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The Neutrality of Multiple Exchange Rates: Industrial Distortions in Brazil, 1953-1961

Bernardo Stuhlberger Wjuniski
London School of Economic - LSE
Economic History Department
B.S.Wjuniski@lse.ac.uk

Abstract: This paper investigates whether the famous Multiple Exchange Rates (MER) system of the 1950s in Brazil, installed by Instruction 70 of Sumoc, caused negative externalities to industrial growth. By performing a counterfactual exercise of substituting the auctions exchange rate by the market exchange rate for 10 sectors, the results refute the view that the MER system caused important distortions, with minimal deviation between the sectors trajectories with the MER rates and without it. These results also confront the idea that the MER system was part of a typical import substitution process. Industrial deepening of that time was the result of government expansionary policies, state participation and the attractiveness of foreign companies through Instruction 113 but not exchange rates protection.

Keywords: Multiple Exchange Rates, Import Substitution, Distortions, Industrialization, Instruction 70

Resumo: Este artigo investiga se o regime de taxas de cambios multiplos da década de 1950 no Brasil, criado pela famosa Instrução 70 da Sumoc, causou externalidades negativas para o crescimento industrial. Através de um exercício contrafactual de substituir a taxa de câmbio dos leilões pela taxa de câmbio de mercado para 10 setores, os resultados refutam a visão de que o sistema MER teria causado distorções importantes, com desvio mínimo entre trajetórias dos setores de sector com taxas de câmbio do regime e sem elas. Este resultado também confronta a idéia de que o sistema MER era parte de um processo típico de substituição de importações. O desenvolvimento industrial daquele período foi o resultado de políticas expansionistas do governo, a participação do Estado e a atratividade de empresas estrangeiras por meio da Instrução 113, e não pela proteção das taxas de câmbio.

Palavras-chave: taxas de câmbio múltiplas, substituição de importações, distorções, industrialização, Instrução 70

1 – Introduction

Between 1953 and 1961, Brazil adopted a well known experience of a Multiple Exchange Rates (MER) regime, which was installed by the famous Instruction 70 of Sumoc (Superintendencia de Moeda e Credito, the Brazilian Monetary Authority between 1946-1964). The regime imposed a singular experience of currency management where all the country imports were included in a single system of auctions of foreign exchange, allowing a controlled depreciation process for different sectorial exchange rates after a long period of over-appreciation of the cruzeiro in the post war period (Huddle, 1964)

The system functioned very well for at least five years and managed to maintain a stable balance of payments, controlled inflation, decent growth rates and prevented the emergence of a black market for the exchange rate. For this reason it is generally considered by the literature as a successful case of capital controls and one of the causes of the positive economic results obtained in that decade in Brazil (Kafka, 1956; Huddle, 1964, Baer, 2009; Figueiredo Filho, 2005; Lago, 1982; Vianna, 1987, Sochaczewski, 1980).

But while there are reasons to agree that the regime was successful to stabilize macroeconomic conditions, there is an important missing gap in the literature, which prevents the conclusion that it was indeed a "successful" experience case of capital controls. It the current stance of the literature on capital controls in historical context any attempts to modify free market flows as naturally seen as distortive unless proven wrong (Magud at all, 2011; Habermeier at all, 2011; Shultze, 2000). And researchers are generally required to provide as much counterfactual tests as possible to show that a specific use of controls was indeed the best available option at a specific time.

And since there isn't in the current literature any attempts to test the counterfactual options of that policy framework, this is the objective of this paper. For the 1950s Brazilian experience a natural question that emerges is whether the MER system could have caused distortions to other areas of the economy at that time. While when fully functional the MER

system was as effective mechanism to keep macroeconomic conditions balanced, it could have potentially led industrial sectors to over or under perform since various exchange rates were being used by each sector rather than a single market exchange rate.

And this also raises a very important question about the use of import substitution policies to develop industrial growth in Brazil in the 1950s. For most of the Brazilian literature on import substitution policies (Baer, 1972; Abreu at all, 1997; Tavares, 1975; Colistete, 2006), exactly because of the different exchange rates were applied to the various sectors, the MER regime is seen a major policy tool for import substitution industrialization, helping to protect and stimulate specific parts of the economy and give an impulse for industrial deepening.

For the most critical literature on import substitution policies and the recent literature on capital controls (Taylor, 1998; Haber, 2006; Shultze, 2000), however, this differentiation can be also seen just another form of distortion caused by a large currency intervention in the economy, an any deviation from market equilibrium could be called a distortions. So if one proves the existence of these distortions, or more generally deviations from a market path, it would be also partly confirming the that the MER system was indeed a relevant import substitution tool - since it was exactly targeted to create this differentiation (distortions) between sectors.

To answer these questions this paper performs a counterfactual exercise asking what would have happened with industrial growth if all sectors had the same market exchange rate during the period of the MER regime in Brazil? The comparison between the trajectories of industrial sectors with the auctions exchange rate versus the market exchange rate should answer whether that MER tool have indeed provided differentiation between industrial sectors (or distortions) and consequentially if this was in fact an important instrument for import substitution at that time.

The main conclusion confronts both these views. The MER system does not seem to have caused important distortions in the economy and at the same time and consequentially it was not a major policy tool to explain industrial development during the 1950s. By

performing an econometric counterfactual exercise there is evidence that the diversion in industrial growth when the auctions exchange rates are substituted by the free market exchange rates were minimal. On average during the whole period of the auctions experience the weighted average growth difference for industrial sectors was only -1.03%, which means that on average growth would have been only about 1% smaller for industrial sectors in case the auctions system did not exist.

This also confronts the idea that the system was a typical import substitution tool. It suggests the MER regime was much more concerned with adjusting exchange rates in a controlled devaluation process. The industrial deepening that took place in Brazil during the 1950s, particularly in its latest part during the government of Kubistchek, was much more the result of government expansionary policies, the state participation in industrial development and the attractiveness of foreign companies through Instruction 113 of Sumoc rather than exchange rates protection (Baer, 1972; Colistete, 2006).

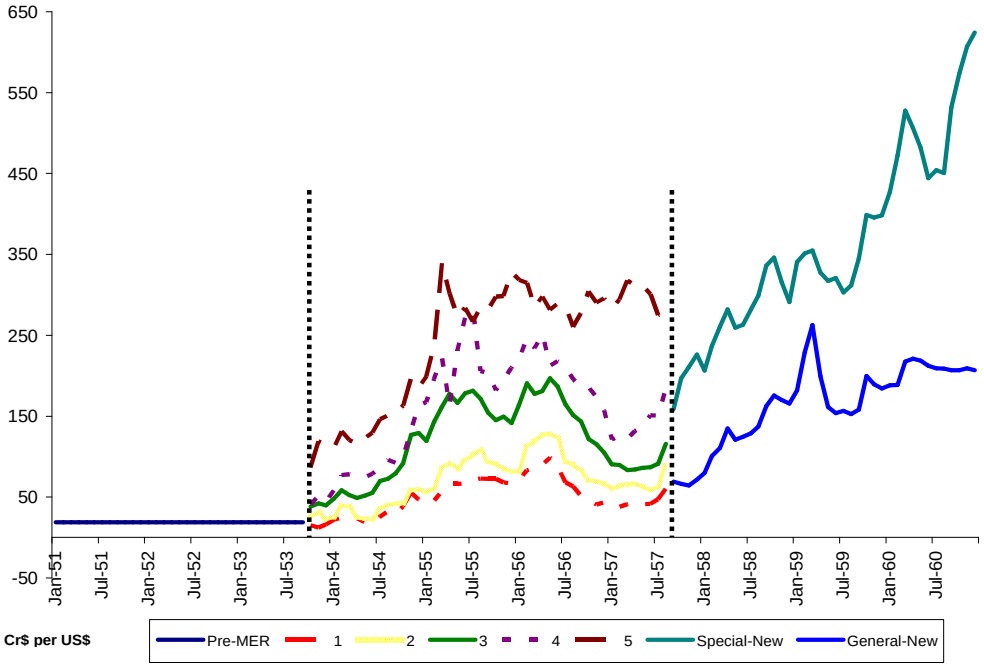
The paper is divided in 7 sections. Following this introduction, parts 2, 3 and 4 will briefly present the good results of the MER in Brazil during the 1950s, the stage of industrial development and discuss the possible distortions of the MER experiment. Sections 5, 6 and 7 present the data, methodology, econometric results and robustness checks. Finally section 8 concludes the paper.

2. Peak and Decline of the MER auctions system

In 1945 the Brazilian currency (Cruzeiro) was fixed at its 1939 (pre-war) level to keep inflation under control and based on the belief the exports (mostly coffee) were inelastic to currency depreciation. But this overvaluation and the shortage of global dollar liquidity originated large problems to stabilize the balance of payment, which remained under pressure for eight years even with some attempts to restrict imports with ineffective quantitative controls (Lago, 1982). In 1952 the current account deficit peaked at U$ 600 million (2.7% of GDP) nearing a balance of payments crisis.

In October 1953, the Brazilian monetary authority (Sumoc) created the multiple exchange rates regime targeting to correct this disequilibrium. It replaced the pegged official currency by auctions of foreign exchange for imports, which were distributed in categories according to their level of priority. To regulate outflows, Banco do Brasil, the operator of the system, established the quantities of dollars to be auctioned daily in each category in regional marketplaces (Vianna, 1987). With fixed quantities, bidders then defined the price of foreign exchange. The rationale was to rank sectors and differentiate their import prices and the higher the category, the smaller the volume of foreign exchange offered, inducing a selective depreciation of the exchange rate for each category. Category 1 included the most essential sectors such as food, chemistry, agricultural equipment and medicine. Category 2 production inputs, electrical material and medical equipment. Category 3 all industrial equipment, capital goods and vehicles. Category 4 all non-essential equipment and Category 5 all remaining sectors.

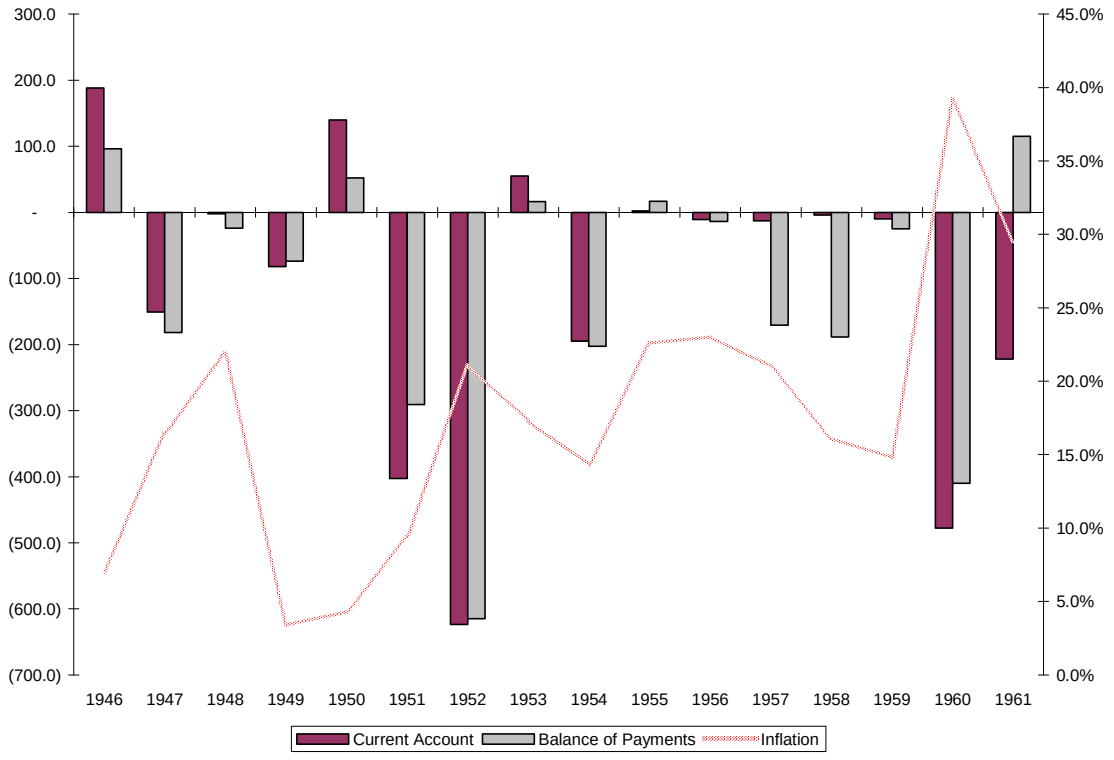
Chart 1: Multiple Exchange Rates (Cr$ per U$)



Source: Annual Reports of Banco do Brasil (1951-1961)

The devaluation reached in all categories was impressive. In extreme cases, the exchange rate reached 1700% of depreciation, with the official Cr$ 18.5 rate being kept as the reported parity to the IMF (Vianna, 1987). With all foreign exchange centralized and auctioned, the immediate result of the new system was effective to reduce imports and the current account and balance of payments quickly stabilized. And all of these happened without the emergence of a black market or a major spike in inflation which remained around 15-20% as shown in chart 2, which shows the current and the balance of payments recovering rapidly between 1953 and 1955.

Chart 2 - Balance of Payments (U$ million) and Inflation (%)



Source: Estatisticas Historicas do Brasil - Instituto Brasileiro de Geografia e Estatistica (IBGE)

In 1956 there was a change in the Brazilian government (Juscelino Kubistchek assumed the Presidency) which brought about significant modifications to economic policies in an effort to accelerate growth and substitute imported manufactures (Skidmore, 1982). This was the trigger for the auction system to slowly start to decline. The government reformed it by reducing the number of categories from five to three, reintroducing ad valorem tariffs and creating a large number of exemptions for imports to take place outside the MER system. The objective was to reduce restrictions to foreign exchange liquidity and to further stimulate industrialization through additional differentiation; but these changes also rapidly led to a deterioration of the macroeconomic equilibrium (Sochczewski ,1980). By replacing the quantitative restrictions of the MER with import tariffs and exemptions, the new system severely distorted the controls of outflows; imports rose quickly and the dollar shortage reappeared. At the same time, to fund infrastructure investments monetary expansion also surged at an annual growth rate of 15% y/y on 1955 to 60% y/y in 1958 in the monetary base (Lago, 1982) [1].

These populist policies further pressured imports and inflation, and the balance of payments deteriorated to a deficit of almost $500 million dollars (2.3% of GDP) by 1960, forcing the cash out of reserves and the end the MER regime in 1961. According to the policymaker responsible for ending the system, Mr. Bulhoes (1990, pg 131), , there was no other option at that moment rather letting the currency depreciate and fight its inflationary impacts with monetary control. A gradual depreciation of the exchange rate had been ruled out.

It is important to highlight that during this whole period, including the two phases of the MER system, a free market of exchange rate only for a services, wages and the capital account was kept outside the auctions system. Since the capital account was almost fully closed, they represented a very small part of transaction. And there was no direct link

[1] And to fund the construction of the new capital of the country, Brasilia.

between the free market and the auctions exchange rates. All import had to go through the exchange rate system, while the availability of foreign exchange for the free market only coming from inflows outside the trade balance. This is important is the existence of this free market exchange rate is essential to perform the counterfactual exercise below.

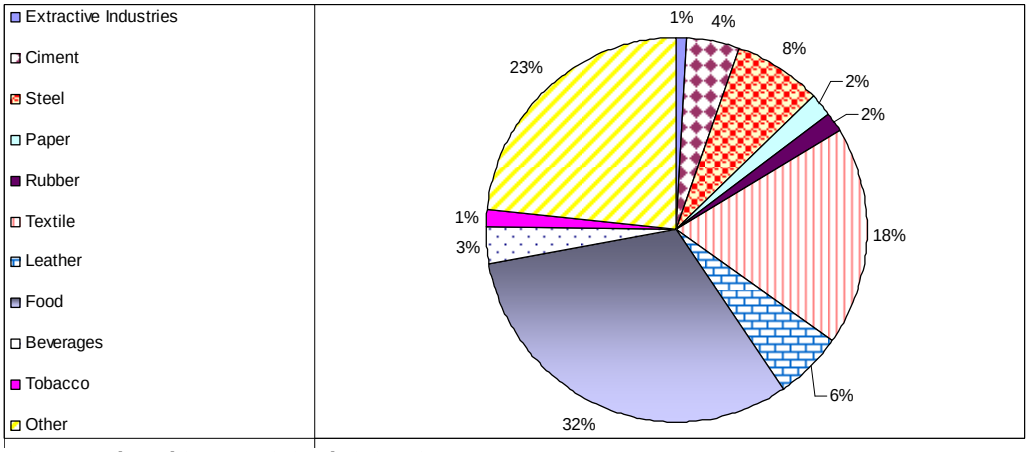
3. Interpreting the 1950s Industrial Deepening

The 1950s were part of the golden age of Brazilian industrial development and largely seen by the existing literature as part of the major impulse policies coming from the import substitution industrialization toolkit, including the MER just described above. Indeed, the data confirms the important structural changes on industrial growth The performance of the Brazilian economy was exceptionally high during the 30 years of post-war. During this golden age between 1945 to the early 1980s, annual average GDP growth was 7.3% and of industrial production was 8.8%. For the 1950s specifically average GDP growth in the 1950s was 7.35% per year and industrial production was indeed the main driver behind that process, with average growth around 10% per year (Aldrighi & Colistete, 2013). During the first part of the 1950s, until 1955 and during the presidency of Getulio Vargas, the share of the industrial sector in the GDP increased from 17% to 22% and its internal structure changed with the increased participation of dynamic branches and the production of durable consumer goods, intermediate and capital goods. Before the 1950s, most non-durable consumer goods were already produced domestically, and by 1955 almost all sub-sectors of manufacturing goods already being produced internally (Bergman ,1970).

In the later period between 1956 and 1961 during the presidency of Juscelino Kubistchek the industrialization process was further accelerated and industrial output growth reached an annual cumulative rate of 11%, while GDP grew at 7%. This second period is seen as a phase of diversification and integration of the industrial structure, where advanced industries both on consumer durable goods but also on capital goods, such as steel or vehicles, were introduced in the country.

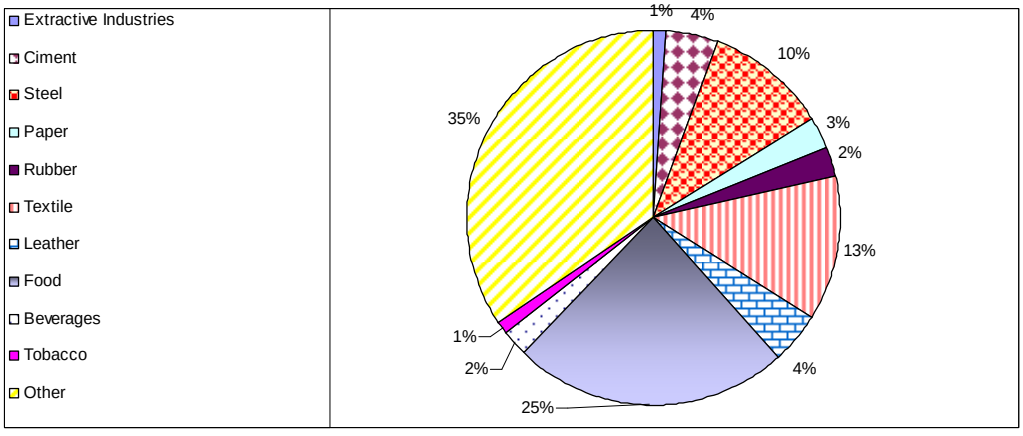
Tavares (1975) compares the structure of imports and the industrial sectors between 1949 and 1961. She shows that over those years decreases the share of food and textile industries ("traditional industries") in the value of total production, with an increase in the relative weight of mechanical engineering, steel, electrical and chemical, "dynamic industries" according to the author. Aldrighi & Colistete (2013) state that in this initial post-war period of import substitution a core group of traditional and modern industries managed to adapt to foreign technology, helping to increase substantially productivity and maintain growth for a reasonable period of time. Charts 3, 4 and 5 present this evolution.

Chart 3 – Industrial Composition in Brazil - 1949 (Percentage of output)



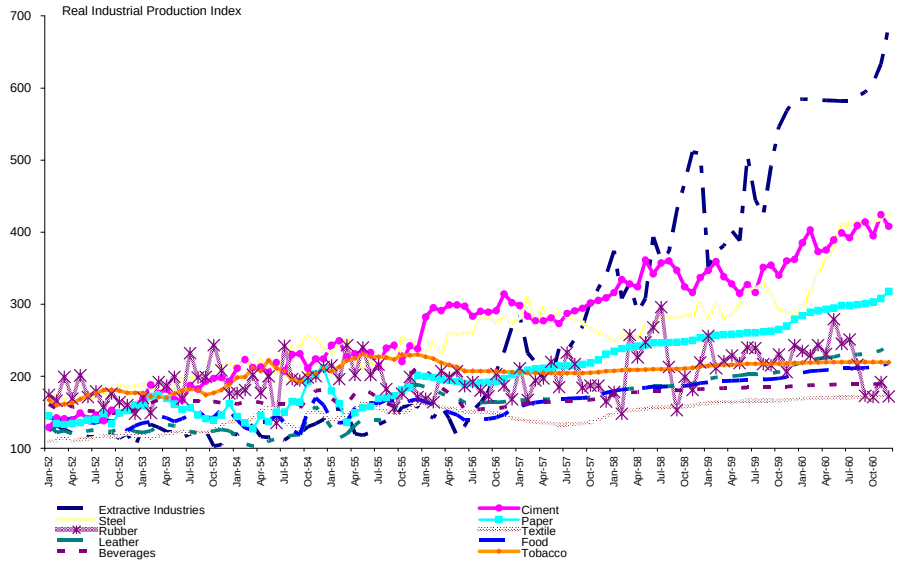
Source: Industrial Sensus – 1949 and 1959, IBGE

Chart 4 – Industrial Composition in Brazil - 1959 (Percentage of output)



Source: Industrial Sensus – 1949 and 1959, IBGE

Chart 5 – Industrial Growth in Brazil – 1952 -1960



Source: Fundacao Getulio Vargas – FGV, Revista Conjuntura Economica

The combined interpretation of the graphs shows not only the rapid increase in industrial output during the 1950s, but also the change in its composition. Traditional industries such as food, textile and leather lost share in industrial output, while more advanced industries such as steel and metallurgical gain share on he overall industrial composition. It is possible to say that by the end of the period industrial production was more diversified, including most sectors, and vertically integrated, with both capital and consumer goods being a relevant part of the structure (Bergman, 1960).

The conventional interpretation of this peak in industrial development normally focuses on the use of import substitution policies. Both the traditional literature of the 1970s and 1980s on the subject (Tavares, 1975; Weisskoff, 1980; Versani and Barros, 1977; Baer, 1972), as well as more recent revisions from economic historians (Abreu at all, 1997; Colistete, 2006) seem to emphasize the importance of import substitution policies such as tariffs and capital controls as central to those results. From a theoretical standpoint, import substitution gained academic foundation during exactly this period of the 1950s, when Argentine economist Raúl Prebisch together with Brazilian economist Celso Furtado

developing the basis for why countries should use tariffs as the main policy instrument to overcome lagged development (Prebisch, 1949; Furtado, 1959).

And this view is embedded behind the Brazilian industrial take off that time. According to Tavares (1975), during all the 1950s the coefficient of imports declined in traditional industries as well as in dynamic industries, reflecting the progress of the import substitution process, and she claims that "there was a considerable effort of import substitution performed by almost all manufacturing industries" (Tavares, 1975, pg 96). Abreu at all (1997, pg 3) states that “High tariffs, or non-tariff barrier after 1930, have been a crucial feature of import-substitution in Brazil.” And Weisskoff (1980, pg. 665) argues that “Brazilian economic growth was spurred by deliberate and accelerated promotion of modern industry”. Versani and Barros (1977) argue that the currency MER mechanism had a direct impact in this transformation by bringing advantages to dynamic sectors and stimulating the imports of capital goods.

Other traditional authors that have looked at import substitution policies in Latin American have also placed large importance to these group of policies. Hirschman (1966) defends the use of deliberate policy tools to stimulate industrial growth as one of the four impulses to industrialization and largely present in the mature part of the import substitution process in the 1950s and 1960s. Haber (2006), although defends that there was a considerable process of industrialization in Latin America before the 1930s, points that the peak of import substitution only took place in the post war period when policies were designed to accelerate the import substitution process. Taylor (1998) argues that this deliberate policies of the 1950s led to major distortions in the Latin America economies in the 1960s and 1970s. Another important recent revision of the topic that is Colistete (2006), which discusses the importance of the Cepal ideas for Brazilian industrialist in the 1950s, helping to shape policymaking during the peak of import substitution in Brazil in that decade and the following.

Werner Baer, one of the most distinguished authors on import substitution in Brazil agrees that the after World War II, most “of the larger countries of Latin America implicitly

or explicitly accepted the Cepal analysis of the hopelessness of gearing their economies towards the traditional world division of labor" (Baer, 1972, p. 97). However, he also states that "The principal policy instruments to promote and intensify ISI were: protective tariffs and/or exchange controls; special preferential for domestic and foreign firms importing capital goods for new industries; preferential import exchange rates for industrial raw materials, fuels and intermediate goods; cheap loans by government development banks for favored industries; the construction by governments of infrastructure especially designed to complement industries; and the direct participation of government in certain industries, especially the heavier industries, such as steel" (Baer, 1972, pg. 98)

What is interesting about his view is that very few like Baer emphasize the variety of policy instruments beyond the basic tariffs and capital controls, which have received the major share of attention from scholars. Another one that follows this approach is Fishlow (1972) in his seminal contribution to the understanding of import-substitution since the 19th century. He states that while we cannot read the minds of policymakers, many of the impulses for import substitution came from second round effects of other policy rather than direct policymaking. Of course the importance of explicit policies has grown significantly in the post-war period but he argues, for example, that the overvaluation of the exchange rates after the war in many countries, including Brazil, actually did more to stimulate and subsidy the import substitution of capital goods rather than explicit tariffs or other forms of direct trade control. This is in line with Baer's view that other forms of policymaking were central to the process.

Bergman (1969) is also in this group. While he also agrees that tariffs and the MER system were a central part of the industrial development at that time when states "From 1954 through 1964, the system of multiple exchange rates and tariffs gave a bias to import-substitution in manufacturing well over 100 percent" (pg, 33), he also puts a lot of emphasis on the government role in that process. He argues that "throughout the period of postwar growth, protection, public investment and investment subsidies generally complemented each other" (pg 32). He exemplifies this with the new public companies such as the steel producer

Volta Redonda in 1946 or the oil producer Petrobras in 1954, as well as the foundation of the National Economic Development Bank (BNDE) in 1952, all examples that the government was playing a major role in the industrial deepening process not with protection but direct intervention.

But while all this literature emphasizes the links between import substitution policies and the industrialization in the 1950s and 1960s, there is actually very little really testing the importance of each one of this policy tools for industrial growth. Tariffs have only become important in Brazil in the 1960s and later, simply because tariffs were kept fixed and at very low levels, rather than ad-valorem, between 1934 and 1957 (Silva, 2008). Colistete (2006) states that the discussion about revising the tariffs agreement started early in the 1950s, but nothing was done until 1957.

And this same question should be also raised for the use of capital controls and the MER system adopted by Brazil in the 1950s, which also tends to be seen as an important policy instrument for import substitution at that time. Most of the fast industrial process in Brazil in that period seems to have come from other policy instruments, such as highlighted by Baer (1972), Colistete (2006) and Bergman (1969). This includes the incentives for foreign investments with Instruction 113, direct state participation in new companies, the attraction of foreign companies and major credit and fiscal expansions in the Kubistcheck period. It was clearly a stated led process, but not necessarily a traditional import substitution process in that decade.

3. – Possible Distortions on Industrial Growth

There are different ways to assess distortions when examining experiences of capital controls and multiple exchange rates. From a straight conventional point of view, as discussed by Shutlze (2000), distortions are simply any deviations from the economic results that would have otherwise been obtained if capital controls were not used. According to this view, free market flows are always the most efficient option, and all the other options cause distortions in case they deviate from this equilibrium. This is of course too narrow and quite

unrealistic. Most of the recent literature on capital controls after Bretton Woods searches for distortions but actually tests whether the use of controls was able to reach better economic results after their adoption (Magud at all, 2011; Habermeier at all, 2011). If this is proved, then the initial distortion is considered to be a good policy instrument to reach a superior economic result.

But this is not enough. The other way to look at distortions in cases of capital controls is to test whether these experiments have resulted in negative externalities for other parts of the economy which were not necessarily targeted by the initial use of controls. Shutze (2000) argues that counterfactual exercises are needed to prove that a specific use of controls can be really considered successful. Most of the experiences could pass the first test of improving the economic results for their stated objective of that use of controls, but only a few would pass a broader test of looking at externalities for the rest of the economy.

For the Brazilian case, the most natural question is what happened to the different industrial sectors that were using distinct import exchange rates as a form of protection. In the same way that there is a long literature on the use of tariffs and capital controls as tools for import substitution Industrialization just discussed above, there is also a long literature on the many inefficiencies that those protectionist policies could have created overtime. Haber (2006), for example, argues that the results of that process were highly inefficient protected industries with consumers paying the price of import-substitution. For him, those protectionist policies created incentives for sectors to develop which would not survive without the protection offered by the government. Taylor (1998) says that the cost of that process came in the capacity of the region to increase productivity and keep growing when import substitution was over a few decades later. Baer (1972) provides a very in deep discussion on the costs of the import-substitution process in Latin America. He is contrary to the simple criticism from the literature that puts excessive attention to “inefficient allocation of resources”, but underscores that by the 1970 the import substitution model was already reaching its limits.

The objective here is not to discuss the deeper reasons for the failure of the import substitution framework and not even to test whether the MER experience had positive or negative long-term impacts on the economy. Our interest is to test if during the period when the MER system worked well and produced positive macro results, if it has also caused sectors to underperform or outperform what they would have been in case everyone had the same exchange rate. At the same time, if evidence of negative externalities is found, it would also confirm that the MER system was an import substitution policy tool helping some sectors to outperform against other.

And this type of exercise is even more relevant when the objectives of policymakers is not clearly stated. The officials documents (minutes) of Sumoc meetings do not provide the clear aims of policymakers when they first introduced the MER system in 1953, although the literature on the MER system tends to argue that the differentiation on the five categories was naturally targeted to benefit capital and essential sectors (Vianna, 1987; Lago, 1982). Officials only state that the objective was to find a permanent solution to the balance of payments difficulties, but do not explain why sectors were divided into five different categories or how foreign exchange was planned to be distributed between them. So the simple assumption that the system was a import substitution tool, without direct state from policymakers, require this empirical evaluation.

4. Methodology and Data

Ideally, to perform this counterfactual experiment a General Equilibrium Model would be the most appropriate method. Since industrial sectors interact in dynamic way overtime, having links to each other through the supply chain, an exercise that could test the overall impact of the different exchange rates throughout the supply chain could provide a full understanding of the impact in the economy. Unfortunately, data limitations do not allow us to do it. The first input-output information published in Brazil is only for the recent period

in the 2000s[2]. Before that, the availability of data only includes final industrial production series.

In this case, a partial equilibrium framework emerges as the second best alternative, but looking for ways to also include controls to correct and account for these intermediate links in the supply chain. In the partial equilibrium framework, I opted to perform individual time series regressions for each industrial sector, having real industrial production as the dependent variable and with the main coefficient of interest being the nominal auctions exchange rate of each sector. This is essentially the MER exchange rate from the category that sector was included.

Individual regressions rather than a panel data set seem to be more appropriate for this exercise. Not only the coefficient of interest is the individual sector exchange rate, rather than the average impact of the exchange which would be obtained under a panel data structure, but also the composition of the data suggest a panel would not perform well. My data comprises 10 industrial sectors - which represent between 65-75% of industrial production - during 86 months between 1953 and 1960. The much larger information on the time horizon compared to very small variation under the cross-section space suggests a panel is not appropriate. More importantly, the variation in the cross-section space would be even smaller than 10 since some industrial sectors were part of the same categories and had the exact same exchange rate. So the individual exercises allow us to assess the different impact of these exchange rates in distinct sectors. But just for robustness checks, the results of a panel data are presented in section 6.

Two sets of controls are included in the regressions. First, to account for the problem presented above of the dynamic impact of other industrial sectors on each other, lagged industrial production information from the other different sectors are included as explanatory variables in the regressions. These function as instruments to the larger relationship between all the industrial structure and help to reduce the problem of working with only partial

[2] The only input-output tables for Brazil start in 2000 and are published by IBGE (http://www.ibge.gov.br/home/estatistica/economia/matrizinsumo_produto/)

equilibrium. And in order to not choose these explanatory sectors arbitrarily, I perform a granger causality tests between all the 10 industrial sectors. Only the sectors that have statistical power to explain another one in the following period (*granger cause*) are included as controls in the regressions. This is a way to reduce the risk of omitted variables and make sure the regressions coefficients are reliable.

The second set of controls account for other important macroeconomic or policy information. Since after 1957 the system was changed to introduce ad-valorem tariffs, this information was also included in the regressions. I opted to use tariffs as a separate control rather than directly adjusting the exchange rates, since the later would be looking at the overall combined impact of both policies and this is not the objective here. But also for robustness checks, regressions with exchange rates adjusted by tariffs, rather than separate as a control, are include in section 6.

Apart from tariffs, the other important policy change during that period was instruction 113, which allowed sectors to import capital goods but account them as FDI. Since it also possibly created important stimulus to some sectors, the amount of FDI through Instruction 113 for each sector is also included as an explanatory variable in the regressions. Finally, population is also used to control for trend growth. The regressions are also performed in log and first difference and ARMA terms are included to adjust for serial correlation problems.

The proposed regression function is:

$$\textbf{Real Industrial Production}_t = c + \beta_1 \textbf{ Nominal Exchange Rate}_t + \beta_2 \textbf{ Tariffs}_t + \textbf{Controls} + \textbf{ARMA terms} + e$$

The data was collected from a variety of different sources. The exchange rate information was obtained from Sumoc's annual reports, and is part of the brand new dataset collected for this thesis. The industrial productions series come from the yearly statistical books from the Brazilian Institute of Geography and Statistics ("Anuarios Estatisticos do IBGE") combined with the monthly real industrial production series published by the Getulio

Vargas Foundation (FGV). The information on tariffs comes from Morley (1969), population from IBGE and FDI inflows from Caputo (2007).

Based on the results of the regression and the coefficients for each one of the 10 sectors, the second part of the analysis is to perform the counterfactual exercise. During the whole period a free market for the exchange rate was kept functioning for services and capital account flows, and although it was a small market, it was kept separate from the auctions system and purely based on supply and demand for the currency. This variable can be used here to perform the counterfactual experiment. For each sector, the auctions rate is then substituted by the markets exchange rate and an in-sample forecast is performed. The difference between the two series, the original industrial production for each sector and the in-sample forecast with the market exchange rate, can be considered the size of the distortion, or the deviation from what it would have been if all sectors had the same exchange rate. The bigger the difference between the two series, the larger was a sectors under or over performing because of the existence of a different exchange rate. There are two ways of analyzing the size of these distortions. The first one is to look at the average monthly difference between the two series, which tells us how far from each other on average are them. The second is to look at the final result for each two series and check whether, besides any fluctuations that the different exchange rates could have caused, industrial growth would have not been any different after the end of the whole experiment.

Based on the first of these distortion metrics, the average monthly distortion, we can also build an index of distortions overtime, weighting this monthly indicator by the share of each industrial sector. This would construct the weighted average monthly distortion, and gives an idea if the industrial sector as a whole was performing very differently when the MER or the market exchange rate. Since our sample represents between 65-75% of overall industrial production, the index has to be adjusted to the whole economy. I have build three indexes for the whole economy, using different assumptions for the remaining part of industrial production which was not part of the sample. The first assumes the average distortion for the remaining out of sample data, the second assumes zero distortion and the

third assumes double average distortions. This helps to build a range of where distortions for the whole economy would have been. The results of all these exercises - the regressions, in-sample forecasts and index results - are presented in the next section.

5. Econometric Results

Table 2 presents the results of the individual regressions.

Table 2 – Individual Regression Results - 1953-1961

	Dependent Variable - Real Industrial Production Index (Log and 1st Difference)									
	Food	**Beverages**	**Rubber**	**Leather**	**Ciment**	**Extractive**	**Tobacco**	**Steel**	**Textile**	**Paper**
Equation	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
Intercept	0.061 (0.003)	0.0026 (0.003)	0.005*** (0.017)	0.006*** (0.001)	0.0 (0.0069)	0.01 (0.02)	0.000 (0.0005)	0.039 (0.015)	0.006 (0.003)	0.000 (0.003)
Exchange Rate - Nominal Currency Cr$ (Log and 1st Difference)	**0.097*** **(0.02*)**	**0.037*** **(0.013)**	**0.164*** **(0.089)**	**0.029*** **(0.015)**	.-0.032 (0.04)	**.-0.159*** **(0.088)**	**0.037*** **(0.008)**	**0.139*** **(0.078)**	0.02 (0.022)	**.-0.049*** **(0.021)**
Tarriffs - Ad Valorem Level (1st Difference)	.-0.0023 (0.0021)	0.0006* (0.0003)	.-0.01* (0.0056)	.-0.0005 (0.0008)	0.0001 (0.001)	0.0004 (0.002)	.-0.0001 (0.00017)	0.01* (0.0055)	0.0002 (0.0006)	0.0000 (0.001)
Controls										
Intersectorial Effects (Log and 1st Difference (-1))										
Food				.-0.16 (0.14)	.-0.44*** (0.15)		0.027 (0.04)		.-0.066 (0.074)	0.11 (0.10)
Beverages					0.12 (0.17)		.-0.018*** (0.046)			0.05 (0.109)
Rubber						.-0.12* (0.07)				
Leather	0.189* (0.0104)	0.67*** (0.069)								0.52*** (0.10)
Ciment										
Extractive										
Tobacco			.-0.98 (0.70)	0.10 (0.23)	0.89*** (0.32)			.-1.11 (0.72)		
Stell					0.06* (0.03)					
Textile				0.28 (0.20)						
Paper	.-0.39*** (0.057)	.-0.14** (0.076)	0.088 (0.28)		0.50*** (0.14)		0.004 (0.039)	0.20 (0.30)	.-0.20*** (0.071)	
Population (Log and 1st Difference)	.-0.016 (0.87)	.-0.09 (0.99)	.-25.6*** (6.01)	0.89* (0.47)	1.62 (2.10)	11.4* (5.97)	.-0.50** (0.22)	.-14.04** (6.19)	.-0.82 (1.05)	2.04** (0.94)
113 FDI (1st Difference)	0.0015 (0.0079)	.0.005 (0.0045)	0.022 (0.024)			0.0029 (0.016)	0.009** (0.003)		0.003 (0.006)	0.019 (0.015)
ARMA Terms	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Number of Observations	77	81	84	83	84	80	81	84	83	79
R-Squared	0.64	0.75	0.41	0.56	0.29	0.26	0.55	0.4	0.61	0.76
Adjusted R-Squared	0.6	0.72	0.35	0.51	0.2	0.19	0.48	0.35	0.56	0.72

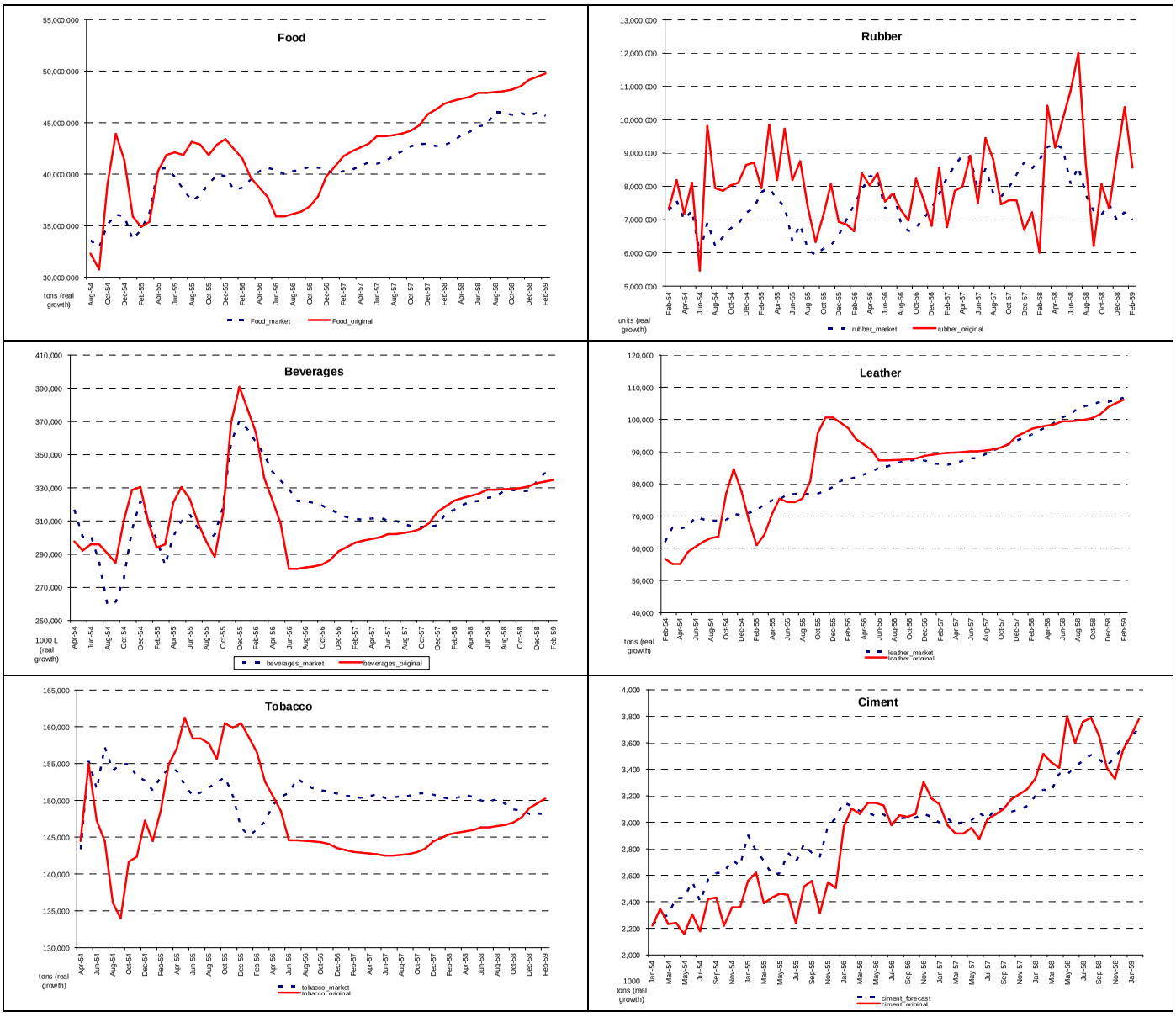
A few points are worth highlighting from the regression results. First, the elasticity of the exchange rate to industrial production is normally small and statistically significant for most industrial sectors. The higher coefficients are for rubber, steel and extractive industries, above 0.1. All other sectors have very small elasticities, normally close to 0. The interpretation of this coefficient follows the standard log-difference approach; a 1% increase

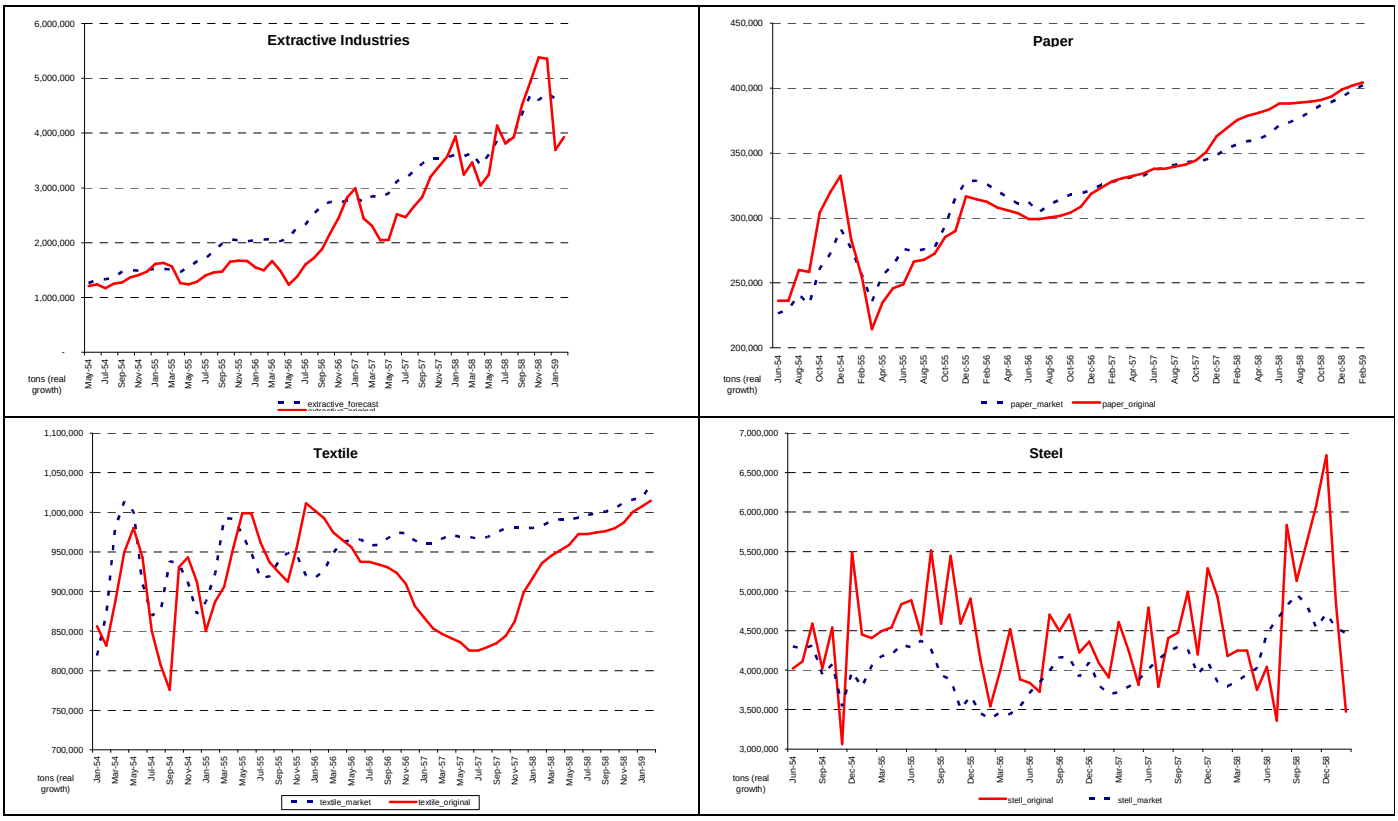
in the difference of the exchange between two months leads to a 13.9% increase (for the case of steel for example) in the growth of industrial production between two consecutive periods. Since these coefficients represent the impact on the acceleration or deceleration of industrial production growth, no a direct elasticity, they show a small impact of the exchange rates in industrial production for that period.

Second, it is worth pointing that tariffs have very low coefficients and are generally also not statistically significant. This is not a surprise since tariffs were only introduced in 1957 and are present in a small part of the series. This does not mean tariffs do not cause long-term effects on industrial production as this is not the design of this test. It only shows that during that period between 1953 and 1961 exchange rates represented the larger part of the protection, and the addition of tariffs in 1957 did not represent an immediate supplementary source of growth for industrial production. From an econometric point of view, it also means the exchange rate is capturing all of the protectionist effect and the tariffs, which were initially designed to provide the same level of protection from the different exchange, was indeed only substituting rather than complementing the exchange rates in the end of the 1950s.

Based on these regressions, and following the methodology proposed in the previous section, it is possible to do the in-sample forecast of each individual industrial production series, only substituting the auctions exchange rate by the free market exchange rates in each case.. Table 3 shows the 10 graphs comparing the original industrial production series and the new in-sample forecast.

Table 3 – In-Sample Forecasts





The graphs show a very similar story to the regressions table. Since most exchange rate coefficients are small, the forecasted series are generally similar to the original ones. This is true for most of the sectors, including the most representative ones in Brazilian industrial production such as textile, food and leather. The similarity of the forecasted series and the original ones also suggest the regression analysis is robust and shows a good forecasting precision. The distortions only emerge in a few series in which the coefficients were larger than 0.1 in the regressions. This is basically the case for steel, rubber and extractive industries. In the case of steel and rubber, the original series run below the forecasted for most of the series. The opposite takes place in the case of extractive industries, in which the original series runs below the forecasted one.

These results are consistent with the overall trend of industrial production in Brazil in the 1950s. Since this was the period of industrial deepening, when most of the traditional

industries were already established and the government played a major role in developing base sectors such as steel. It suggests that the auctions system played only a minor role to shape this process by helping some few sectors, but at the same time it did not distorted the traditional sectors of the economy and had essentially no impact on the core share of industrial production.

In the case of steel, which was an important production good targeted by the government back then, it is interesting to see that the exchange did play a small role on helping its development. The large investment made in the Volta Redonda steel company in 1946 was still a major part of this industrial deepening, and the government did managed to help its development by protecting the sector with the currency. On the other hand, although the investment in oil and mining production was also important for the government (mining company Vale do Rio Doce was created in 1942 and oil company Petrobras in 1954), these two sectors were still a small part of the economy by the mid-1950s (only 1% of industrial production) and these raw materials were needed for the industrial deepening process. Both oil and other raw materials were included in the lower categories of the MER, and thus had their imports subsidized. For all the other sectors, since the exchange rate was kept overvalued for a long period of time, and the depreciation process was made in a controlled way allowing markets to adjust to more equilibrium level, this did not bring relevant distortions to their overall performance.

With these in-sample forecasts is it possible to estimate the exact size of the distortions, which are shown below at table 4.

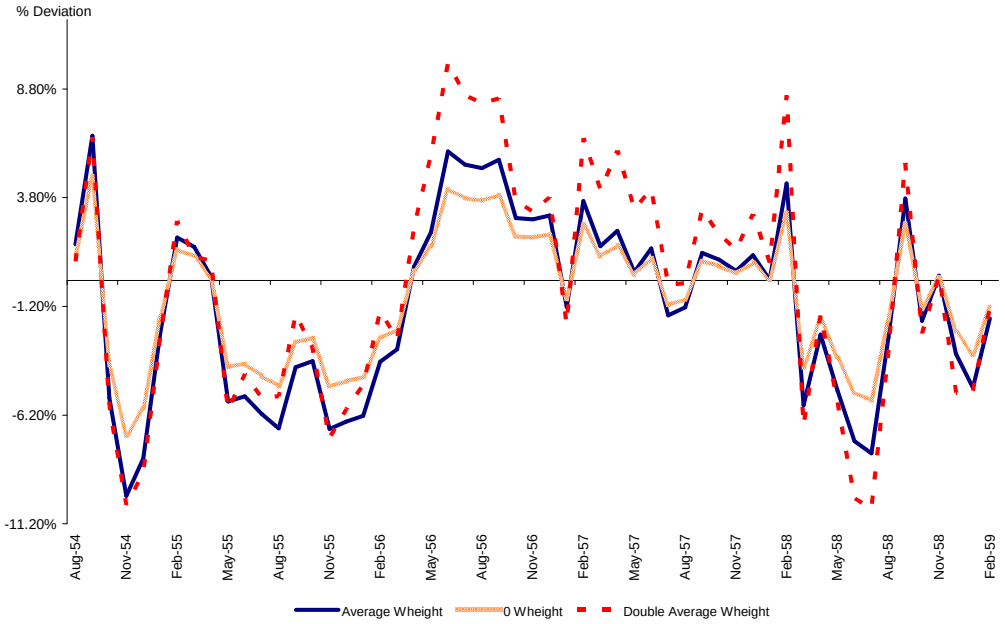
Table 4 – Industrial Distortions

Exchange Rates controlled by Tarriffs				
Industry	Original Category	Coeficient	Average Monthly Distortion	Final Distortion
Rubber	2	**0.164**	-6%	-18%
Steel	4	**0.139**	-8%	9%
Food	1	**0.097**	-3%	-8%
Beverages	5	**0.037**	1%	1%
Tobacco	3	**0.037**	2%	-1%
Leather	3	**0.029**	0%	1%
Textile	3	0.02	5%	2%
Ciment	5	-0.032	3%	-2%
Paper	3	**-0.049**	0%	-1%
Extractive	1	**-0.159**	17%	17%

As discussed in section 4, it is possible to calculate both the average monthly distortion – which is the monthly difference between the two series – and the final distortion – which is the difference in the end of the two series. The table shows both metrics for each individual sector. As flagged by the graphs and the regression coefficients, distortions are very small for most sectors, and this is reflected in both metrics. There are distortions for rubber, steel and extractive industries, which also only reflect the same explanation above.

Finally, based on the monthly distortion estimates, we can build an index of the weighted average distortion for the industrial sector as whole, whose results are presented below at chart 5. The chart presents three variations of the index assuming the out of sample industrial production to have the average weighted distortion of all other sectors, zero distortions or double the average distortions.

Chart 5 – Index of Industrial Distortions



The index shows very small variation between the three indexes when assuming different distortions for the out of sample part of industrial production. It only reflects the overall result of very low average distortions throughout the period. Finally, based on the indexes, it is possible to calculate the average distortion in each index for the whole period. This is just the same metric used in table 4 above for the end of the period but now making the weighed average of all sectors as done in the indexes. This is presented in table 5 below.

Table 5 – Average Distortions

Final Average Distortion		
Average Wheight	**0 Wheight**	**Double Wheight**
-1.03%	**-1.13%**	**-1.16%**

The table confirms the discussion made above, and shows the average distortions at around -1% for the three indexes at the end of the whole period, confirming that industrial production would only have been 1% smaller on average in case the auctions system was substituted by the market exchange rate.

6. Econometric Robustness Checks

To confirm that the above results are robust, two sets of variations from the original regressions were performed to check whether the initial results would be maintained. The first is to run the same individual regressions only changing the specifications, while the second is to run panel data estimates.

For the first exercise, three new regressions were performed for each one of the individual sectors, removing different sets of controls. But the main difference from the original regressions was the change in the exchange rate variable, which in this exercise was adjusted to the level of tariffs after 1957. This means the new coefficient of the exchange rate gives the overall impact of protection from both policies during the period. If the results discussed above were correct, since the coefficient of tariffs to industrial was always very small, and the exchange rate was the only variable providing protection, then the new adjusted exchange rate series should not be very different from the result of the original regression. Table 6 and 7 shows the results of this first robustness exercise.

Table 6 – Regressions with Adjusted Exchange Rate (Part 1)

	Dependent Variable - Real Industrial Production Index (Log and 1st Difference)														
	Food			Beverages			Rubber			Leather			Ciment		
Category		1			5			2			3			5	
Equation	i	ii	iii	i	ii	iii	i	ii	iii	i	ii	iii	i	ii	iii
Intercept	0.003 (0.002)	0.14 (0.21)	0.15 (0.22)	0.001 (0.0039)	0.0028** *	0.0028 (0.002)	0.006 (0.001)	0.004 (0.011)	0.005*** (0.017)	0.008*** (0.002)	0.0076** *	0.007*** (0.001)	0.009** (0.0045)	0.04 (0.004)	0.0 (0.0069)
Exchange Rate - Nominal Currency Cr$ (Log and 1st Difference)	**0.075*** (0.027)**	**0.070*** (0.023)**	**0.070*** (0.022)**	0.0026 (0.195)	**0.038*** (0.011)**	**0.047*** (0.012)**	**0.192** (0.09)**	**0.173* (0.09)**	0.132 (0.086)	**0.046** (0.02)**	**0.032** (0.015)**	**0.042** (0.015)**	.-0.02 (0.049)	.-0.017 (0.045)	.-0.01 (0.04)
Controls															
Intersectorial Effects (Log and 1st Difference (-1))															
Food											.-0.2* (0.1)	.-0.15 (0.14)		.-0.43*** (0.15)	.-0.44*** (0.15)
Beverages														0.10 (0.17)	0.13 (0.17)
Rubber															
Leather		.-0.001 (0.018)	.-0.001 (0.019)		0.68*** (0.06)	0.69*** (0.06)									
Ciment															
Extractive															
Tobacco								.-0.45 (0.73)	.-0.95 (0.70)		0.59*** (0.19)	0.11 (0.24)		0.86*** (0.32)	0.88*** (0.32)
Stell														0.06* (0.03)	0.06* (0.03)
Textile											0.43*** (0.14)	0.21 (0.20)			
Paper		.-0.39*** (0.05)	.-0.38*** (0.05)		.-0.14** (0.069)	.-0.158** (0.07)		0.018 (0.28)	0.073 (0.28)					0.50*** (0.14)	0.50*** (0.14)
Population (Log and 1st Difference)			0.19 (0.89)			.-0.042 (0.95)			.-22.5*** (5.94)			0.19 (0.56)			1.57 (2.09)
113 FDI (1st Difference)			.0.002 (0.008)			.0.007* (0.004)			0.025 (0.025)						
ARMA Terms	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Number of Observations	78	77	77	84	81	81	85	84	84	78	77	83	85	84	84
R-Squared	0.49	0.61	0.61	0.37	0.75	0.76	0.25	0.27	0.39	0.57	0.69	0.57	0.07	0.28	0.28
Adjusted R-Squared	0.46	0.57	0.56	0.35	0.73	0.73	0.24	0.23	0.34	0.54	0.66	0.52	0.05	0.21	0.21

Table 7 – Regressions with Adjusted Exchange Rate (Part 2)

Dependent Variable - Real Industrial Production Index (Log and 1st Difference)															
	Extractive			Tobacco			Stell			Textile			Paper		
Category	1			3			4			3			3		
Equation	i	ii	iii	i	ii	iii	i	ii	iii	i	ii	iii	i	ii	iii
Intercept	0.030** (0.014)	0.031** (0.014)	0.01 (0.02)	0.000 (0.001)	0.0001 (0.0003)	0.000 (0.0005)	0.0023 (0.002)	0.000 (0.003)	0.039 (0.015)	0.001 (0.001)	0.004 (0.002)	0.006 (0.003)	0.013 (0.010)	0.004 (0.002)	0.000 (0.003)
Exchange Rate - Nominal Currency Cr$ (Log and 1st Difference)	**-0.31*** (0.072)**	**-0.31*** (0.073)**	**-0.30*** (0.074)**	**0.025** (0.010)**	**0.030*** (0.007)**	**0.029*** (0.007)**	0.1368 (0.086)	**0.181* (0.105)**	**0.179* (0.105)**	**0.029* (0.014)**	0.0078 (0.016)	0.009 (0.017)	**-0.036** (0.015)**	**-0.044** (0.017)**	**-0.049** (0.017)**
Controls															
Intersectorial Effects (Log and 1st Difference (-1))															
Food					0.027 (0.04)	0.027 (0.04)					.-0.055 (0.071)	.-0.055 (0.072)		0.070 (0.095)	0.12 (0.095)
Beverages					.-0.018*** (0.036)	.-0.017*** (0.047)								0.018 (0.107)	0.03 (0.107)
Rubber		.-0.05 (0.06)	.-0.06 (0.06)												
Leather														0.53*** (0.10)	0.53*** (0.10)
Ciment															
Extractive															
Tobacco								.-0.918 (0.763)	.-1.15 (0.74)						
Stell															
Textile															
Paper					.-0.019 (0.041)	.-0.009 (0.04)		0.072 (0.29)	0.076 (0.28)		.-0.216*** (0.070)	.-0.215*** (0.070)			
Population (Log and 1st Difference)			8.79 (7.49)			.-0.17 (0.20)			.-15.14** (6.03)			.-0.84 (1.02)			1.85** (0.90)
113 FDI (1st Difference)			0.0048 (0.0107)			0.006* (0.003)						0.003 (0.004)			0.02 (0.01)
ARMA Terms	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Number of Observations	81	80	80	82	81	81	85	84	84	83	83	83	80	79	79
R-Squared	0.35	0.36	0.37	0.45	0.51	0.53	0.33	0.35	0.4	0.35	0.6	0.61	0.4	0.75	0.76
Adjusted R-Squared	0.33	0.32	0.33	0.42	0.46	0.47	0.3	0.29	0.35	0.32	0.57	0.56	0.36	0.72	0.73

A few points are worth highlighting from this exercise. First, the new explanatory variable produces very similar results to the original one. Coefficients are generally not very different from the specification when the exchange rate is tested separately from tariffs, and the level is only above 0.1 for the same three sectors (extractive industries, steel and rubber). Second, the change in the specification provides little changes to original results but standard errors improve when controls are included, indicating they are helping to improve the quality of the regressions. This is why the third specification using all controls was the one used for the original exercise.

The second robustness exercise introduces a different approach. Instead of making changes to the specification or a simple alteration to the explanatory variable, the new test is to completely change the individual regressions to a panel data set. As initially discussed, a panel is not expected to perform well with this type of data set, where the time horizon is long and there is little variation in the cross section space. But the panel can provide an

interesting counterfactual exercise. Since the results of the original regressions point to small coefficients between the exchange rates and industrial production, and on average the constructed index suggests a very small aggregate impact, we would expect that a panel, which provides the average impact of the exchange rate on industrial production, to show a minimal or not statistically significant coefficient. And this is the main difference in the panel specification to the original regressions. Since all sectors are tested together, and all of the non explained cross section variation goes to the fixed effects, the original coefficient of the exchange rate to industrial production is not a sectorial one, but a combined coefficient for the whole economy. This is why we would expect it to be very small; otherwise the panel would be contradicting the original results.

The panel was performed with specifications both on level and first difference, as well as with a variety of estimating methods. The regressions in level were also performed this time since in panel data set information is lost when the panel is performed in difference. The various estimating methods were used to guarantee that the results are tested in a robust way, with two stages least square and general method of moments being the best used to correct for serial correlation problems. The results of the panel estimates are presented at table 8.

Table 8 – Panel Data Estimations

	Dependent Variable - Real Industrial Production Index (Log)								
	Level					First Difference			
Estimation	OLS Pooled	OLS FE	OLS FE	2SLE FE	GMM	OLS Pooled	OLS FE	2SLE FE	GMM
Equation	i	ii	ii	iii	v	vi	vii	ix	x
Intercept	0.13** (0.058)	4.53*** (0.09)	0.36*** (0.11)	0.196** (0.12)	0.196** (0.12)	0.006*** (0.001)	0.006*** (0.001)	0.019 (0.02)	0.019 (0.02)
Exchange Rate - Nominal Currency Cr$ (Log and 1st Difference)	**.-0.00016 (0.0053)**	**0.01 (0.008)**	**0.01 (0.008)**	**0.04 (0.01)**	**0.04 (0.01)**	**0.02 (0.03)**	**0.019 (0.03)**	**.-0.32 (0.59)**	**.-0.32 (0.59)**
Tarriffs - Ad Valorem Level (1st Difference)	0.0001 (0.0002)	0.0004 (0.0003)	0.0004 (0.0003)	0.00018 (0.00027)	0.00018 (0.00027)	.-0.0015 (0.0017)	.-0.0018 (0.0017)	.-0.009 (0.029)	.-0.009 (0.029)
Controls									
Lagged Industrial Production	0.977*** (0.010)		0.92*** (0.02)	0.96*** (0.02)	0.96*** (0.02)				
113 FDI (1st Difference)	.-0.0011 (0.0013)		.-0.0011 (0.0016)	.-0.0009 (0.0018)	.-0.0009 (0.0018)	0.004 (0.68)	0.00 (0.62)	0.018 (0.038)	0.018 (0.038)
Time Fixed Effects	YES	YES	YES	YES	YES	YES	YES	YES	YES
Number of Observations	860	860	860	860	860	860	860	860	860
R-Squared	0.95	0.73	0.95	0.95	0.95	0.1	0.1	-0.08	-0.08
Adjusted R-Squared	0.95	0.7	0.95	0.95	0.95	0.09	0.09	-0.22	-0.22
Durbin-Watson Statistic	2.43	0.18	2.38	2.47	2.47	2.46	2.49	2.37	2.37

The panel data results confirm the above expectations. The coefficients of the exchange rate are generally very small and in all cases not statistically significant. In the same way as the original results, tariffs are also very small and not statistically significant. This confirms that there does not seem to be any important average impact of the exchange rate on industrial production, same result obtained above from the indexes. When performed separately, individual regressions do show a relevant impact of the MER system, but not at the aggregate level. It is also worth highlighting that the panel data regressions are not very robust. Even in the cases when serial correlation is corrected by GMM or 2SLS, the explanatory power of the first difference regression is very small, confirming that this model is not the best option for the proposed exercise. Much more variation on the cross section space would be needed to improve the panel results.

7. Conclusions

This paper has investigated whether the MER system of the 1950s in Brazil has caused negative externalities to the different industrial production sectors of the country. By

performing a counterfactual exercise of substituting the auctions exchange rate by the market exchange rate in 10 different industrial sectors, the main results refute the view that the MER system could have caused important distortions and that this was a major policy tool to create differentiation between sectors at that time.

On average during the whole period of the auctions experience the weighted average growth difference for all industrial sectors was only -1.03%, and the distortions were are only relevant for a few sectors which had low participation of industrial production in Brazil. For most sectors, particularly the more relevant ones such textile, leather and food, which represented the bulk of Brazilian industrial production in that time, there was minimal distortions from the different exchange rate which suggests that their growth was not related to the exchange rate system.

Ultimately, these results confront the idea that the system was really targeted to create differentiation between industrial sectors in a typical import substitution process. There is some evidence that some small sectors were beneficiaries but overall, it suggests that the system was much more concerned with adjusting the exchange rates to more equilibrium levels rather than creating distortions. Since the MER system was not more than a controlled depreciation process which acknowledged exchange rates had to adjust after a long period of overvaluation, this correction was nothing more than bringing back the exchange to a more neutral condition for most sectors. And the industrial deepening that took place in Brazil during the 1950s was much more the result of government expansionary policies, the state participation in industrial development and the attractiveness of foreign companies through Instruction 113 rather than exchange rates or the tariffs protection.

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