028* (1,620)	0,031* (1,949)
TXCRESC	-0,023 (-0,963)	-0,015 (-0,700)	-0,005 (-0,224)
TXNEMPR	-0,011 (-0,431)	-0,020 (-0,798)	-0,030 (-1,328)
INTTEC	-1,012 (-0,882)	-0,596 (-0,561)	-0,752 (-0,760)
DIFPROD	-0,015 (-0,182)	-0,077 (-1,040)	-0,095 (-1,391)
DPROD	0,099*** (4,154)	0,081*** (3,647)	0,061*** (2,921)
CRi1996	-0,132*** (-3,005)	-0,069* (-1,767)	-0,047 (-1,269)
Adjusted R ²	0,251	0,217	0,198
F	5,878***	5,027***	4,588***
n	104	104	104

t-statistics in parenthesis.

* Significant at the 10% level.

** Significant at the 5% level.

*** Significant at the 1% level

Chapter 4

Will the Market Keep Brazil Lit Up? Ownership and Market Structural Changes in the Electric Power Sector*

Nobuaki Hamaguchi

I. Introduction

This paper will analyze some of the consequences of the privatization process that began in 1995 in the Brazilian electricity sector. The privatization program constituted an important part of the Brazilian industrial restructuring process in the 1990s, and brought far-reaching results to various sectors of the economy.¹ However, despite the announcement of a quite ambitious sectoral reform plan, the privatization of electricity progressed very slowly and incompletely. This unsatisfactory performance owes partly to political pressure against privatization but, at the same time, it concerns the very nature of the industry.

The electricity industry is often considered as a typical example of a natural monopoly because of the requirements for large-scale investments, making a single firm operation most efficient due to economies of scale (see Stiglitz 1999, chap. 8). This specific characteristic leads to the justification of public ownership on both economic and political grounds. Economically, economies of scale implies that production by a nonregulated private monopoly will fall short of the socially optimal supply. Politically, public ownership allows the government to secure the nondiscriminatory provision of services to marginal populations who might be underserved by private firms. As Shleifer (1998) recalls, about a half century ago, future Nobel laureates like Arthur Lewis and James Meade were concerned with monopoly power and supported the public ownership (or the socialization of firms), motivated partly by the successes of government control during the war, the failure of competition and regulation during the Great Depression, and the apparent success of the Soviet Union's industrialization.

* This chapter first appeared in *The Developing Economies* 40(4), December 2002.

Recently, however, publicly owned enterprises have been criticized as inherently inefficient, leading to the global phenomenon of privatization. Public enterprises come under criticism when their operations are directed wrong goals, or they are badly managed. The main source of misdirection is political interventions aimed at realizing private objectives. Bad management often stems from the low morals of bureaucratic managers trying to rationalize operations to maximize social benefits at minimum cost. The theoretical literature points to problems in incentive structures, principal-agent problems, and soft budget constraints (Kornai 1986), as well as the absence of takeover threats, among others.

With pro-privatization arguments prevailing, an increasing number of public utilities in developing countries have been acquired by foreign enterprises. This is partly due to the lack of capacity by local capital to assume responsibility for the large amount of fixed investments with long-term maturities. On the other hand, since their business is basically nontradable, public utility enterprises in industrialized countries are motivated to invest in foreign countries in order to increase their customer base as well as to neutralize market risks by diversifying their markets, and avoiding dependence on the market situation of one country. Foreign companies are also favored by the developed capital markets in their home countries, which enable them to move into new markets. Thus, privatization simultaneously stimulated the trend toward the internationalization of the ownership of productive assets in developing countries and the globalization of a number of transnational enterprises.²

It is also important to understand that developing countries are under pressure from international rating agencies and Washington-based international institutions, whose main concern is macroeconomic imbalances with a particular focus on government accounts. Since their evaluations have a tremendous impact on external financing, many highly indebted countries, particularly in Latin America, found it beneficial to sell government assets not only to obtain financial revenues from their liquidation, but also because tight fiscal constraints have made it impossible for governments to promote social welfare without assistance.

The current core of the discussion on private/public ownership and development is how to transfer property rights orderly, ensuring that their monopolistic behavior does not worsen public welfare. Since public ownership was developed under a particular institutional arrangement, privatization does not simply mean the transfer of ownership,

but also requires comprehensive systemic reform. Accordingly, the role of the government should be shifted from being a direct provider to a regulator. This task is complex and requires the careful elaboration of a sophisticated regulatory framework. Thus, in contrast to the private mergers and acquisitions, which were triggered by a series of deregulation measures and stimulated new patterns of competition, privatization was induced by external pressures, and has required the establishment of appropriate regulatory frameworks following the change of ownership.

By focusing on Brazilian electricity we intend to contribute to the discussion on problems arising from the ownership change of public utilities in developing countries given limited regulatory capability and economic uncertainties. The sector was initially developed under public ownership, but the macroeconomic situation of the 1990s made privatization inevitable. However, privatization was implemented under poor planning and coordination. Not only did it fail to bring the ownership change to completion, but it was also unable to create attractive market conditions to stimulate investment into capacity expansion. Our analysis finds that the delayed privatization of generation and transmission led to a long period of defensive adjustment, with low investments and cuts in expenditures. Insufficient capacity building, associated with the rainfall shortage in 1999-2001, led to a severe energy crisis, obliging the population to cut back at least 20 per cent on their energy consumption.

In the following section, we will begin our discussion by reviewing the theoretical literature on the effect of ownership on enterprise performance, from the perspective of private versus public. Based upon this understanding, the logic of the privatization of electricity in Brazil will be characterized in Section III. Then, after reviewing the historical background of the Brazilian electricity sector in Section IV, we will analyze the structural reforms in Sections V to VII. Section VIII will present the reactions of firms, as shown by their financial data. The last section will conclude the discussion.

II. Ownership Matters: A Review of the Theoretical Literature

This section provides a selective survey of economic theory on how ownership matters in the provision of public utility³ and of the principal obstacles to privatization. Following Vickers and Yarrow (1988), a public enterprise is defined as one: (a) not maximizing

profit, (b) with no marketable ordinary shares in the firm, and (c) being sustained by public funding. This means that the manager of a public enterprise is supposed to maximize the social welfare as an agent of the government, which in turn represents the public interest, while the internal efficiency of its operation is allowed to be a secondary objective, thanks to the absence of the takeover threat. Instead of engaging in in-house production, the government can contract private enterprises to achieve the same objective. Private enterprises are profit seeking, and will choose the most efficient method under the conditions imposed by the government. The point at issue is whether privately owned enterprises can achieve given social objectives more efficiently than public ones.

We start by recalling that although publicly owned enterprises do not seek efficiency, it is nevertheless possible for them to be operated as efficiently as privately owned enterprises under appropriate incentive structure arrangements (Williamson 1985). A complementary view presented by Sappington and Stiglitz (1987, p. 568) states that “all of the government’s objectives can be attained by an appropriately designed auction of the rights to produce a given product or service.” The latter conclusion depends on: (1) auction for the ownership market being competitive and the bidders sharing symmetric information about the least cost production technology; and (2) the government being able to write a perfect contract or the cost of intervention into delegated production being low. The first condition implies the extraction of monopoly rents through a competitive ownership market and no technological rents or barriers to entry due to symmetry regarding technical information. The second condition ensures that the delegated private firm will choose the most efficient production whose output will be paid the amount exactly equal to its social valuation, which is known to the government. These views lead to the neutrality theorem of Shapiro and Willig (1990) which states that ownership does not matter if the eventualities are contractible, all private information is revealed, and there is no cost of raising government funds for the tax and incentive policies.

Thus, any ownership debate must start from assuming away at least one of these neutrality conditions. The problem of incomplete contracts called the attention of various researchers from industrial organizations, such as Hart, Shleifer, and Vishny (1997), Schmidt (1996) and Laffont and Tirole (1994). Hart, Shleifer, and Vishny (1997) adopt the notion of the residual rights of control introduced by Grossman and Hart (1986).⁴ It is assumed that the enterprise manager, whether public or private, can invest in quality improvements and cost reductions in order to obtain more customers and maximize profit,

but that cost reductions have an adverse effect on quality. Neither effort is contractible ex ante. In the case of public ownership, the fruits of noncontractible management efforts belong to the government. The manager is unlikely to invest in this case, since he knows that the reward for his effort will be exploited. By contrast, since privately owned enterprises are fully entitled to residual control rights, privatization will create stronger incentives for both types of efficiency improvement. Yet, despite the cost reductions, consumers may be worse off if: (1) the privatized firm depends too heavily on lowering quality to reduce costs; or (2) incentives for quality improvement are either unimportant or do not differ much depending on the ownership structure. Laffont and Tirole (1994) further remark that if we assume the problem of incomplete contracts between the private owner and the manager in the private ownership case, the manager may produce inefficient results as he tries to respond to two masters, the regulator and the shareholders. Shapiro and Willig (1990) developed an argument regarding the relationship between ownership structures and locations of undisclosed information. According to their formalization of public ownership, a minister represents the public interest and controls the firm. He has access to information about both internal efficiency and social effects, and maximizes social welfare, aggregating the social benefit and enterprise's profit. But the minister does not necessarily choose the first best solution, because he also tries to maximize his private benefits, which are not observable from outside. On the other hand, if the company is privately owned, it pursues profit maximization based on private information on internal efficiency. A regulator then conducts tax and incentive policies to guide the production level to the socially most desirable level. The less the regulator is informed and the more information is privately held by a manager, the more the regulator will have to pay to change the company's decision. Within this framework, privatization means a shift of undisclosed information from the minister to the private manager. Private ownership is more welfare enhancing when the minister/regulator has greater discretionary power to redirect the enterprise to pursue his private interest. This implies that a transparent democratic political regime would reduce such a risk. On the other hand, privatization may yield undesirable outcomes if the information rent for redirecting the firm's decision is very high.

The question of political interference has been one of central themes of the debate on public ownership. Vickers and Yarrow (1991) demonstrate that privatization reduces political influence and increases the influence of capital market factors. Boycko, Shleifer,

and Vishny (1996) consider political influence to still be workable under private ownership if shareholders can be convinced by giving subsidies sufficient to compensate for the foregone profit. Thus, privatization alone cannot achieve increased efficiency unless the Treasury implements strict monetary controls to raise the cost of politicians boosting their political benefits.

Thus, one cannot state that private ownership is always more efficient than public ownership. The success or failure of privatization depends on local circumstances and the idiosyncratic features of particular industries with regard to market conditions, contractibility of eventualities, and information structure. If the results are so inconclusive, why has privatization become such a global phenomenon?

On this point, Yarrow (1998) points out that strong fiscal pressure increased the political cost of destabilizing macroeconomic conditions by increasing the public account deficit. Although he apparently underestimates the cost of contracting private firms, and fails to take into consideration information rent and incomplete contracts, the notion of identifying public ownership as a luxury is increasingly gaining force. For example, a World Bank report found an inverse correlation between the weight of publicly owned enterprises and economic growth, with the reason being that the bureaucrats are still in business that there is a lack of political will for public sector reform (World Bank 1995). This kind of ideology⁵ is widely held in the international financial community, including country risk rating agencies. Thus, it seems that privatization has been set as an a priori policy objective to demonstrate the determination for sound macroeconomic management, apart from analysis of the welfare consequence of ownership change.

Since the supremacy of this macroeconomic logic has become clear in the development policy agenda, many countries continue to seek ways to protect social welfare by regulation. However, there is great difficulty in implementing regulations in developing countries, due to the lack of monitoring ability of agencies, lack of market infrastructure promoting competition, and the highly asymmetric location of information. Furthermore, while excessive monopolistic rents can be prevented by promoting market competition, the government should also promote additional capacity in order to secure stable supply. For the latter purpose, the interests of delegated producers need to be protected in the long term, to induce investment. In some cases, the promotion of investment may require coordination among participants to share the protected rent, this contradiction makes regulation a very complicated task.

III. Privatization in Brazil

The Brazilian experience of privatization provides an excellent opportunity for examining the controversies raised above. During the ten years from 1991 to 2001, privatization generated revenues of about U.S.\$103 billion, including U.S.\$85 billion in cash and U.S.\$18 billion in debt transferred to the private sector. This is the largest privatization program ever conducted among developing countries and transition economies. It tells us something about the significance in size and scope of the privatization process, while reminding us of the predominant position held until then by the state in the Brazilian economy.

The program proceeded in three parts: (1) the National Denationalization Program (PND) promoted by the National Bank for Economic and Social Development (BNDES) since 1991; (2) the privatization of telecommunication (Telebrás system) implemented in 1998 by the Ministry of Communication; and (3) the privatization of firms owned by local states, which conducted their own privatization programs starting from 1995. Table I shows that with PND and Telebrás, the federal government accounted for two-thirds of the total results, and that the remaining a third were handled by the state governments. There were two phases in the process. The first corresponds to 1991-94, under President Collor and, after his impeachment, by his successor President Franco.⁶ PND during this period included manufacturing firms in areas such as steel (Usiminas, CSN, CST, Cosipa, Açominas), petrochemicals (Copesul, Petroflex, Fosfertil), and aircraft (Embraer), resulting in revenues of U.S.\$11.5 billion. These firms were the legacies of the import-substituting industrial policy that had been pursued until the mid-1980s, in which the government had attributed strategic roles to these industries for deepening and widening industrialization. But their competitiveness was hampered by the limited size of the domestic market as well as by the inability of public finance to continue supplying the funds to build new technological capabilities.

As shown by Figure 1, revenues from privatization increased from 1.3 per cent of GDP in 1991 to 3.5 per cent of GDP in 1993. This revenue was utilized to reduce central government debt, and paved the way to sounder public finances in the later stage. Between 1991 and 1994, the total stock of public sector debt fell from 38.6 per cent to 30.4 per cent of GDP. There were no major political obstacles as the separation of these enterprises did not threaten the public interest as far as social welfare issues were

concerned, except for some nationalistic reaction against selling natural resource-related companies to foreign ownership.⁷ As discussed by Yarrow (1998), the privatization program was vigorously pursued as one of major macroeconomic policy instruments. However, it was also expected that privatization would promote the efficient management of firms. It is useful to remember that Hart, Shleifer, and Vishny (1997) present the proposition that a competitive environment is essential in a post-privatization market to stimulate efforts to enhance productivity. In this regard, the liberalization of imports, which took place under the Collor administration, was an important impetus. We can observe that the consolidation of the steel industry, triggered by privatization and international competition, made some Brazilian steel enterprises such as CSN, Usiminas, and Gerdau global players. In another instance, the aircraft producer, Embraer, has become the country's most active export company. Pinehiro (1996) conducted a comprehensive statistical study, finding a substantial increase in the operational efficiency of firms privatized during the first phase.

The macroeconomic situation of the country deteriorated in the first half of the 1990s. The annual inflation rate surged to the four-digit level and the 1995 budget deficit, measured as the public sector borrowing requirement, amounted to 7.3 per cent of GDP, to which public enterprises contributed 1.3 percentage points.⁸ While the implementation of the PND was delayed due to the populist characteristics of President Franco's administration, the continuing fiscal crisis paved the way for the second phase of the privatization under President Cardoso beginning in 1995, as a part of the stabilization plan of his administration, the "Plano Real."

In the second phase, the scope of privatization was broadened to include public utilities (electric power, telephones, roads, railways, ports) and the banking sector. These enterprises were originally created to fill the vacuum of interests in the private sector and to promote the wide provision of services. However, as shown by the deterioration of infrastructure conditions due to a lack of adequate investment and maintenance, it was already evident that the state of government accounts was too fragile to allow compliance with such a mission.

Given this fact, the government could have chosen either to privatize or to strengthen corporate governance in order to restore the financial equilibrium of each firm. The adoption of the first option was associated with several local features. Firstly, political interventions had already seriously distorted the management of these firms in favor of

the private agendas of politicians. Especially at the local state level, it would have been difficult to restore management discipline in the short to medium term. It was expected that profit-seeking private firms would opt for efficient production and benefit consumers with lower costs and higher quality of services. Secondly, the government was pessimistic about its future financial capability for the infrastructure investments that would be necessary to avoid bottlenecks to economic growth. Thirdly, it was expected that privatization would have a positive macroeconomic impact in the short run, by increasing revenues, reducing public debt, and increasing foreign direct investment, thus reducing pressure on the balance of payments. Fourthly, demonstrating a determination to carry out privatization would increase confidence in Brazilian economic management. Given the political decision to implement privatization, the introduction of several institutional reforms was in order. Among others, a crucial step was the establishment of the Law of Concessions of 1995. It prescribed that a competitive auction should give a concessionaire a license to operate public utilities for a fixed period of time, without discrimination regarding the nationality of the capital. As reviewed in the previous section, a competitive ownership market is one of the fundamental conditions for successful privatization. Also, by giving regulators the right to intervene and terminate contracts in case of noncompliance of required obligations, the law strengthened their voice.

In addition, in order to stimulate state government privatization programs, the federal government launched a program which allowed the restructuring of state debt with the federal government at low interest rates and long-term maturity, conditional upon an initial cash payment of no less than 20 per cent of the outstanding debt. For most state governments, privatization was the only means to obtain such funds.

The success of the “Plano Real” also gave crucial momentum to the progress of the privatization program. Stabilization boosted confidence in the Brazilian economy and increased investors’ interest in privatization auctions. The participation of foreign investors in privatization was fundamental to covering the current account deficit without creating pressure in the foreign exchange market. This had a strong implication for the “Plano Real” to use fixed nominal exchange rate as the anchor of the monetary policy. This synergistic effect between stabilization and privatization became apparent around 1997-98 (Pinheiro 2000) and privatization continues to be important part of

macroeconomic policy, generating total revenues of U.S.\$91.5 billion between 1995 and 2000.

While privatization has enriched the cash inflow to the government, new challenges have arisen about how to ensure that privatized firms honor the public interest. The public interest resides in the provision of services with regularity, continuity, efficiency, safety, technological modernity, and nondiscriminatory access. Compliance with these conditions requires investment, which can be promoted by guaranteeing profit-making opportunities. It is also in the public interest that abuses of market power are not allowed and that services are provided at low cost. For these purposes, an adequate combination of competition policy and incentive policy is the complicated task for regulatory agencies. The previous review of theories suggests that it is crucial for the regulatory agency to set clear rules to establish confidence between the regulator and firms in order to minimize the information asymmetry problem and increase the efficacy of privatization contracts. In the remaining part of this paper, these issues shall be examined in more detail, through an analysis of the case of the electricity sector.

IV. The Rise and Fall of Public Ownership in the Brazilian Electricity Sector

The evolution of Brazil's electricity sector can be characterized by four phases of changes in ownership structure:

- Private ownership with minimal regulatory control (until 1930);
- Private ownership with poor regulation (from the 1930s to the 1940s);
- State ownership with centralized control (from the 1950s to the first half of the 1990s); and
- Mixed ownership, increasing privatization, with more sophisticated regulation (since the second half of the 1990s).

As we can observe in Figure 2, these regime changes were prompted by periods of saturation of previous models, portrayed by the low growth rates of installed capacity in the 1930s and 40s and between the mid-1980s and 1990s.

Until the first crisis during the 1930s and 40s, the liberal political regime that held power at the time left the responsibility for the development of infrastructure to local governments. Municipal governments granted concession contracts to private companies, most of which were of foreign origin. The Canadian company Light and the American

company Amforp were particularly dominant. Their investments were concentrated especially in the more profitable markets in wealthier São Paulo and Rio de Janeiro. They were favored by contracts which granted automatic tariff adjustments in accordance with currency depreciations, and there was little intervention from the federal government. Beginning in 1931, President Getúlio Vargas introduced a nationalistic political regime, and strengthened centralized control. Previous arrangements between local governments and private electric power companies were suspended, and were placed under the regulation of the federal government. The basic idea of the regulation was to force investments while controlling the tariff, so as to assure a 10 per cent return on the historical cost of capital and granting local monopoly status to concessionaires. However, the minimum rate of return guarantee was ignored in order to keep electricity tariffs at a lower level. The relations between the regulator and regulated companies became confrontational as the federal government began to charge that the private foreign companies were remitting large profits to their home countries. The government also complained about the lack of attention to high-cost consumers, namely, poor populations living in the outskirts of big cities and in rural areas. These conflicts reduced investments during the 1930s and 1940s, leading to power shortages for prolonged periods. The government stopped granting new concessions, contributing further to a decline in the growth of power supply capacity.

The government responded to the energy shortage by increasing public investments. President Vargas announced the National Electrification Plan during his second term, and inaugurated Chesf in 1954 in the poor Northeastern region and Furnas in the industrialized Southeastern region in 1957. Some state governments also established their own power companies. In particular, Rio Grande do Sul, Minas Gerais, and São Paulo made substantial investments financed by the National Economic Development Bank (BNDE). As a result, the share of the public sector in total installed generation capacity expanded from 6.8 per cent in 1952 to 54.6 per cent in 1965, while the share of the private sector shrunk from 82.4 per cent to 33.6 per cent.

The public ownership model was gradually consolidated during the 1960s and 1970s through the creation of the Ministry of Mining and Energy (MME) in 1960 and the Electric Power Company of Brazil (Eletrobrás) in 1962. The MME took responsibility for regulation and Eletrobrás became responsible for planning and implementation.

By the mid-1970s, Eletrobrás had become the most powerful institution in the sector. It became a holding company, controlling four regional generation-transmission utilities: Chesf (Northeast), Furnas (Southeast and Central-West), and Eletronorte (North) and Eletrosul (South). These regional utilities produced and delivered electricity to local power distributors, which were owned by state governments. Later, the power generation capacity of this holding company was further strengthened with the inauguration of a wholly owned nuclear plant and the Itaipú Binational Hydroelectric Power Generation, where Eletrobrás shared control with the government of Paraguay. By the mid-1980s, Eletrobrás accounted for more than 60 per cent of Brazil's total electric power supply capacity, with the state power companies responsible for the remainder.

Eletrobrás controlled the Group of Coordination of Interconnected Operation (GCOI), which operated most of regional transmission networks and high voltage interregional transmission lines (North-Northeast in 1984, South-Southeast in 1986, and North-South in 1999) and traced the planning of their expansion. As a project financier as well, Eletrobrás provided intermediation for government funding and provided sovereign guarantees to syndicated loans to electric power companies during the 1970s.

The MME established a regulatory authority, the National Department of Water and Electric Energy (DNAEE), which was responsible for authorizing concessions for electricity generation, transmission, and distribution as well as determining tariffs. Yet, the role of the DNAEE as a regulator was quite limited since development planning was actually concentrated in Eletrobrás, and competition for concessions did not exist until the implementation of the Concession Law of 1995. Moreover, tariff adjustments were automatic, guaranteeing a minimum rate of return on invested capital, and there were no instruments to stimulate productivity increases. When the regulated tariff revenue fell short of the promised rate of return, the difference was filled by public expenditures credited in the Balance Compensation Account (CRC). Further regulations, introduced in 1974, established the national equalization of tariffs, regardless of differences in the marginal costs of each regional network. Eventual differences in profitability were later leveled through transfers from companies in surplus to others in deficit. Thus, electricity firms were guaranteed profits, at least on paper. It was even said, "the regulator was in hands of the regulated" (Ferreira 2000, p. 188), since most of DNAEE's technical officers were loaned from the power companies.

In retrospect, the public ownership regime contributed to spectacular growth in

electric generation capacity: a roughly ten times increase from 1955 to 1980. According to the same data used for Figure 2, the average annual growth rate of generation capacity during this period was 9.2 per cent. It is worth mentioning that Eletrobrás was successful in implementing the electrification of the rural Northeast and the development of the Tucuruí power plant in the North, allowing energy-consuming industries such as aluminum to locate there, while the expansion of Furnas supported industrialization in the Southeast.

To a great extent, this spectacular growth owed to the funding capability of Eletrobrás. Public ownership was suitable for development in its early stage. Vertical integration allowed the internalization of the information problem. Large-scale reservoirs for power generation and transmission lines were constructed in response to demand projections based on ambitious industrialization plans. External borrowing and credit from the National Economic Development Bank were channeled through Eletrobrás.

However, as pointed out by Baer and McDonald (1998),⁹ the financing structure of the Brazilian electricity sector became increasingly vulnerable with the significant changes in the 1970s. In 1967, 34.0 per cent of its financing came from internal resources (tariff revenue) and 31.9 per cent from state resources, while domestic and foreign loans accounted for 13.0 per cent. This structure remained almost unchanged until 1973, but by 1979 the share of internal resource and state resource had dropped to 24.2 per cent and 6.1 per cent respectively, and domestic loans had risen to 30.1 per cent and foreign finance to 32.0 per cent. In the early 1980s, Brazil faced a sudden deterioration of terms of borrowing, and the cost of debt servicing skyrocketed. By 1984, the share of internal resources had fallen further to 17.9 per cent, while that of foreign borrowing had risen sharply to 62.8 per cent. As a result, while the shares of fixed investment and debt servicing in total expenditure were 78 per cent and 15 per cent in 1973, the former declined to 26 per cent and the latter increased to 74 per cent in 1984.

The deterioration of the financial situation of Eletrobrás translated into decreasing investment in generation capacity during the 1980s and 1990s, as shown in Figure 2. The same applies to transmission lines (Table II). It is important to note that there was no expansion of high voltage transmission lines above 500KV in the first half of the 1990s.

Pires (1999) and Ferreira (2000) suggest that these problems are mainly related to political interventions. The most serious problem was the use of tariff controls as an

instrument for the stabilization of inflation. In view of the acceleration of inflation in the late 1970s, authorities at the ministries of planning and finance intensified their intervention in public utility tariff formation. Adjustments in electricity tariffs always lagged behind the rate of inflation. As Figure 3 shows, the electricity tariff declined in real terms during the second half of the 1970s throughout the 1980s. Although the energy policy authority technically maintained the rate of return guarantee, it was not reflected in the actual tariff as the difference was simply accumulated as CRC account credits. Firms did not actually have cash flow and accumulated arrears in federal income taxes and payments for electricity purchased from Eletrobrás.¹⁰

At the same time, governance problems increased. Since it was common for persons without any particular expert knowledge to be politically appointed to executive positions, they usually served as agents of populist politicians, collaborating to maintain a high level of employment. There were few incentives to rationalize expenditures as profits were guaranteed by the rate of return tariff regulation, at least at the surface and as long as the budget constraints were soft enough to be able to cover the actual cash flow shortage. At the state level, companies were utilized to raise borrowings by proposing investment programs, many of which were not even implemented, and the money was used for other ends, such as to cover the fiscal deficit.

By the end of the 1980s, as predicted by the theoretical literature, the Brazilian electricity sector under the public ownership model found itself with a serious debt overhang, weak investment capability due to lack of cash flow, and low productivity, with an excessive labor force. In order to promote productivity growth, reforms were needed in the balance sheet structure, regulatory framework including tariff adjustments, and the governance structure.

V. Tariff Reform

The restructuring of the electricity sector was initiated in 1993, with tariff system reform. It eliminated the tariff equalization, allowing tariff differences across regions, and the CRC was subsequently closed. The reform introduced the so-called price cap regulation whose standard formula is described by the following equation:

$$IRT = \{ VPA_1 + VPB_0 * (\pi - X) \} / PA_0,$$

where IRT is a tariff adjustment rate ceiling and VPA_1 refers to a firm's uncontrollable costs for the year in operation, including water resource utility fees determined by the

government and the cost of fuel and electricity imports affected by exchange rate fluctuations. VPB_0 is the controllable costs in the previous year, including labor and purchasing of materials and external services, and adjusted to the current value with inflation rate p , discounted by the productivity improvement factor X . PA_0 is the annual total revenue of the previous year.

This formula implies that IRT is determined by an arbitrary determination by the regulator of X . Since the firm's revenue is capped by $IRT \cdot PA_0$, the formula induces a reduction of controllable costs greater than X per cent because the residual belongs to the firms. This scheme is coherent with private ownership, under which residual control rights belong to companies. If the agency problem between capital owners and managers is negligible, productivity improvement efforts are enhanced. However, such incentives are weak under public ownership because the residual control rights do not belong to the manager, and the public owner in the face of soft budget constraints is not motivated to enforce cost reductions. Thus, while the price cap regulation is conducive to productivity improvements, the ownership structure matters in determining whether the regulation change is effective.

The formula also suggests that tariff increases can be contained to levels below inflation. Therefore, the benefits of cost reductions are theoretically shared with consumers. However, once privatization takes place, the fact that information on private production costs are not fully visible from the outside implies that regulations should encourage information disclosure to adequately determine X . The regulator should also be careful to ensure that cost reductions were not achieved through a deterioration of the quality of services. To be effective, such a framework requires strong capability by the regulatory agency.

The new tariff scheme was intended to restore the financial equilibrium of electric companies, by allowing tariff revenues that could ensure current cost recovery and also the generation of the necessary cash flow to implement reasonable investment plans. However, the continuing pressure to contain tariff rises in order to control inflation, as well as inflation itself, prevented the real values of tariffs from rising quickly in 1993-94. Only starting from 1996, with the success of the "Plano Real" which reduced inflation rates dramatically, did real tariff revenue start to recover slightly (see Figure 3).

VI. Institutional and Regulatory Reform

In 1996, the MME contracted consulting firm Coopers & Lybrand to outline a model for privatization based on this law. The Coopers & Lybrand (1996) report (hereafter CL report) became the basis for the restructuring of the electric power sector.

It proposed fundamental changes in the structure of the sector. The proposal included not only privatization but also the introduction of market competition through the creation of a wholesale electricity market. In order to prepare a competitive environment, it made a controversial recommendation for the separation of ownership among power generation, transmission, and distribution. The historical process of public sector-based development had resulted in the sectoral structure centralized around Eletrobrás and vertically integrated, as depicted by Figure 4.

Vertical disintegration became essential for the market-based sectoral model to lead to a competitive environment, as it would prevent cross-subsidies from the regulated sector (whose profits were guaranteed) to the competitive sector in order to deter the entry of competitors. Moreover, it would prevent collusion between different segments. For example, a generation company might collude with a transmission company to reject the transmission of other generators' electricity in order to exploit monopoly profits. Or a distribution company could conspire with a transmission company to exert monopsonistic pressure on generators.

On the other hand, from the viewpoint of transaction cost theories, vertical integration is advantageous in preventing information asymmetry problems, which make risk-averse generators cautious about capacity expansion, eventually leading to power shortages. Especially due to economies of scale and networks, the transmission segment has stronger characteristics of a natural monopoly.

In 1996, concerned with these conflicting views, Brazil created the National System Operator (ONS), a nonprofit private organization representing generation companies and distribution companies, to assume the control rights over energy flow. ONS was entrusted with operating networks by transmission companies in exchange for receiving a profit-guaranteeing regulated transmission fee. Real time technical information on the availability and cost of supply, location of demand, and level of congestion of energy traffic were concentrated in ONS to optimize the system to minimize the marginal cost of the integrated power supply system. This institutional change laid the groundwork for decentralizing ownership while centralizing the control of the system, as a means to

internalize network externalities and prevent private information from creating high transaction costs. The government planned not only to give the concessions for new transmission to private companies but also to privatize the existing transmission networks owned by Eletrobrás and the state utilities. The ultimate structure of these ownership changes was to have led to Figure 5.

Cut off from transmission, the generators were considered simply as commodity suppliers with much smaller sunken costs. Assuming that no company would have sufficient market power, the generators would be induced to minimize costs to maximize profit, which in turn would contribute to increasing the efficiency of the system as a whole. On the demand side, while large consumers would have direct access to the wholesale market, small customers would be represented by distribution companies which would act like brokerage agents, with the retail price regulated by a price cap mechanism. By encouraging more customers to enter the free market by lowering barriers, competitive pressure in the retail market could also be strengthened and cost reductions induced. ONS would guarantee nondiscriminatory access to the transmission network for generators and consumers.

The technical role of ONS was complemented by the policy on the regulatory supervision of competition laid out by the National Agency for Electrical Energy (ANEEL), which was established at the end of 1996. ANEEL obtained financial independence from the MME by gaining a special purpose tax as a financial source, and independence from political interference regarding the appointment of executive positions, while maintaining transparency through public audits as well as the disclosure of financial information through the Internet. Among the competencies of ANEEL are the authorization of bilateral contracts, realization of auctions for concession, standardization and monitoring of quality of services, and regulation of market concentration.¹¹ It is endowed with the power of veto over ONS decisions.

However, from the viewpoint of transaction cost economics, the separation of ownership entails problems arising from the previously discussed information problems. Generation companies facing competition try to minimize costs and avoid investment. Since investments in power generation have long maturity periods, the supply system tends to lose its buffer supply, increasing the risk of failure if there is a sudden significant increase in demand. Moreover, the unpredictability of investment plans in other subsectors may hold investment down at a level lower than what is socially desirable. While the regulator

expects a sort of formal or informal agreement for coordinating investments among private companies (which will also enhance their profit), uncertainties in final demand and cost variables¹² tend to encourage firms to collude as a means of overcoming those externalities (Yarrow 1994). Such difficulties complicated privatization in Brazil, because sufficient confidence was not created that market regulation would be compelling enough to ensure that the competition-based model would be able to supply energy more efficiently than the traditional public ownership model.

The idea of a competitive wholesale market was put into practice with the approval of Law 9648 of 1998, which established the Electricity Wholesale Market (MAE). Initially, the MAE was created as a spot market to adjust for real time surpluses/deficits of electricity load. Generators with excess supply capacity, and distributors which were overloaded after compliance with the bilateral contract, would be sellers,¹³ while generators which could not fulfill bilateral contracts with their own generation and distributors in deficit were to be buyers. It differs from the usual concept of a marketplace in that the spot price is not defined at the point that clears supply and demand but rather is calculated by ONS using engineering computational programs based on the marginal cost of the generation output of the entire system.

When the MAE was created, it was predicted that the generating companies would prefer to sell in the MAE, seeking higher prices and avoiding prices that were fixed for long period of time. Out of concern that the sudden transition to the MAE would raise consumer tariffs, ANEEL decreed in 1997, prior to its introduction, that all existing generators and distributors would have to bilaterally negotiate and sign agreements of so-called initial contracts, with a duration of nine years, fixing transaction prices with an option for regular adjustments. The initial contracts fixed all transactions at that time, with projection of a partial liberalization of transactions to MAE starting in 2003, at an annual rate of 25 per cent, with complete liberalization in 2006. Until that time, only new entrants would be allowed to sell without restriction on the MAE spot market, as a measure to encourage new entry.

Despite these expectations, a large part of the wholesale trade is still actually realized outside the MAE through bilateral contracts, in which generators and distributors negotiate amounts and prices for a determined period of time. The old energy (secured by the initial contracts) was for the large part (nearly 95 per cent) generated by hydroelectric plants which had already been fully depreciated and whose running costs were very low,

when the reservoirs held sufficient levels of water. On the other hand, new entrants had to bear high capital cost and/or pay high running costs for imports of natural gas fuel denominated in dollars, in the case of thermoelectric plants. Distributing companies, for their part, were regulated by ANEEL in accordance with the price cap regulation, which did not allow them to automatically add cost increase, to the retail price. Therefore, the privatized distributing companies fulfilling their obligations under bilateral contracts for the old energy have been reluctant to use the spot market for procurement. A lack of demand and the high volatility of the exchange rate after the floating of the real in 1999 discouraged new entrants.

VII. Privatization – Ownership Changes

With the privatization of electricity in its sights, the government enacted in 1995 the law of concessions (Law 8987) and a specific sectoral law of concession (Law 9074) which set the following conditions for the exploration of energy services:

Concession periods of thirty-five years for generation, and thirty years for transmission and distribution, renewable for the same period, if concessionaires satisfied the operational requirements;

Hydroelectric generation of 1,000KW or above and thermoelectric generation of 5,000KW or above would be subject to competitive auctions. Smaller power generation could be explored upon notification to the regulatory authority. Generation for self-use would need to be communicated and authorized;

Independent power producers (IPPs) could sell electricity to distributors and large consumers;

Large-scale consumers, of 10,000KW or above, could contract directly with IPPs. The criterion of large consumers would be reduced to 3,000KW in eight years (by 2003), and could be further reduced by the judgment of the admission authority;

Ownership of transmission lines comprising the basic network could be auctioned, but its operation had to be subordinated to coordination with independent system operators who would optimize the use of the interconnected system.

Eletrobrás was formally incorporated into the PND in May 1995, and made ready for privatization. The first privatization occurred in 1995, when the distribution company of the State of Espírito Santo (Ecelsa), then controlled by Eletrobrás, was brought to auction

(Table III). This was then followed by the privatization in 1996 of a distributor in Rio de Janeiro metropolitan area, Light, which was also controlled by Eletrobrás, and which was acquired by a consortium formed by the French national company EDF and the American firm AES, with the participation of other power distributing companies owned by local states.

The privatization moves in the States of São Paulo and Rio Grande do Sul deserve particular attention as they involved the separation of the ownership of vertically integrated system, following the CL report recommendation. São Paulo State owned two integrated electric power systems – Cesp and Eletropaulo – and a distribution company CPFL, which operated in different market areas for historical reasons. CPFL was sold in its entirety to a Brazilian business consortium in 1997. Cesp first sold off its distribution business and then established Elektro, which was sold to the American company Enron in 1998. The remaining part of Cesp was divided into three generators (Paranapanema, Tietê, and Cesp) and one transmitter (CTEEP). In the privatization of 1999, the American firm Duke Energy acquired Paranapanema and AES obtained Tietê. Eletropaulo, for its part, was unbundled into four companies: two distribution firms (Eletropaulo Metropolitana and Bandeirante), one generator (Empresa Metropolitana de Águas e Energia Elétrica: EMAE), and one transmission company (Empresa Paulista de Transmissão de Energia: EPTE). In 1998, Eletropaulo Metropolitana was sold to the EDF-AES consortium, which also obtained the control of Light.¹⁴ In the same year, Bandeirante was sold to a local consortium, VBC. In total, the State of São Paulo privatized the entire distribution business and a part of generation, maintaining control over the generation sections of Cesp and EMAE and the transmission business of CTEEP and EPTE, which are planned to be merged together in the near future.

In the privatization of CEEE by Rio Grande do Sul, the state separated the distribution in the North-Northeastern region (sold to AES) and Central-Western region (sold to VBC). CEEE still maintains control over distribution in the Southern-Southeastern region, which includes the state capital, Porto Alegre. Generation and transmission were separated from CEEE and joined into another state company, CGTEE.

Several observations can be drawn from Table III. First, the privatization of the electricity sector has been ongoing for more than six years, but the process is not yet completed. This is very different from the case of telecommunication, where the Telebrás system was totally privatized in 1998 (see, for example, Goldstein 1999). Although the first

privatization took place even before the presentation of the CL report, key institutions such as ANEEL, ONS, and MAE have been established only gradually. Due to this systemic uncertainty, the first privatizations did not attract much interest from investors. Secondly, most sales took place by distribution segment. To date, only a few cases of privatization of generation have been realized and not a single transmission company has been privatized. In particular, there has only been one case of privatization of the generation and transmission assets of Eletrobrás,¹⁵ with regard to the generation of Eletrosul. The integrated power companies of the States of Paraná and Minas Gerais have not yet been privatized. Thirdly, foreign companies obtained control of many of these companies. Investment by EDF of France, AES of the United States, and Endesa (together with its Chilean affiliates Chilectra and Enersis) and Iberdrola of Spain have been particularly noticeable. Brazilian electric power operators Rede, Inepar, and Cataguases-Leopoldina, as well as financial capital-based consortium VBC, have also strengthened their positions. This concentration of ownership implies the possibility of a future consolidation of the sector into a smaller number of groups through post-privatization mergers and acquisitions. Some group formations have already been seen, such as Escelsa's buy-out of Enersul and CPFL's acquisition of Eletropaulo Bandeirante. Also interestingly, Spanish power company Endesa has used its Chilean subsidiaries Chilectra and Enersis to make acquisitions in Brazil, such as CERJ, Cachoeira Dourada, and Coelce.

After the slow and incomplete implementation of privatization, the ownership structure was reformed into the form depicted by Figure 6, which is still far different from the pattern shown in Figure 5. Private ownership is now dominant in the distribution section, and the entry of free consumers has started. On the other hand, the generation segment is still largely owned by the public sector, and vertical disintegration has not been completed. The figures in Figure 6 tell us that almost 90 per cent of electricity is generated by the public sector, including the Eletrobrás system (accounting for 52 per cent) and state power companies (37 per cent), while private generating companies are responsible for only 8 per cent, with 3 per cent being carried out by self-generation by distributing companies. The picture also shows that the governance of the interconnected transmission has been separated from ownership, and assumed by the ONS.

VIII. Firm Performance

In this section, we analyze a data set compiled from the financial reports of the electric power companies in order to identify the characteristics of the adjustment carried out during the process of ownership reform. The data is reported annually by each company to the Security Exchange Commission (CVM), and is available from its website. Table IV shows changes in employment and fixed assets, comparing the status before the reform and the most recent figures. For ease of comparison, the post-privatization figures aggregate all separated companies. For example, data for Cesp after privatization includes Elektro, Paranapanema, Tietê, Cesp, and CTEEP.

Table IV demonstrates that employment fell sharply after privatization, without exception. The rate of the reduction reached 40-50 per cent in most privatized firms. Nonprivatized companies as CEMIG and COPEL also reduced their work force, but we found that the rate of reduction was smaller. However, this rule does not apply generally, because Eletrobrás implemented rather deep employment adjustments.

In terms of investment, Table IV shows that firms that were not privatized or only partially privatized tended to invest less, while the growth of fixed assets of the privatized firms tended to be much higher. In particular, members of the group of largest firms Eletrobrás and CEMIG did not show any substantial increases. This corresponds to the low growth of generation and transmission, as observed in Figure 2 and Table II. With regard to the relatively higher growth of investment in privatized distributors, many cases correspond to expansions of self-generation capacity, which is allowed by ANEEL up to a level of 30 per cent.¹⁶

Table V shows changes in shareholders' equity/total liabilities ratios. The decline of the ratio implies that a growing portion of company assets is being financed by borrowings, making them more vulnerable to external shocks. This figure is very important for Brazilian companies, because any macroeconomic shock -- such as an interest rate hike or sharp devaluation -- will affect financial costs significantly. According to the table, there was a tendency by privatized firms to reduce shareholder's equity ratios during the years following privatization, implying an increase in borrowing to finance asset acquisitions relative to equity. Most notably, Escelsa and Light, which were privatized early on, reduced their shareholders' equity ratios substantially as a result of increased borrowings for the acquisition of Enersul and Eletropaulo Metropolitana, respectively. In other instances, CERJ and Coelba increased investment into their own

fixed assets, as shown by Table IV, and saw continuous declines in their equity ratios. On the other hand, while CPFL, Cosern, and Coelce also increased their investments significantly, they were sustained by increases in equity financing, leading to increases in the equity ratio. The vulnerability of companies with low equity ratios became apparent in 1999, when the Brazilian real experienced a sharp depreciation, and interest rates were raised substantially to stabilize the economy. In that year, AES Sul, Escelsa, Light, CERJ, and Coelba suffered large operational losses, while CPFL, Cosern, Coelce maintained stable performance.

The publicly owned generation enterprises and integrated utilities performed relatively well because of increasing electricity demand accompanying growth recovery during the second half of the 1990s. Financial data on Eletrobrás and CEMIG suggests that particular efforts were made to redirect profits to the reduction of long-term debt, instead of investing in fixed assets, to strengthen their balance sheet structures. On the other hand, COPEL made substantial investments into fixed assets, increasing the composition of debt financing in relation to equity, while making operational profits in each year (Table VI).

To summarize, electric companies carried out a variety of adjustment strategies during the period of ownership change in the second half of the 1990s. All of them attempted to restore financial equilibrium, firstly by reducing the excessive work forces they had acquired during the public ownership period. These adjustments tended to be more accentuated in privatized companies. Some privatized companies reduced their equity ratios by increasing borrowings to finance their initial post-privatization restructurings or for the acquisition of other privatized firms. Larger borrowings translated into vulnerability, which was revealed in the 1999 currency crisis. Several companies made investments using equity financing, and maintained relatively more stability under the turmoil. Among the companies remaining under public ownership, CEMIG and Eletrobrás were more defensive in making balance sheet adjustments, while COPEL was more expansionist; it carried out smaller employment reductions, increased investment substantially, and made more borrowing.

IX. CONCLUDING REMARKS

Although privatization in Brazil achieved far-reaching results in general, the case of electricity was not successful, and left many lessons to be learned. The original idea contemplated in the CL report envisaged a shift toward a private ownership model, separating ownership into generation, transmission, and distribution. While the transmission and distribution segments were to be rigidly regulated, a wholesale marketer was created to stimulate competition in the generation market. It was expected that the introduction of this new structure would stimulate cost reductions and induce an expansion of supply capacity.

However, rather disappointingly, the new model did not obtain support. While state ownership had already been rejected because of the lack of the public sector's financial capability, the future of the market competition-based sector model for electric power remains highly uncertain and at this moment we cannot be sure if the market will really keep Brazil lit up. Some of the evidence presented in our analysis suggests that privatization under high uncertainty led companies to conservative strategies, maintaining a passive attitude toward investment and seeking short-term financial gains through sharp job cuts. This uncertainty arose from substantial delays in defining new market institutions through the establishment of regulatory institutions and clear rules of competition as well as ownership structure reform. Making the companies even more conservative were the fluctuations of interest rates and exchange rates during the late 1990s, which increased the financial vulnerability of highly indebted firms.

Given this anxiety, private firms have tended to demand high rents for private information in order to neutralize risks, and to be induced to investment, especially since with privatization the government lost access to information on the profitability and viability of investment projects. For example, in order to promote investment into thermoelectric power generation, the generating companies are demanding much higher tariffs, coverage of exchange rate risks for the importation of natural gas from Bolivia, and sharing in project risks by equity participation of the national oil company Petrobrás and the national development bank BNDES. The government is still unsure of what kind of market regulation will be sufficient to amend such market failures, and how great a burden should be given to fiscal accounts and consumers' expenses. It needs to carefully calculate whether such costs will really be less than the cost of public ownership.

An alternative path suggested by the opposition parties, which will be taking power after winning the 2002 presidential election, would be to go back to the public sector

ownership model. Even the outgoing government itself, in view of the energy crisis in 2001, announced in December 2001 that the structural reform in the past years had been a failure, and suspended the privatization of the Eletrobrás system. Still, it has not been able to provide an alternative model for the electric power sector, or for rebuilding the financial capability of Eletrobrás, nor has it presented any vision of what kind of governance structure should be constructed.

The Brazilian experience shows that privatization driven by macroeconomic problems should be carefully reexamined, especially for public utilities that have natural monopoly characteristics, given that the market tends to fail to supply socially optimal supply. People can be seriously affected when market regulations cannot be clearly defined and the regulatory agency is not capable of managing the transition appropriately.

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Footnotes:

- 1 Rocha and Kupfer (2002) provide a broad overview of this process.
- 2 De Paula, Ferraz, and Iooty (2002) discuss the emergence of mixed consortia, jointly formed by foreign and local investors.
- 3 For more comprehensive surveys, see Sheshinski and López-Calva (1999), Megginson and Netter (2001), and Shleifer (1998).
- 4 While Grossman and Hart (1986) discuss comparisons of benefits from acquiring vertically/horizontally related firms or contracting them at arm's length from a private profit maximization view, Hart, Shleifer, and Vishny (1997) analyze the cases of public and private ownership from a government social welfare enhancing view.
- 5 It can rightly be considered ideological, because it is not known a priori whether the fiscal cost of contracting the private enterprise under regulation is lower than that of in-house provision by the public sector.
- 6 President Collor was impeached in 1992 and replaced by Vice-President Itamar Franco.
- 7 Pinheiro (2000) observes that the expansion of state intervention during the period of import-substituting industrialization was an expression of a pragmatic approach to promoting industrialization urgently, through the occupation by the government of open spaces, which could not be filled by the private sector, rather than anything based on a well-defined political ideology. The pragmatism was reflected in the fact that in the late 1970s to the 1980s, the objective of state ownership was switched to macroeconomic stability and external adjustment, and state enterprises were used for price control and as borrowers of external credit. In this vein, when the budget deficit became the main problem in the 1990s, the government made another pragmatic move to large-scale privatization, without any harsh ideological confrontation.
- 8 Data obtained from Giambiagi and Além (2000, p. 129, table 5.1).
- 9 Data from Baer and McDonald (1998, table 2).
- 10 When the CRC was eliminated in 1993 as a part of the tariff reform, it had already accumulated credits of approximately U.S.\$25 billion, the equivalent of almost 2.5 years of electricity sales of the entire sector (Ferreira 2000). These credits were utilized to cancel delayed payments of state power distributors for purchased electricity from Eletrobrás and federal tax.
- 11 In order to avoid a concentration of market power, the market share of generation and distribution/commercialization should be less than 20 per cent at the national level, or less than 25 per cent at the regional level in Southeast and South and 35 per cent in North, Northeast, and Central-West.
- 12 Final demand will depend on macroeconomic performance, and cost variables will fluctuate depending on the exchange rate, fuel prices, and interest rates.
- 13 Actually, they have an incentive to sell at any price, because electricity is not storable.
- 14 It is reported that EDF and AES will dissolve the consortium in Brazil by an exchange of shares, where EDF will concentrate in Light and AES, which also controls ex-Cesp generator Tietê, will take Eletropaulo Metropolitana.
- 15 Since the power shortage of 2001 revealed an urgent necessity to expand generation-transmission capacity, the government announced in December 2001 that the privatization of Eletrobrás would be suspended for an undetermined period in order to increase investment based on centralized decisions.
- 16 Detailed information on investment can be found at <http://www.provedor.nuca.ie.ufrj.br/Eletobras/>.

TABLE I

Results of Privatization in Brazil (as of July 2001)

(U.S.\$ million)

Program	Revenue in Cash	Transferred Debt	Total Result
National Denationalization Program (PND)	28,234	9,201	37,435
Telecommunication (Telebrás)	28,793	2,125	30,918
State governments	27,919	6,751	34,670
Total	84,946	18,077	103,023

Source: BNDES web page (<http://www.bndes.gov.br/privatizacao/pndnew.asp>), accessed in April 2002.

TABLE II

Growth in Electricity Transmission Lines, by Voltage Capacity

(km)

Year	69KV	88KV	138KV	230KV	345KV	440KV	500KV	525KV	750KV
1970	16,418	1,593	14,531	6,050	2,228	1,097			
1975	22,996	2,082	22,522	11,854	4,405	2,873			
1980	29,094	3,396	31,929	17,700	6,669	5,778	6,185	361	
1985	34,493	3,569	37,587	22,715	7,478	5,763	7,920	1,545	568
1990	37,600	3,437	45,953	26,996	7,434	5,652	14,783	1,612	1,782
1995	39,084	3,529	51,913	28,381	8,545	5,923	13,973	1,612	1,783
2000	39,986	3,291	56,080	34,050	8,952	6,498	18,617	1,612	2,379
Growth rate (%: annual average):									
1970s	5.7	7.6	7.9	10.7	11.0	16.6	-	-	-
1980s	2.6	0.1	3.6	4.2	1.1	-0.2	8.7	15.0	-
1990s	0.6	-0.4	2.0	2.3	1.9	1.4	2.3	0.0	2.9

Source: Eletrobrás, Sistema de Informações Empresariais do Setor de Energia Elétrica, *Relatório estatístico de linhas de transmissão e subestações*, various issues.

TABLE III

Privatization in the Electric Power Sector

Name of Firm	Year	Seller	Sub-sector	Value (U.S.\$ Million)	Acquirer	Partners
Escelsa	1995	Federal	D	520	Iven and GTD* (BR)	
Light	1996	Federal	D	2,508	EDF (France)	AES (U.S.)
CERJ	1996	Rio de Janeiro	D	587	Chilectra (Chile)	Enersis (Chile)
Coelba	1996	Bahia	D	1,598	Iberdrora (Spain)	Previ (BR)
Cachoeira Dourada ⁺	1996	Goias	G	714	Endesa (Spain)/Enersis (Chile)	
CEEE Centro-Oeste	1997	Rio Grande do Sul	D	1,372	AES (U.S.)	
CEEE Norte-Nordeste	1997	Rio Grande do Sul	D	1,486	VBC (BR)	CEA (U.S.), Previ (BR)
CPFL	1997	São Paulo	D	2,731	VBC (BR)	Bonnaire (BR)
Enersul	1997	Mato Grosso do Sul	D	565	Escelsa (BR)	
Cemat	1997	Mato Grosso	D	353	Rede/Inepar (BR)	
Energipe	1997	Sergipe	D	520	Cataguases-Leopoldina (BR)	
Cosern	1997	Rio Grande do Norte	D	606	Iberdrora (Spain)	Previ (BR)
Coelce	1998	Ceará	D	868	Enersis (Chile)	Endesa (Spain)
Eletropaulo Metropolitana	1998	São Paulo	D	1,777	AES (U.S.)	EDF (France), Houston (U.S.)
Celipa	1998	Pará	D	388	Rede/Inepar (BR)	
Elektro	1998	São Paulo	D	1,489	Enron (U.S.)	Power Holding (U.S.)
Eletropaulo Bandeirante	1998	São Paulo	D	860	CPFL (BR)	EDP (Portugal)
Gerasul [!]	1998	Federal	G	880.2	Tractebel (Belgium)	
Cesp-Parapanema	1999	São Paulo	G	682	Duke Energy Co. (U.S.)	
Cesp-Tietê	1999	São Paulo	G	472	AES (U.S.)	
Celpe	2000	Pernambuco	D	1,004	Iberdora (Spain)	Previ, BB Banco de Investimentos (BR)
Cemar	2000	Maramhão	D	289	Pennsylvania Power & Light (U.S.)	
Sealpa	2000	Paraíba	D	185.1	Cataguases-Leopoldina (BR)	

Source: <http://www.bndes.gov.br/pndnew/compriv.htm>.

Note: VBC = consortium composed of Brazilian business groups, Votorantim, Bradesco, and Camargo Correa. GTD = group of pension funds. G = generation. D = distribution. BR = Brazil.

* Later acquired by EDP of Portugal.

⁺ Generation of CEG (electricity company of the State of Goias).

[!] Generation of Eletrosul of Eletrobrás.

TABLE IV

Adjustments of Employment and Investment during the Ownership Reform Period

	Employment (Number of Employees)			Fixed Assets (R\$ Billion at Current Prices)		
	Before Privatization	After Privatization	Rate of Reduction (%)	1995		
				(a)	2000 (b)	(b)/(a)
Firms privatized:						
Escelsa	2,789	1,604	42	638	1,510	2.37
Light	10,618	6,142	42	6,472	7,369	1.14
CERJ	4,806	1,842	62	509	1,688	3.31
Coelba	6,494	3,541	45	1,601	2,343	1.46
CPFL	6,786	3,842	43	2,701	4,419	1.64
Enersul	2,017	1,048	48	605	721	1.19
Cemat	2,483	1,479	40	796	792	0.99
Cosern	1,615	656	59	239	329	1.38
Celpa	2,914	2,243	23	785	835	1.06
Coelce	3,510	1,775	49	569	1,556	2.74
Celpe	3,838	2,158	44	568	715	1.26
Cemar	2,147	1,689	21	524	571	1.09
Firms deverticalized and partly privatized:						
CEEE*	8,760	4,184	52	5,061	5,875	1.16
Eletropaulo*	18,199	11,542	37	11,567	11,203	0.97
Cesp*	10,165	6,649	35	22,124	28,549	1.29
Firms not privatized:						
Eletrobrás*	24,311	12,625	48	76,207	77,801	1.02
CEMIG	16,452	11,648	29	10,201	9,364	0.92
COPEL	8,835	6,142	30	4,918	6,225	1.27

Sources: Demonstrações Financeiras Padronizadas (DFP) published annually by each company (available from the sub site "companhias abertas" of the website of the Comissão de Valores Mobiliários [CVM] -- <http://www.cvm.gov>).

* Figures after privatization and for the year 2000 aggregate those companies which were separated in the process.

Figures for firms not privatized are simply comparisons between 1995 and 2000.

TABLE V

Changes in Shareholders' Equity/Total Liabilities Ratios

	1995	1996	1997	1998	1999	2000
CEMIG	0.7446	0.7122	0.7094	0.7073	0.6616	0.6577
COPEL	0.6979	0.6502	0.6536	0.6306	0.6012	0.6156
Eletrobrás (consolidated)	0.6588	0.6456	0.6349	0.6794	0.6975	0.6815
Gerasul				0.5716	0.5435	0.5334
CEEE	0.5440	0.4484	0.3329	0.2412	0.2168	0.2143
RGE			0.6354	0.6493	0.5912	0.5168
AES Sul			0.5952	0.3262	0.1249	0.0488
Eletropaulo (Metropolitana)	0.5352	0.4135	0.5140	0.3102	0.3346	0.2904
Bandeirante				0.3139	0.2280	0.2495
Cesp	0.5322	0.5144	0.5373	0.5795	0.5449	0.5467
Elektro				0.4687	0.5027	0.4699
AES Tietê					0.2243	0.3338
Duke Paranapanema					0.6446	0.6181
Escelsa	0.8030	0.8012	0.5082	0.4889	0.3864	0.3623
Light	0.8498	0.6932	0.6648	0.3785	0.2761	0.2397
CERJ	0.2230	0.2558	0.2552	0.1531	0.1033	0.1372
Cachoeira Dourada		0.8139	0.7812	0.7940	0.7741	0.8044
Coelba	0.5742	0.5324	0.5077	0.4954	0.4221	0.4451
CPFL	0.7498	0.6916	0.5389	0.5029	0.6999	0.6814
Enersul	0.5204	0.4233	0.4772	0.5577	0.4814	0.4818
Cemat	0.2433	0.0226	0.4330	0.4103	0.3303	0.2474
Energipe	n.a	n.a.	0.5737	0.6054	0.5649	0.6633
Cosern	0.4000	0.4575	0.2521	0.2809	0.3616	0.4811
Celpa	0.4737	0.4663	0.4253	0.5085	0.4606	0.4173
Coelce	0.5894	0.5435	0.5100	0.4630	0.6996	0.6482
Celpe	0.7351	0.6924	0.7009	0.6014	0.5735	0.4888
Cemar	0.6718	0.6130	0.5771	0.4903	0.4694	0.2966

Source: Same as Table III.

Note: Shaded cells correspond to private ownership.

TABLE VI

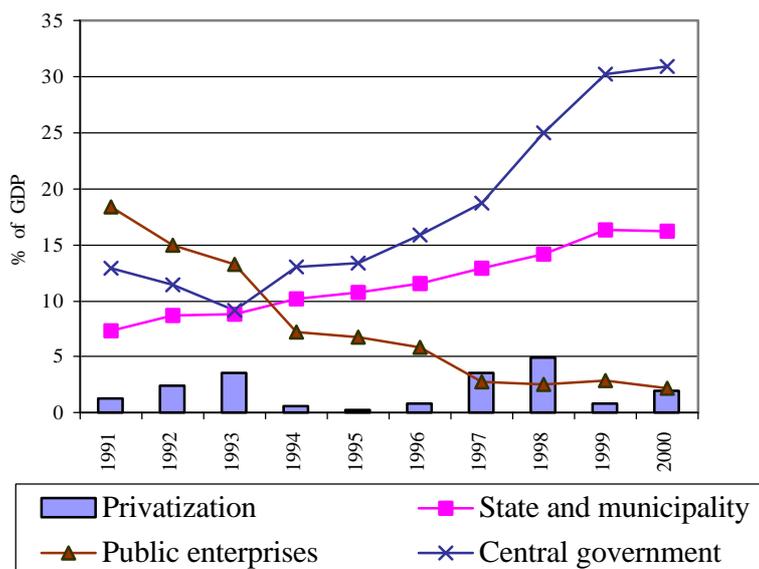
Changes in Operational Profits

(R\$ million)

	1995	1996	1997	1998	1999	2000
CEMIG	109,357	307,388	266,086	213,090	-96,727	434,655
COPEL	102,754	160,585	272,507	327,660	286,043	448,347
Eletrobrás	-1,895,716	1,514,945	1,093,839	2,405,358	1,626,768	3,070,843
Gerasul				-13,574	-111,279	206,733
CEEE	-104,127	-523,887	-690,940	-235,163	-230,299	-149,268
RGE			-21,233	37,127	-77,479	-77,226
AES Sul			10,175	20,536	-482,504	-168,963
Eletropaulo	-537,456	207,734	-436,433	391,803	376,591	161,078
Bandeirante				-108,768	-181,886	160,495
Cesp	-168,409	-491,482	-1,188,147	-540,007	-2,055,299	-307,494
Elektro				72,913	-486,182	-79,525
AES Tietê					-194,468	93,672
Duke Paranapanema					-47,669	16,619
Escelsa	-135,742	119,316	131,117	107,982	-185,923	10,887
Light	-4,192	133,186	227,448	-555	-404,706	-465,939
CERJ	-59,845	-264,185	28,665	60,101	-45,687	-97,821
Cachoeira Dourada		n.a	1,859	47,072	41,112	68,086
Coelba	-159,105	-4,987	95,242	3,257	-102,805	127,397
CPFL	-53,626	179,892	174,290	199,347	79,043	80,425
Enersul	23,088	-108,683	-63,876	4,640	-50,838	17,091
Cemat	-86,943	-152,936	-126,703	-21,383	-101,401	-128,457
Energipe	n.a	n.a.	-3,404	401	-18,355	-4,126
Cosern	-4,008	2,712	-79,206	38,303	20,993	78,855
Celipa	-73,519	42,437	-56,731	-3,440	11,572	-11,361
Coelce	-11,961	17,920	1,991	21,845	46,419	51,347
Celpe	32,732	22,402	26,004	7,757	10,771	-97,823
Cemar	-40,983	-28,182	13,265	-56,525	-106,365	-177,959

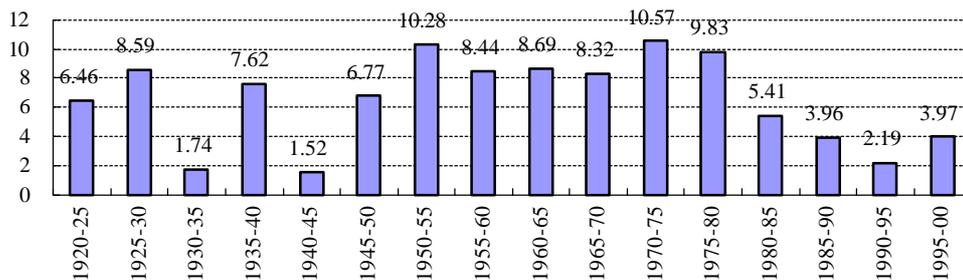
Source: Same as Table III.

Fig. 1. Results of Privatization and Stocks of Public Debt at Each Administrative Level



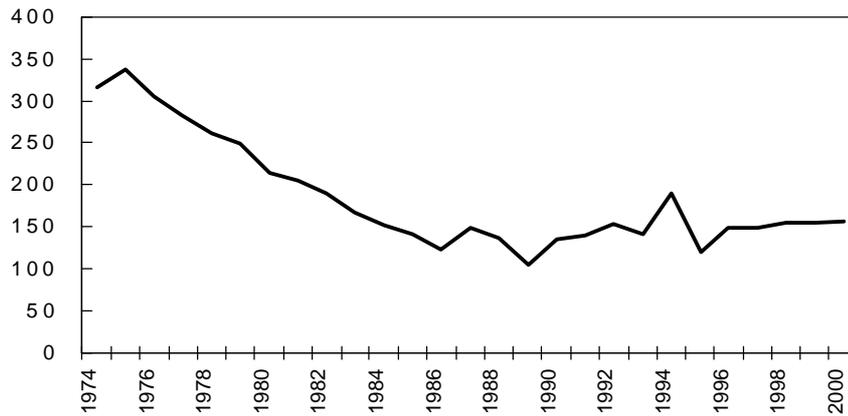
Sources: Results of privatization are periodically published by BNDES, <http://www.bndes.gov.br/privatizacao/pndnew.asp>; stocks of public debt are taken from IPEA data, <http://www.ipeadata.gov.br/>. Both accessed in April 2002.

Fig. 2. Installed Electric Power Generation Capacity: Average Annual Growth Rate (%)



Sources: 1920-80: Comitê Nacional Brasileiro da Conferência Mundial da Energia, *Estatística Brasileira de Energia*, vol. 5 (1981); 1985-2000: Ministério de Minas e Energia, *Balço Energético 2000*.

Fig. 3. Changes in the Electricity Tariff for Residential Users (R\$ at 2000 prices)



Sources: Eletrobrás, *Anuário de Tarifas de Energia Elétrica*, 1993; and Eletrobrás, *Tarifas Médias do Mercado de Energia Elétrica-Síntese*, 2001.

Fig. 4. Public Ownership Structure before the Reform

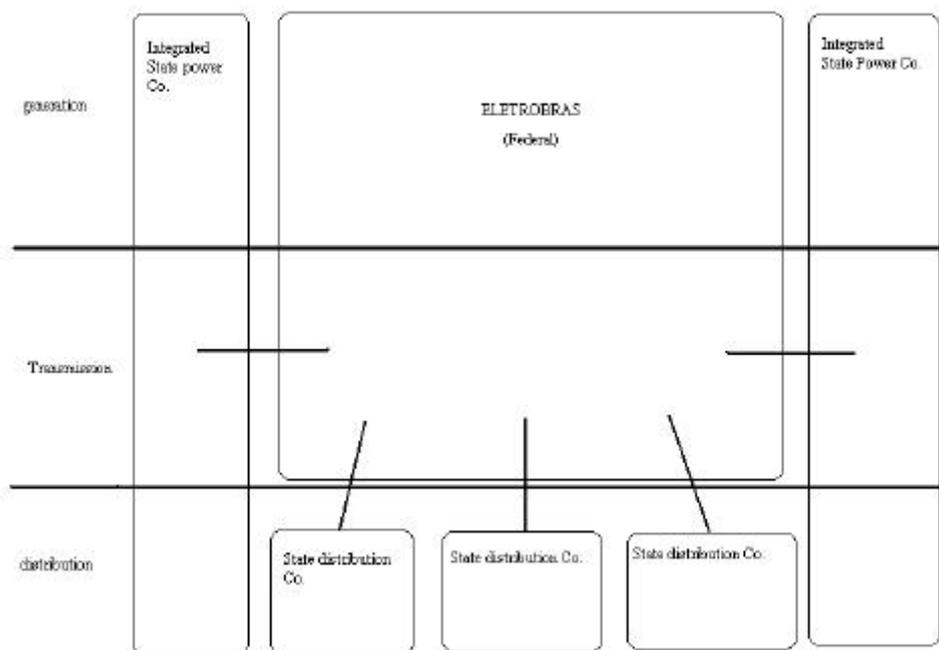


Fig. 5. Privatization Ownership Structure Proposed by the CL Report

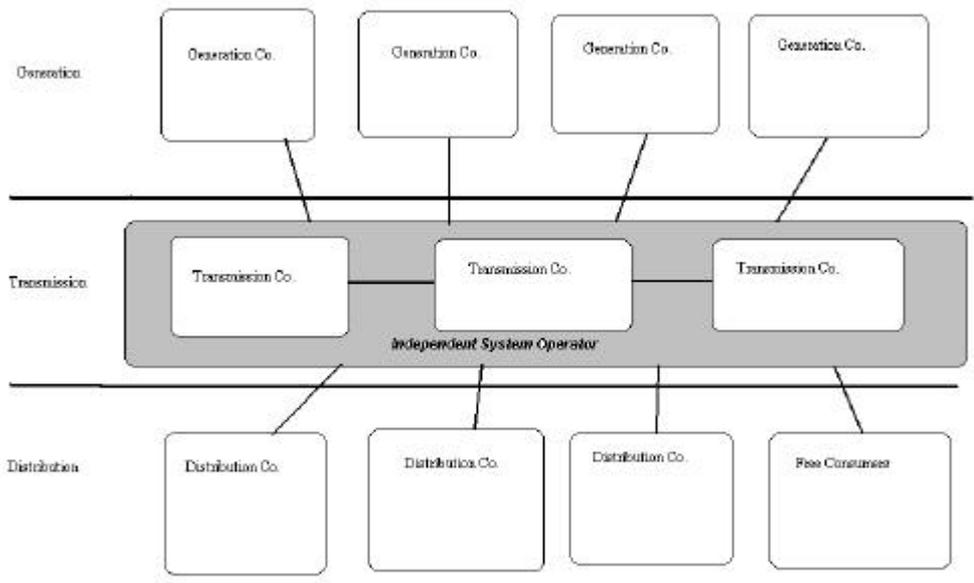
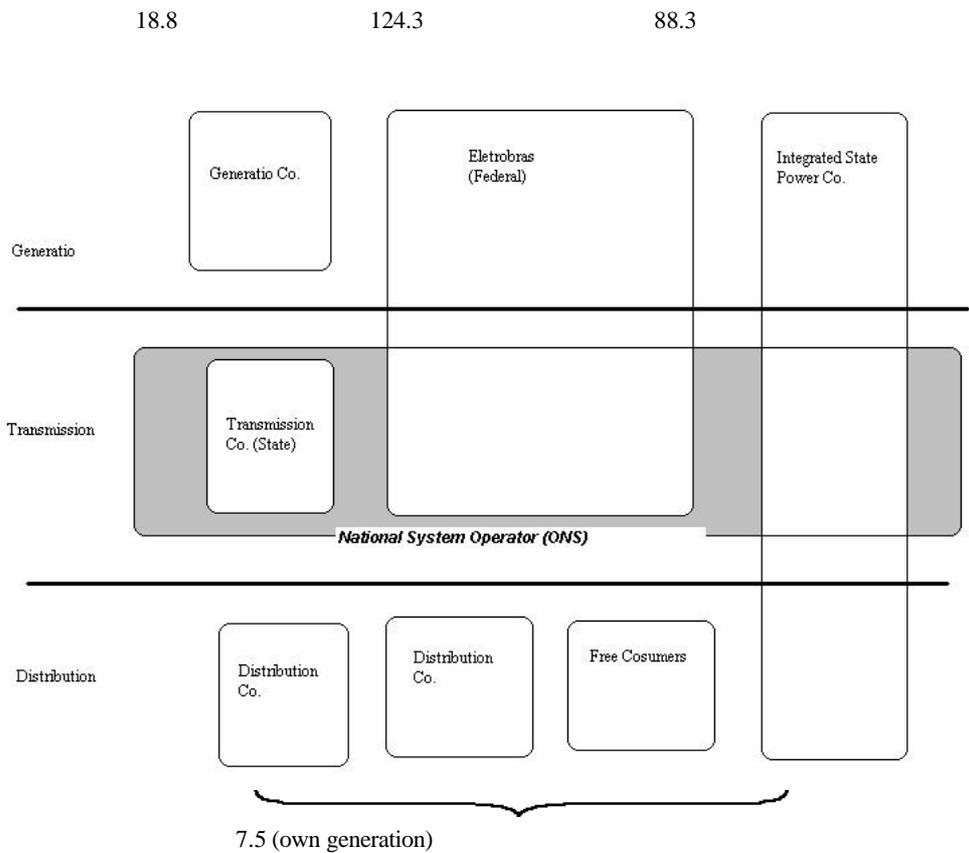


Fig. 6. Current Ownership Structure after the Partial Reform of Ownership



Note: Figures show electricity generated in 2000 (in 1,000 GWh), obtained from BNDES, "Ranking 2001: Setor Eléctrico," *Cadernos de Infra-Estrutura*, vol. 1, Rio de Janeiro, 2001.

Chapter 5

High-tech Brazil: Challenge of Local Innovation Systems

Nobuaki Hamaguchi

I. Introduction

Brazil constitutes a group of a small number of developing countries exporting technology intensive products. Table 1 includes technology intensive manufactured products such as aircrafts, automobiles, and cellular telephones. The government initiatives in the past shaped the core part of the Brazilian aircraft technology, which was further sophisticated after the deep structural transformation and internationalization in the 1990s. A privatized national company Embraer is the fourth largest aircraft producer competing for the third rank with Bombardier from Canada.

It is to be also noted that even some primary products appearing to be natural resource based actually contain high technology contents. Take soybeans as an example. Soybean exports increase was made possible by expansion of plantation in the vast semi-arid inland area. The national agricultural laboratories of EMBRAPA created biologically modified seeds and developed the method of optimum application of calcium to transform acid soil arable. Consider also the case of petroleum. Since most of crude oil reserves in Brazil are found in a deep sea, exploration projects require highly sophisticated search technology. Petrobras, a national oil company, spent R\$1.5 billion during 1995-2001 for research and development. (Petrobras, Relatório de Gestão 2002, p.23)

On the other hand, in some cases high technology products may actually have little local technology contents. Automobile industry in Brazil developed by foreign technology and local parts suppliers were also grown together. Yet, in the climate of the liberalization in the 1990s multinational auto parts firms largely acquired competent local suppliers and others were replaced by imports. In these events, local technological capability was considerably lost while increasing the dependence on foreign technologies. Cellular telephone equipment exports have become significant only recently. Since the import

substitution of telecommunication equipment and informatics failed to establish electronic component industry, increasing exports of cellular telephones contain least local technological contents, provoking large volume of imports of parts and components at the same time. Exports of foreign technology dependent products like automobiles and cellular telephones have been especially helped by devaluation of the real in recent years which encouraged multinational enterprises to utilize their production in Brazil as the export base to neighboring countries. Their competitiveness also depends on tax incentives offered in specific locations. These kinds of exports will not construct a solid basis of the export structure because multinational companies can easily switch their export platform from one country to another.

In the era of the globalized economy, a semi-industrialized country like Brazil should facing a challenge to increase own technological capability. Although there is no doubt to say that the national R&D efforts have already made significant contribution to widening exports variety, much more local R&D is required to have more solid and diversified export structure.

Currently, the R&D expenditure in 2000 represented only 1.4% of GDP and 60% of them comes from the public sector (Figure 1). This contrasts to the case of OECD countries where private enterprises' expenditures account for 65-75% of the total R&D (OECD, Main Science and Technology Indicators). The government is eager to stimulate private R&D and introduced at the federal level such measures as *Fundos Setoriais* (Sector Funds) managed by the FINEP – a science and technology development fund under the Ministry of Science and Technology. Given that the financial constraint is the highest obstacle for private R&D, the funds has financing for R&D activities of private companies allocated to designated sectors as well as co-research projects with universities. In addition PDTI/PDTA (Program for Industrial/Agricultural Technology Development) established by Law 8661/93 and modified by Law 9532/97 provides tax incentive for R&D. Most of beneficiaries of this program are large firms, including local subsidiaries of multinational firms. The new Informatics Law (8248/91 and renewed by Lei 10176/01) in turn provides tax incentives to R&D expenditures in area related to informatics technology.

At local level incipient attempts are being made to help newly established technology based firms to grow by nursing in incubators. According to the survey by National Association of Promoters of Advanced Technology Enterprises – ANPROTEC, there are currently 183 incubators in operation in Brazil, increasing from 12 in 1992. Out of them 147 are located in Southeast and South Region and 57% are considered as technology based ones. 47% are privately owned non-profit seeking and 42% are controlled by federal and local governments. 67% of them incubate less than 10 firms. A half (49%) of incubated firms are of electronics-information technology – telecommunication complex and only 4% are of biotechnology. 47% of entrepreneurs own undergraduate degree and 21% received graduate education. Many of these firms are originated from university research.

It should be recalled that scientific production is intensely concentrated regionally. Table 2 indicates that almost 70-80% of graduate students in biology and engineering are located in Southeast region while other 15% are in South. Naturally, technology based industrialization tend to agglomerate in these regions.

While the federal level effort to ease the bottleneck of finance is considered vital, our argument here is to stress importance of taking geographical dimension of innovation. Namely we emphasize that in practice new ideas of production tend to emerge interaction of related agents and the facility of interaction has much to do with the distance among them. Several scholars like Cassiolato & Lastre (2000) have developed a compelling argument justifying the concept of the local innovation system (LIS) in the Brazilian context, as an analog to the national innovation system idealized by Nelson (1996) and others. According to them the local system will capture production linkage among firms and involvement of related agents other than firms themselves such as universities and other scientific research institutions, workers, local government, and civil societies, promoted by shorter inter agent distances.

The concept of a LIS coincides with a cluster, which is a spatial concept of agglomeration of industries in particular location. We consider LIS as a subset of a cluster, differentiating from other kind of cluster by its very nature of orientation toward creation of products and production methods that are new to the industry. In contrast, a non-LIS

type cluster is based on technologies either already locally standardized or adapted from outside. Following Nelson (1996), information on technology is a public good in such places. Firms do not compete trying to be differentiated from each other, but they collaborate to use the shared technology in most efficient way. Thus, the centripetal force of agglomeration is the frequency of interaction among firms. This type of cluster can be modeled in consistency with neoclassical perfect competition model: i.e., $Q=A(N)f(\cdot)$, where Q is the sector output, A is an increasing function of the size of local firms N capturing Marshallian externalities, and $f(\cdot)$ is a constant-to-return production function.

In contrast, firms in LIS seek competitive advantage by enlarging technological differentiation to capture monopolistic rent, following the pattern of the Schumpeterian competition. Such differentiation can be made by incorporating innovative scientific research results. Unless such knowledge flows can be generated inside the firms, private interactions with universities or research institutes are imperative. Even when R&D is internalized, firms should rely on supply of highly educated human resource produced by universities. Thus, firms are attracted by accessibility to universities and research institutions.

Such distinctions lead to different policy implication to local authorities. In the case of non-LIS cluster, local governments are required to support institutions for sharing local knowledge such as local vocational training center, formation of chambers and cooperatives, and arrangement of subcontracting works. For LIS cluster promotion of interaction between local academic institution and firms are most welcome, including joint research, matching of university researches and firm business interest, and spin-off of university researchers establishing their own companies.

This paper consists of three case studies of the LIS type clusters representing different scenarios of industrial policy. The first story is about the case of telecommunication equipment in Campinas of São Paulo State. There, original national technology was developed under the government initiatives but as the result of disorganized privatization and market opening resulted in hollowing out of the major part of the previous efforts leaving only small niches of business. However, the intensified competition has made the

locational advantage of the region reevaluated to become one of the most interesting places for technology-based multinational firms because of its strong academic and research base. The second example relates to the most successful case of aircraft industry in São Jose dos Campos of São Paulo State. The initial strong government initiative played a decisive role in formation of sound technological basis and then with privatization the industry made successful transition to local private ownership with strategic alliance with foreign capitals. The third case deals with emerging biotechnology industry in Belo Horizonte of Minas Gerais State. Apart from the previous two cases, there was no government initiative even at the initial stage of its development. Still, there have been some important development led by spin-off of university researchers. Firms are born small and struggle to grow bigger on the basis of their technological competitive edge. Although local arrangements are being organized in systematic way and there is strong local political will to support, firm growth tend to be constrained by limited access to financing. Such constraints may lead to convince them to sell off the developed technologies to multinational firms.

II. Campinas – Telecom Equipment

Brazilian telecommunication industry was restructured by the Telecommunication Law of 1962 that put the national telecommunication system under the coordination of a federal agency. Telebras was then created as the holding company of state level local telephone service companies and the long-distance call operator Embratel. Telebrás exerted monopolistic power in procurement of equipments as a tool of industrial policy⁷. Initially telecommunication equipments were supplied only by local subsidiaries of multinational firms such as Ericsson, NEC, and Equitel/Siemens. Telebras promoted competition of the three firms by utilizing its monopsonic procurement power inducing them to bring the latest technology to Brazil.

⁷ The procurement policy was guided by the following principles: (i) diversification of suppliers in order to avoid monopolization or excessive fragmentation of the market; (ii) organization of purchases in clusters according to kind of equipment and geographical area they will be used in order to rationalize operation and maintenance; and (iii) planning the expansion of services within a five-year interval with the specification of the equipment to be ordered to allow the industry to organize production accordingly (Bastos, 1995: p.9).

Later, Telebras gradually established an industrial policy to absorb foreign technology and substitute a part of market share by national brand. It started an ambitious project targeting the development of the pulse code modulation component in 1973 recruiting professors of University of São Paulo. This endeavor was pursued more systematically after the Telebras' creation of a research and development center CPqD (Centro de Pesquisa e Desenvolvimento) in 1976. Activities of CPqD broadly varied from electronic switching, digital transmission, optical communication, data and text communication, and satellite communications.

The location of CPqD was chosen in Campinas, located at 100 km to the north of the state capital. The location choice was influenced by the existence of São Paulo State University of Campinas (Unicamp) founded in 1966, taking Massachusetts Institute of Technology as a model to create the center of excellency in research and graduate programs especially in hard sciences. In the related area of electronics, and information and telecommunication technology, Unicamp embodied the Faculty of Electric Engineering and Computation (FEEC), and the Institute of Physics (know as Instituto de Física Greb Wataghin – IFGW) which developed intense interaction with CPqD. Moreover, Campinas has a Catholic University (PUCCAMP), University of São Francisco (USF) and Campinas Technical School (COTUCA), a vocational education unit of Unicamp, offering specializing course in electronics and telecommunication.

According to Dahlman and Frischtak (1993), in 1988 CPqD was the largest and most sophisticated applications laboratory in Latin America. It employed 400 professionals directly engaged in R&D with about US\$ 60 million of allocated budget. Yet, for CPqD's too broad activities without particular focus, the resource was not enough. Coupled with lost opportunities to take advantage of cheaper international technologies, government R&D efforts were considered slow and not very effective (Dahlman and Frischtak 1993: pp.437).

CPqD established a joint-venture with a national private group Procom a manufacturing firm producing the locally developed communication equipment Trópico. An early models were put into practice in the 1980s but due to its limited capacity they were installed only in rural area. After the introduction of high capacity model Trópico RA in 1991, Telebras

preferentially procured it and by the mid 1990s, Trópico already divided almost equal market share with other multinationals. (Szapiro, 2000) Today Trópico model commutation equipment is produced by Promom and also licensed to a French multinational Alcatel.

CPqD was transformed into a private foundation following the privatization of Telebras in 1998 and its role of the integrator was lost. Yet, there is no doubt about that the presence of CPqD was a critical mass leading to a formation of the current local productive arrangement for technology based manufacturing in Campinas.

First, the frequent interaction with CPqD marked strong characteristics in research and education orientation in local universities. In Unicamp, FEEC (<http://www.fee.unicamp.br/FEEC-nova/index2.htm>) has over 100 professors in its eleven departments and its graduate program of has about 550 students in the field of industrial automation, biomedical, computer science, and application of electronics to microelectronics e opticonics, energy, telecommunication, and telemetric. They produce more than 60 master degrees and 40 doctor degrees annually. Their program is nationally renown as the only one that is given the highest grade of CAPES, the higher education evaluation office of the Ministry of Education. Institute of Physics (<http://www.ifp.unicamp.br/>), with 94 professors and 186 graduate students and 458 undergraduate students, confers 25 to 25 master and doctoral degrees annually. Their graduate program also receives the highest grade of CAPES.

Secondly, many local firms in the related business were born. Since 1973, IFGW has worked with CPqD for the development of optic telecommunication technology, leading to foundation of Xtal, the largest optic fiber producer in the domestic market. Another case of spin-off was AsGa, founded by ex-director of IFGW aiming at production of optic-electronic component for electric/optic signal converter. IFGW is recently implementing joint R&D projects in the advanced optic fiber technology with companies such as Ericsson which established a research center in Campinas. From CPqD itself, one of its former researcher (and a graduate of IFGW, too) founded OptoLink, a producer

of optic amplifiers and connectors. The following is a partial list of Campinas-based local companies.

Brazilian firms

Art Craft Produtos Ópticos Ltda. New materials/ Optics
Bioluz- Equipamentos e Serviços Ltda. New materials/ Optics
Carel Indústria Óptica Ltda. New materials/ Optics
Fausto Becca
Fiber Work- Tecnologia de Comunicações Ópticas New materials/ Optics
Fybercom
Ideal Brasil
LR Telecom
Nalitel Telecomunicac. e Teleinformatica
Neger Telecom
Montmartre Produtos Ópticos Ltda. New materials/ Optics
Optolink
Darumatec Digital telephonic assistance systems
Consórcio Tess Telecomunicações Telecommunications
Emerson Electric do Brazil Ltda.
AsGa Microeletrônica S.A. New materials/ Optics
Redein Telecommunications
Promon - Trópico Sistemas e Telecom. S.A. Telecommunications
Celtec / Celplan Ltda.

The Brazilian government reformed the Law of Informatics in 1991. While the old law aimed to import-substitution by practically prohibiting imports of electronics parts, the new law changed aims to stimulate innovation in information technology related area by giving a firm tax reduction when it invest no less than 5% of its revenue in research and development. Since 2.3% out of this can be spent for contracting research institution or university, demand for interaction with CPqD and Unicamp was stimulated. Thus, telecommunication equipment producer such as Promon and Zetax were concentrated in Campinas looking for proximity to CPqD.

Thirdly, availability of skilled labor attracted a number of multinational firms of informatics and telecommunication equipment industry⁸.

Telecommunication technology related foreign enterprises in located in Campinas area.

Compaq do Brasil (Computing)	USA
DEC (Computing)	USA

⁸ Other than telecommunication technology related, there are increasing localization of automobile industry in Campinas and its surroundings, such as Toyota, Honda, Mercedes-Benz.

IBM (Computing Research Center)	USA
Hewlett- Packard Brasil S/A (Computing/ Bank automation)	USA
Texas Instrumentos Eletrônicos do Brasil (Computing/ Electronic components)	USA
Avex Electronics do Brasil (Computing/ Goods manufacture)	USA
SCI Systems-Advanced Electronics Technologies (Computing/ Goods manufacture)	USA
GE Plastics (Blades and Cover)	USA
FiberCore Inc/Xtal Fibras Ópticas S.A (New materials/ Optic Fibers)	USA
Motorola do Brasil Ltda. (Telecommunications/ mobile telephony and pagers)	USA
Nortel Comércio e Serviços Ltda. (System integration and data communication)	Canada
Fibercore Inc. (Telecommunication)	USA
Lucent Technol Network Systems Brasil S/A (Telecommunication)	USA
Alcatel Telecomunicacoes (Telecommunication)	France

The concentration of high technology firms has also very much to do with the deregulation process. Privatization of the telecommunication service abolished the monopsonic procurement power entitled to Telebás. Newly installed telecommunication companies found the telecommunication infrastructure severely under-invested and operated under obsolete technology. Such regulatory framework change created expectation for huge demand for equipment with the state-of-art technology. This paved the way to entry of foreign companies such as Alcatel, Lucent, Nortel and Cisco Systems. Most of them established local production because of tariff reduction in the early 1990s and the new law of informatics of 1991 liberalized imports of equipment and electronic parts. Newly entered multinational firms do not engage in R&D but provoked large inflow of imports of parts. Trade deficit of the sector reached to US\$ 2 billions annually in 1996-2001. (Oliva, 2002)

Although regulatory framework change has led to expansion of the market and promoted internationalization of the telecommunication equipment industry, the sector increased dependence on foreign technology and autonomy of local innovation was lost⁹. De Souza et.al (2001) considers that the new institutional framework contributed to attract foreign investment and new technology but reduced the degree of internalization of technology in the local production chain, contributing the significant part of the trade deficit, and reduce

⁹ De Souza et.al (2001) reports that CPqD's difficulty after the privatization having to survive with small projects rather than long-term strategic ones like Tropicão and training service to local enterprises which end up inducing outflow of personnel to such companies.

the chance of spillover. Porto et.al.(2000) also pointed out that the structural change in the 1990s provoked profound “dismantling” of the telecommunication equipment agglomeration.

The regulatory reform gave profound impact on the local firms as well. CPqD was reestablished as a private consulting firm and lost the characteristics of the integrator of the local innovation system. Several firms were acquired by foreign enterprises. An American firm Fiber Core recently acquired Xtal (Xtal Fiber Core Brasil as it is now called). Zetax was acquired by Lucent together with Batik of Minas Gerais in 1999. As for the companies remaining in the market, Promon established manufacturing plant in Manaus, away from Campinas, seeking for tax incentive in the Free Zone. Promon recently accepted a minority participation of Cisco Systems which still does not have its own local production unit in Brazil. AsGa, one of CPqD spin-offs, could not compete in the electronic component market and sought to survive by switching specialization to produce equipment such as optic modem with imported parts.

Although Campinas area is sometimes dubbed Brazilian Silicon Valley because of the high concentration of high technology based big names, Cassiolato et.al (2001) remarked that operations of these companies do not necessarily represent high technological intensity. The new Informatic Law certainly give incentive to local R&D but since R&D is too broadly defined by the Ministry of Science and Technology to include workers training, international trips, adaptation of foreign products (so-called nationalization), and technical services, the current tax incentive scheme tend to distort toward such lower intensity “R&D”. Furthermore, while technology-based firms were attracted to Campinas area by the technological spillover of CPqD in the past, these new coming multinational firms are attracted only by opportunities to hire well-educated workers than the technological dynamics that the region can offer through interaction of research and production. Thus, as Diniz and Razavi (1999) worries, “Campinas will increase its role as an assembly platform with weak supply links to national and local industries.” Such scenario may depend on Brazilian market prospectives. Companies such as Nortel and Motorola have announced an intention to establish research and development units in Campinas integrated in their global innovation network.

III. São Jose dos Campos

São Jose dos Campos is also 100 Km away from the São Paulo State capital, yet to the east along the Dutra Highway connecting São Paulo and Rio de Janeiro. Not only the distance but the city also shares similar characteristics to Campinas. Local innovation system of São José dos Campos is also based on establishment of MIT-modeled research center in 1945 – Centro Tecnológico Aeroespacial (Aerospace Technology Center), which was later complemented by establishment of a higher education institution Instituto Tecnológico de Aeronáutica (ITA) in 1950 and a special research institute Aerospace Research Institute (Instituto de Pesquisas Espaciais, INPE) in 1961. During the 1950s and 1960s, ITA became the most prestigious engineering school in Brazil (Diniz and Razavi, 1999: p.114)

State owned aircraft company Embraer was in turn founded in 1969. Embraer was created with the research and management personnel from the Research and Development Institute (IPD) of CTA. The blue prints of Embraer's first products like Ipanema (for agricultural works) and Bandeirante (for civil market) were also developed by CTA. Embraer initially counted on technical support from foreign companies such as licensing agreement with an Italian firm Aeromacchi for the production of military aircraft Xavante and general engineering support from Piper Aircraft Company of the USA. In the 1980s, Embraer launched AMX project to produce subsonic military aircrafts in cooperation with a joint project with Italian Aeritalia and Aeromacchi. Such experience of technology learning from foreign companies were crucial for formation of development strategy of Embraer¹⁰.

While other import-substitution industries focused on increasing the degree of nationalization, Embraer pursued completely different strategy. The company did not intend to deepen vertical integration but made long-term parts supply contract with foreign suppliers. Instead, Embraer concentrated its effort in design and final assembly. Bernardes (2000) quotes Dagnino (1994) that “if the aircraft industry organization had insisted in nationalization of parts, the production costs could have been even prohibitive

¹⁰ These technical cooperation programs enabled substantial technology transfer to Embraer including training of the personnel in the advanced production facilities in overseas. (Cassiolato & Lastres, 2002: p.17)

and Embraer's market entry could have been substantially delayed (because of the small scale, instable market condition, less reliable quality and underdeveloped technology).” Only the production of fuselages was internalized because it was considered as the key technological area that cannot be learned from overseas. (Bernardes 2000: p.17) In other words, Embraer has identified itself as a final assembler with technological autonomy based on the capability to systemically integrate available advanced technology of the world. Government agencies like National Bank for Economic and Social Development (BNDES) and Banco do Brasil offered buyers credit to streamline the sales. The result was spectacular. The bimotor turboprop airplane Bandeirante one third of the US market of commuter line aircrafts with 10-20 passenger seats in the 1980s. In the military market, Tucano model training airplane was widely sold to British and French air forces.

Changes in local innovation system

The overall deterioration of the macroeconomic scenario in the 1990s affected the government science and technology projects. In the same way as what happened to CPqD in Campinas, CTA suffered reduction of resources and drain of knowledgeable people. Embraer itself experienced substantial structural changes in the 1990s. Its employment was cut half from the peak level of 12,000 at the end of 1980s to about 6,000 in 1994 when Embraer was privatized. Embraer was acquired by a financial consortium of an investment bank (Bozano Simonsen group) and public enterprise pension funds. During the state ownership period, the management board used to be consisted with members promoted internally but after the privatization the management board was replaced with external professional persons. Employment was further reduced to less than 4,000.

After the privatization, productive arrangement changed substantially. Based on the original strategy of focusing design and system integrating assembly, Embraer sought risk sharing partners who take full responsibility in manufacturing of sub-systems with own investment sharing the commercial risk of the final product. There the competitiveness of product design capability of Embraer was tested and such tenders attracted many internationally known enterprises. On the other hand, through cooperation with global partnership Embraer acquired higher technological standard. The first case was the risk sharing contract with United Technologies – Sikorsky in

development of a civil helicopter where the latter develop and produce the fuel system, fuel tank, and landing train. Through this project, Embraer had first access to the design technique through virtual technology utilizing computer aided three-dimensional interactive application, which turned to be technical standard of Embraer (Goldstein, 2002: p.108).

Embraer started development project of medium-size (50 passenger seats) jet airplane (ERJ-145) in 1989 and the jet aircrafts but the project was stopped because of the lack of finance, even though the quality of its design was of high quality. The project became viable thanks to the participation of four foreign companies (Gamesa, ENAer, SONACA, and C&D Interiors) as risk sharing partners which carried out construction of subsystems such as wing, subsections of fuselage, and interior¹¹. Embraer adapted the concurring engineering with real time connection via CAD/CAM with several project teams. This brought substantial saving of cost both in time and money¹² (Cassiolato 2002: p.41).

The regional jet market expanded in the US and Europe prompted exceptional growth of exports of Embraer. The ERJ –145 jet aircraft was well accepted by the market because it was lighter, quieter, cheaper, and more fuel saving. Compacter variations ERJ-140 and ERJ-135 were derived from the same platform of ERJ-145 to attend differentiated needs of customers. It should be also remarked that even after the privatization, Embraer continued receiving substantial financial assistance for R&D activities from government agencies (FINEP and BNDES), tax incentive in the framework of PDTI, and credit and interest subsidies (PROEX) to buyers¹³.

¹¹ The Spanish company Gamesa was responsible for the production of the wings, engine nacelles, fairings of the wing/fuselage junction and the doors of the main landing gear. Sonaca, headquartered in Belgium, committed itself with the production of the luggage, service and main doors located in the fuselage, besides a front and a rear section of the fuselage and the two motor pylons. The Chilean company ENAer produced the airplane wings and rudder controls. The interior of the passenger cabin and luggage compartment was developed and manufactured by C&D Interiors - one of the largest companies of the world in its specialty. (Cassiolato et.al. 2002, Box III)

¹² Embraer established a Virtual Reality Center with the cooperation of Silicon Graphics Inc. in 2000 with the investment of US\$ 2.6 million.

¹³ Canada filed a complaint to WTO that PROEX is a sort of export subsidy not allowed by WTO agreement and Embraer is threatening Bombardier with unfair competition. The trade dispute was enlarged to NAFTA's ban on

Taking the same steps, Embraer initiated a new project for larger (70 passenger seats) airplane – ERJ-170 – in 1998. Risk sharing partners in this project include General Electric, Gamesa, Hamilton Standard, Latécoère, Kawasaki Heavy Industry, Gamesa, Sonoca, C&D Aerospace, Parker, and Liebherr.¹⁴ According to Cassiolato et.al. (2002) up to 2001, about 95% of the suppliers were located abroad (p.48). Embraer is trying to induce its partners and suppliers to establish production in Brazil but so far only Sonoca established in São José dos Campos an affiliate Sobraer. ELEB (Embraer Liebherr) is in São José dos Campos. Recently, Kawasaki announced to establish a plant in Gavião Peixoto

With the internationalization of partnerships, local factors for innovation is weakened. Although CTA performed fundamental role in creating Embraer, the latter do not depend on CTA's research. ITA is still considered as one of the most prestigious engineering school, but its graduate program is not given the highest grade. It is also said that ITA cannot supply specialists at the same speed as Embraer requires (Forbes Brasil, 25/10/2002: p.33). Embraer created own master program “Program of Specialization in Engineering” in partnership with ITA and Unicamp. .

There are still small number (around 40) of locally-owned suppliers and producer service providers depending on subcontracting of Embraer. Many of them were setup by former Embraer employees. A SERCO (Engineering Service Cooperative) setup in 1995 by former engineers of Embraer as a non-profit organization. The associated firms offer specialized services to Embraer and its risk sharing partners. Owing to the recent boom of aircraft exports, employment level of Embraer is the highest since the beginning of 1990s. A part of the ex-employees are retuning to Embraer's workplace. This existence of a pool of specialized labor has given Embraer a certain flexibility enabling its rapid growth. Availability of highly qualified engineers, in turn, has given agglomeration effect

Brazilian beef imports. Although it was justified on the basis of the suspect of foot and mouth disease, Brazil recognized it as retaliation. The dispute was settled by WTO in favor of Brazil.

¹⁴ GE is responsible for supplying turbines. It then holds 99.6% stake of Celma, a supplier of motors, accessories and parts, located in Petrópolis-RJ. GE also took over Honeywell who supplies most avionics. Gamesa supplies rear fuselage. Kawasaki, from Japan, is developing the central part of the wing. Liebherr established a joint venture with Embraer for the supply of the landing gear.

to technology-based multinational firms in transport equipment and electronic sectors like General Motors, Volkswagen, Ericsson, Panasonic, Philips, and Kodak located in São Jose dos Campos and its vicinity.

IV. Belo Horizonte

Unlike the previous two cities, Belo Horizonte is not a specialized industrial city. It is the state capital of the third largest economy in Brazil, Minas Gerais. So, like other state capitals, Belo Horizonte has highly diversified economic structure with high proportion of service activity. Secondly, Belo Horizonte cannot be seen as a *technopolis* as the previous two because technology-based activity is not really representative. The state is known for its agricultural richness and as the name of the state – the land of all mines – speaks, industrialization of the state was led by metal and machine industry. Hence, in terms of the share in the total industrial production, heavy industries, such as the automobile production complex of Fiat in the outskirts of the city, are still predominant. In this sense, the city economy is more resource based than being technology based. Thirdly, Belo Horizonte did not host a large-scale mission-oriented research institution like CPqD in Campinas and CTA in São Jose dos Campos, through which abundant amount of financial resource was devoted intensively.

Still, there is noticeable development of biotechnology industry¹⁵ in Belo Horizonte. The fundamental vehicle has been the cumulated knowledge in UFMG (Minas Gerais Federal University) from which some entrepreneurial spin-off created competitive firms supported by local institutional arrangement. According to FIEMG (2000), UFMG counts on 161 professors and researchers with PhD degree in the area of biology. The non-profit organization Fundação Biominas serves as the administrative tool to gather newly created firms in its incubator.

The first spin-off from UFMG was Biobras born by biochemist Marcos Luís dos Mares Guia who also founded Institute of Biology of UFMG. The company started production of enzymes in 1976, then engaged in production of insulin as the joint venture with Eli

¹⁵ Another difference from the cases in Campinas and São Jose dos Campos is that the biotechnology is relatively new industry and it was never be a target of import substitution industrialization.

Lilly (USA) in the early 1980s and dominated the domestic market in a few years. The company was sold to Novo Nordisk for US\$ 22 million in 2002, still holding some patents to establish a new enterprise Biom, specialized in development of synthetic insulin.

The 2001 survey by Biominas Foundation identified 304 biotechnology firms creating about 28,000 qualified jobs among which 89 firms (29%) are located in Minas Gerais, being only second to São Paulo which accounted for 129 (42%). (Biominas, 2002) In this, biotechnology firms in São Paulo are suppliers to multinational firms while those in Minas Gerais are independent and locally-owned concentrating in human health products. In Belo Horizonte alone, there are 58 firms with total sales revenue of US\$ 417 million and 4,273 workplaces in 2000, engaging mainly in development of medical diagnostic kits (18 firms) and pharmaceuticals (11 firms). (FIEMG 2000)

Yet, some analysts are still skeptical whether the biotechnology industry in Minas Gerais is as big as to be called “a cluster”.¹⁶ They also cast a doubt that the even that size is exaggerated, given the fact that Biobrás and Vallée (a leading firm in veterinary products such as vaccine for aftose fever originated in Uberlândia, located at 550 km west to Belo Horizonte) has predominant weight in this subset, representing 42% of the total sales revenue. Firms do not show any particular locational pattern in the city neither being agglomerated in particular streets or districts, nor concentrated nearby the university. So it is even doubtful whether they are having any technological interaction among themselves. In particular, production units of the above mentioned two firms are located in Montes Claros in the northern part of Minas Gerais to receive incentives for northeastern regional development of the federal government.

Another key component of the biotechnology LSI in Belo Horizonte is Biominas Foundation. Biominas was funded in 1990 as the non-profit organization for incubating new biotechnology firms. It is located in the northern suburb of Belo Horizonte on the land conceded by the Minas Gerais State Technology Center (CETEC). It is currently incubating 10 companies and 8 companies are already graduated¹⁷. The incubator is

¹⁶ Interview at CEDEPLAR and Faculty of Economics of Minas Gerais Federal University on December 5, 2002.

¹⁷ One of graduated firms Ferrara Ophthalmics produces ring to reform deformed cornea causing myopia and astigmatism. The company invested R\$ 1 million. Among the incubating companies, JHS Laboratório Químico develops material of reconstruction of bones by means of powder based on carbonic calcium with the investment of

concentrated on the second floor of the Biominas building where the space is layout for 26 rooms of 45m² partitioned with removable walls and common laboratory space. The incubation contract is annually and renewable to four years. One room is rent for R\$ 20/m², equivalent to US\$6, totaling to R\$900 (US\$270) per room. One firm can occupy up to 4 rooms slots. Each room is equipped with only basic telecommunication cable (telephone and internet) and purified water, whose services are charged by usage. Research equipment and office furniture should be brought by the rentees. Besides the rental of the space, Biominas provides business support including: legal assistance to setup a corporation; search for funding with private and governmental institutions¹⁸. Biominas also provides seed money based on the loan from Multilateral Investment Fund of the Interamerican Development Bank (MIF-IDB).

In fact, biotechnology firms are not as representative as the telecom equipment means to Campinas and aircraft means to São Jose dos Campos¹⁹, but it is worth visiting the case because it illustrates the case where technology-based industry can be established within the local innovation system framework even without the financial bonanza. Because of the wide possibility of application and potential synergy effect to other business area (like fusion with electronics, creation of new materials, contribution for emission control, etc.), the local business community has high expectation in the potential of emerging biotechnology cluster.²⁰

R\$ 800 thousand. Another incubating case includes Biocod Produtos & Servicos who competes in the market of genetic identification with its own methodology cheaper than the competitors in the domestic markets who depend on imported kit

¹⁸ For example, Minas Gerais State Fund for Promotion of Research (FAPEMIG) associated with Development Bank of Minas Gerais (BDMG) and SEBRAE-MG implements PROMITEC (Financial Support Program for Technology Based Micro and Small Firms). A beneficiary signs a contract for 24 months, renewable once, of the credit line up to R\$ 100,000. A beneficiary should be a research based micro and small firms aiming to develop a scientific research aiming at commercial application, either at setup, initial, or second-stage. The credit has up to 18-24 months of the grace period, interest free (monetary correction by the consumer price index (IPC-A) is charged), repayable in up to 24-36 installments. It requires the guarantee by a third party. Matching fund of 10% of the research project by the beneficiary if the project is in the second stage. BDMG also offers a PROINTEC (Program for the Promotion of Technology based Incubators) which supports incubators.

¹⁹ Remember that a biotechnology is still an incipient industry for Brazil as a whole.

²⁰ The Federation of Industries of Minas Gerais State (FIEMG), in cooperation with McKinsey, elaborated future development vision of the state, in which the biotechnology cluster in Belo Horizonte was given top priority.

With the technological base on UFMG and supporting activity of Biominas, new firms are emerging. In his own sample survey, Fajnzlber (2002) found diversified reactions to his questions on managers' perceptions on their source of competitiveness and obstacles for growth. Quality (product differentiation, qualified personnel, high standard of production facility, precision of product) is most cited as a source of their competitiveness. Most of firms are implementing own R&D and also maintain contact (either formal or informal) with universities and exchange information with other firms. Yet, he found that only a small portion of firms engage in new technology seeking R&D and most of them are simply application of publicly available technologies. Issues of common interest are discussed in the Chamber of Biotechnology Industry and Syndicate of Biotechnology Firms. According to my own visit to these institutions, they discuss mainly about institutional matter such as government regulations.

Each biotechnology firms in Belo Horizonte are still small and faces obstacles for growth. On the other hand, most important obstacles are access to enough demand. Because of creating new products firms are feeling difficulty in creating the market obtaining consumers confidence. Firms competing with multinational firms, like the case of medical laboratory kits, are having difficulty in competing with products with brand name and strong commercialization channel. Most of them do not have access to the foreign markets. Liberalization is seen as both risks and opportunities. Risks are intensified competition with multinationals and chances are greater opportunities for subcontracting and partnerships.

Fonseca et.al (2002) analyzes that Brazil has potential in biotechnology in terms of the quality of the talent in universities and research institutions. According to them, major obstacles are of financial nature to support R&D activities. There are two emerging efforts movements. One is private venture capital fund established by big business groups such as Votaorantim and Copersucar to finance new biotechnology firms. Another is government initiatives led by FINEP in the framework of *Fundo Setorial* to finance private R&D and joint research between firm and universities. Since they are still new institutions and we do not have enough information to evaluate. Yet, private venture

fund, which created high-tech bubble in the USA, has never been a corporate finance model in Brazil. Hence it is hard to predict that this will be a major break-through of the financial bottleneck. Likewise, the public fund for science and technology cannot be sufficient due to the hard budget constraint imposed by the macroeconomic scenario. As Fonseca et.al (2002) predicts, there are already some examples of successful partnership with big corporations which should be followed by new biotechnology firms.

In fact, Salles-Filho et.al (2001) describes that one of major characteristics of the modern biotechnology market is a contract of cooperation. Biotechnology is highly research intensive and involves high degree of uncertainty in viability toward profitable commercialization. There is a tendency that large enterprises are competing internationally for market share through mergers and acquisitions in seek for greater market power and financial strength. They are extensively diversified both geographically and in product variety. While the degree of global oligopoly has been increasing, they are looking for outsourcing of innovative specialized knowledge while minimizing the internalization of R&D cost to sustain technological competitive edge in the diversified activities. In the technological frontier, therefore, so-called new biotechnology enterprises (NBEs) have opportunities of partnership with the big enterprises, mainly financial, to advance their research at their own risk. When the research will reach a concrete result NBEs will let the development for commercialization to the global firms because they cannot compete with the latter due to a scale economy. Thus, NBEs and global firms can play complementary role with each other.

Biotechnology firms in Brazil can amplify potential of growth by pursuing such strategic alliances with big enterprises. The sales of Biobrás to Novo Nordisk can be understood as one of the leading examples²¹. The ex-president of Nordisk and current president of Biom says, “In the technology based industry, a success may not mean to hold a firm for ever, but one can actually make success by transforming from one promising business to another.” (*Cluster*, Abril/Junho 2002: p.32)

²¹ When Biobrás started commercialization of human insulin, Novo Nordisk and Eli Lilly (USA) sold their product below the international price to ruin the new entry. Since Brazil levied antidumping surcharge, Novo Nordisk started domestic production and still tried to undercut the price of Biobrás.

V. Conclusions

Our examination of three cases of high technology based localized industrialization in Brazil leads us to the following tentative conclusions:

Technology based industry depends on the capability of the local research institutions. Such necessity makes the firms necessary to be located at the knowledge center.

Interactions with industries also sharpen the capability of universities and deepen their expertise.

Well-targeted public investments in R&D many have lasting result. Creating a core technology in designing a creative product is an essential part.

Materializing the research result requires uninterrupted (but not necessarily so big) *seed money*. Government programs, private venture capital, or partnerships with large corporations can be such sources. Because of financial constraint of the government and underdeveloped capital market, the third option turned to be frequently used.

Brazilian technology based-firms face obstacles for growth. Relatively successful companies are being acquired by foreign firms before entering the growth phase due to the limited capability of investment. Because of competition with large multinational firms.

Technologically autonomous and competitive firm can grow through strategic partnership with other companies – including multinationals, effectively reducing the financial risk and amplifying opportunities for learning.

Our findings imply that once we will lose the local dynamics of technological learning between industry and universities, the industry will be a set of subcontracting and simple assembly of imported parts. The financial problem continues to be a bottleneck of growth of technology-based firms. Here, the legacy of underdeveloped financial market during the uncertain macroeconomy for many years still cast a dark shadow.

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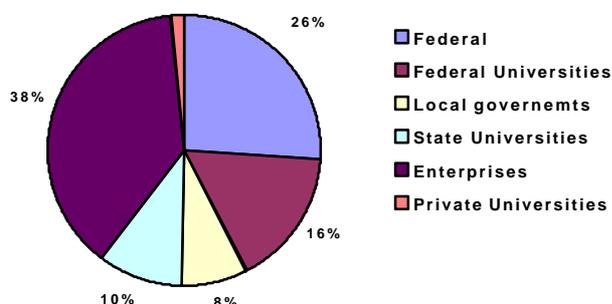
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Table 1: Brazilian top 10 export items in 2002 at 8 digits NCM level (US dollars million)

1. Soybeans in grain	3,029
2. Soybean refuse from extraction of oil	2,197
3. Iron ore, not concentrated	2,021
4. Aircrafts weighted 2000KG<=5000KG	1,826
5. Petroleum crude oil	1,691
6. Automobile with engine 1500<CM3<=3000 for no more than 6 passengers	1,486
7. Coffee crude, not roasted, beans	1,195
8. Sugar from sugar cane, not refined	1,111
9. Wood paste for paper fabrication	1,109
10. Cellular telephone	1,071

(Source) MDIC, Aliceweb, <http://alicewwb.desenvolvimento.gov.br>, accessed on March 7, 2003.

Figure 1: Brazil: R&D expenditures by entities, 2000



(Source) <http://www.mct.gov.br>, accessed on March 17, 2003

Table 2. Regional distribution of the creation of knowledgeable people

	Biology		Engineering					
	Registered Students		Title given in the				Title given in the	
			year		Registered Students		year	
	MASTER	DOCTOR	MASTER	DOCTOR	MASTER	DOCTOR	MASTER	DOCTOR
North	4%	3%	4%	4%	1%	0%	1%	0%
Northeast	10%	6%	9%	4%	9%	5%	9%	3%
Southeast	67%	75%	64%	77%	71%	80%	68%	85%
Rio de Janeiro	17%	19%	18%	20%	20%	25%	18%	26%
Minas Gerais	8%	7%	8%	6%	11%	6%	10%	5%
São Paulo	40%	49%	36%	51%	38%	48%	38%	54%
South	14%	13%	17%	13%	15%	13%	18%	12%
Rio Grande do Sul	7%	8%	10%	5%	6%	6%	8%	5%
Paraná	5%	4%	6%	7%	3%	1%	3%	1%
Central-West	5%	4%	6%	3%	4%	1%	4%	0%
Brazil	4,081	4,238	1,554	779	9,675	5,395	2,651	765

(Source) CAPES homepage <http://www.capes.gov.br>