

The Great Depression and Brazil's capital goods sector: a re-examination*

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Summary: 1. Introduction; 2. Brazil's interwar industrial development; 3. Data on date of establishment of surviving firms; 4. Machinery imports; 5. Steel consumption; 6. Firm-level data from São Paulo; 7. Conclusion.

Key words: industrialization; external shocks; capital goods.

This paper offers a different interpretation of the impact of the Great Depression on Brazilian industrialization, by examining new evidence and re-interpreting existing data. Our focus is on the effect upon the production of capital goods. The demand for locally manufactured machinery came mainly from agriculture and their production responded favorably to the coffee boom. Consequently, the effect of the external shock was not unambiguously favorable. Since these goods were mainly non-tradable, the incentives for import substitution did not entirely offset the decline in demand. Analysis of firm-level data from the state of São Paulo shows a decline in firms producing agricultural equipment. The firms which responded to the crisis by shifting to the production of industrial machinery laid the basis for the future development of the sector.

Este artigo apresenta uma nova interpretação do impacto da Grande Depressão na industrialização do Brasil, examinando novos dados e reinterpretando a informação tradicionalmente disponível. Será dada especial ênfase ao efeito da Grande Depressão na produção de bens de capital. A procura de maquinaria fabricada localmente veio fundamentalmente do setor agrícola e a sua produção respondeu favoravelmente à euforia da produção de café. Consequentemente, o efeito do choque externo não pode ser considerado claramente favorável. Uma vez que os bens eram essencialmente não-transacionáveis, os incentivos à substituição de importações não conseguiram compensar claramente o declínio da procura. A análise de informação nas empresas, no estado de São Paulo, mostra o declínio na produção de equipamentos agrícolas. As empresas que reagiram à crise, desviando sua produção para o setor da maquinaria industrial, lançaram as bases do desenvolvimento futuro do setor.

1. Introduction

The effect of trade upon the industrialization of developing economies has been an enduring source of controversy. Views on this subject range from orthodox trade theory, which sees the effect as essentially beneficial, to that of dependency theory, which argues that disruption of trade relations is essential for industrial development. The Great Depression has been seen as a testing ground for many of these theories — many primary producing developing countries were subject to a severe terms of trade shock, and thereby suffered an invol-

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untary contraction in their trade possibilities. Alternative interpretations of this experience are available for many of the developing countries. This paper sheds additional light on this issue, by examining the development of an important sector — that producing machinery for agriculture and industry in Brazil in the 1920s and 1930s. This sector comes closest in representing the production of capital goods in a primarily agricultural economy.¹ Our findings question the accepted view in the literature, that the Depression was unambiguously helpful for the sector and accelerated its development. By using new data sources, we show that the decline of the export sector in the Depression had an adverse impact upon the machinery producing sector. Our findings also suggest that the consumer and capital goods sectors behaved very differently in this period, and further that the impact of the disruption of international trade upon them was also very different.

2. Brazil's interwar industrial development

In the 1920s, Brazil was an archetypal primary commodity exporter. Agriculture accounted for 79% of the total physical product and coffee was the main export crop. The growth of the export economy since the turn of the century had led to immigration and the emergence of a domestic market for industrial consumer goods, particularly textiles. The increase in local production of simple consumer goods reflected this demand before the First World War, but turned more import substitutive in nature during and after the war (Baer 1983:49).

The 1920s were good years for coffee. Industrial growth was however rather slow for most of the 1920s (3.6% per annum between 1920 and 1929). This primarily reflected the slow growth in textiles as an appreciated exchange rate encouraged imports. However, that decade saw a rapid growth in metal products, which also included machinery produced in small workshops catering to the agricultural sector.

Recovery from the Depression began early, and industrial output increased at 11.3% per annum between 1933 and 1939.² The debate on the question of the role of the Depression in the industrialization of Brazil has focused on the following question: did the Depression result in Brazil's transition from a primary producer to an industrializing economy?

In the classical ECLA literature (Furtado, 1963), the Depression was seen to be the cause of a structural break in Brazilian development. However, subsequent writings have emphasized the link between the expansion on the export sector and industrial development through the rise in income and the expansion of the domestic market. The writings of Fishlow (1972), Villela & Suzigan (1977), Versiani (1984), Suzigan (1984), and Leff (1989) have thrown light on the development of industries prior to the Depression. It has been argued that this early development allowed Brazilian industry to take advantage of the trade dislocation after 1929. The evidence presented in Leff (1989) shows that despite the domination of the coffee sector, the government did follow policies which were conducive to industrial growth. These included expansionary monetary and fiscal policies,

¹ For a discussion of the importance of the capital goods sector in the Third World industrialization, see Chudnovsky, Nagao & Jacobsson (1983), and for a discussion of its role in technological development, see the articles collected in Fransman (1986).

² There have been alternative indices of industrial growth put forward by Fishlow (1972), Haddad (1974) and Versiani (1984), but the overall inter-decadal comparison is unaffected by the specific index one uses.

tariffs and the depreciation of the currency. However, it is necessary to point out that despite the favorable effect of various policies on industry, the interventions do not appear to be specifically designed to foster industrial growth. For example, periods of high industrial growth in Brazil alternated with periods of high capital formation. When the currency appreciated, imports became cheaper and the demand for import substitutes declined; on the other hand, import of machinery was encouraged. The situation was reversed when the currency depreciated.

This paper discusses the impact of trade dislocation of the 1930s on the production of machinery in Brazil. The debate on Brazil's industrialization has implicitly assumed that industrial performance in the 1930s was uniformly superior to that in the 1920s. In addition, it has been specifically argued (Baer, 1983:49-50, Lago et alii, 1979, ch. 1, Leff, 1968:11-2) that the machinery producing sector also followed the pattern of development of the industrial sector as a whole. The first piece of evidence which is used to support this conclusion is the rise in the share of machinery in manufacturing value added between the industrial censuses of 1920 and 1940 (see table 1). However, the absence of an industrial census in 1930 makes it extremely difficult to understand how industry evolved in the two rather different decades, the 1920s and the 1930s.³

Table 1
Shares in manufacturing value added

Sector	1919	1939
Non-metallic minerals	5.7	5.2
Metallurgy	4.4	7.6
Machinery	0.1	3.8
Communications & electrical equipment	—	1.2
Transport equipment	2.1	0.6

Source: Industrial censuses, 1920, 1940.

There is a need to consider the two decades separately, in order to understand the dynamics of the transition. The industrial development in the context of an export boom as in the 1920s and import substitution following from trade dislocation as in the 1930s are two different economic scenarios. It seems possible that the consumer and capital goods industries were affected differently as we shall argue in the following section. To understand how a capital goods sector catering to the export economy adjusted to the new economic environment of the 1930s we must look at data which relates to the period after 1929. The picture that emerges by a comparison of 1919 and 1939, the years of industrial census, overlooks the role of an export sector in creating an industrial base. 1929 is seen as a structural break.

³ See also Neuhaus (1973) and Pelaez & Suzin (1976). An analytical perspective on this debate is provided by Cardoso (1981).

Table 2
Annual rate of growth of industrial output

Sector	1920-29	1929-32	1933-39
Textiles	1.9	8.4	11.1
Metallurgy	7.5	-3.4	20.4
All industries	3.6	1.3	11.3

Source: Villela and Suzigan (1977:130, 164, 166).

Notes: The growth rates have been calculated from quantum indices of industrial production in each subsector and the weights used are the average of the shares in value-added in 1919 and 1939 of each product in that group. The index for all industries is similarly weighted by the relative weight of the subsectors. Before 1923, the estimation of industrial output was based on tax paid on sales. After 1919, information on production was also collected through the tax agents. Thus there remains some inconsistency in the data relating to this period.

Further insight can be had by considering a disaggregated picture. Table 2 presents growth rates in two sectors, textiles and metallurgy. The former was the most important sector and dominated the index of industrial production, whereas the latter includes (but is larger than) the machinery producing sector. While the 1920s witnessed sluggish growth in textiles, metallurgy grew relatively rapidly. Indeed, Villela and Suzigan (1977) show that most sectors expanded faster than textiles in the period 1920-29. This is not surprising. After 1924 the pattern of development in the textile industry has diverged from that of other industries. Stein's classic study (1957) of the cotton textile industry shows that the industry was suffering from overproduction in this period. Together with the appreciation of the currency and the deflationary policies followed by the government, this created insufficient demand, and the average price declined between 1925-27. But despite the existence of excess capacity, there was increased investment either to rebuild new capacity or to modernize in the face of competition. This was facilitated by the exchange rate (Versiani, 1984). After 1929, textile production recovered early and the industry boomed in the 1930s.

The history of the metallurgy industry is somewhat different. This sector grew very rapidly in the 1920s and in the years 1933-39, although the slump in 1929-32 was significant.

We shall show in the next sections that the performance of the machinery subcategory within metallurgy shows an even greater divergence from the trajectory of the textile industry. What explains the differential impact of a boom or slump in the primary producing sector? An export boom had two implications — higher incomes in the export sector and therefore higher demand for industrial products, and a buoyant balance of payments, permitting cheaper imports. We distinguish between two types of industrial productions — those which are susceptible to international competition, and those which have a high weight-cost ratio and high transport costs, and could be classified as non-tradable. The non-tradable category also includes inferior goods. The concept of inferior good in consumption is well known. With an increase in income a consumer's demand for these products declines. Similarly, the demand for inferior capital goods comes from users whose purchasing power is limited and will therefore switch to better products as their financial situation improves. The two types of industries would have different responses to an export boom. In the first case, the effect would be contradictory — while the increase in export

earnings and income would stimulate demand, the improvement in the balance of payments would cause an appreciation of the currency or permit more liberal imports of competing products. On the other hand, a good which is non-tradable will only experience a favorable increase in demand. Further, the currency appreciation would cheapen capital formation in the sector.

The textile industry exemplified the first type of product, since it faced stiff international competition. The machinery producing sector mainly produced inferior quality equipment and machinery with a high weight-cost ratio. When transport costs are high, import of products which are heavy may prove to be uneconomical. This appears to be relevant in agrarian economies using relatively unsophisticated machinery, for example rice threshers, presses and water wheels.

Examples of indigenous production of equipment for agriculture date back to the first half of the nineteenth century in Brazil. The difficulties involved in transporting bulky equipment to Minas Gerais led to the substitution of imports by local manufacture. Workshops were set up by local as well as foreign entrepreneurs to produce equipment locally using imported raw material and components in Bahia, Rio de Janeiro and Rio Grande do Sul (Lago et alii, 1979:78). Imports were also displaced by inferior substitutes. The demand for cheaper though inferior quality sugar mill machinery manufactured by a local entrepreneur in São Paulo in the 1920s, came from small producers who had limited access to finance (Gupta, 1989:50). Since the demand for locally produced machinery in Brazil came mainly from the primary sector, it was stimulated by an export boom and suffered during the Depression, and therefore needs to be distinguished from the demand for consumer goods like textiles. This difference in capital and consumer goods implies that the effect of the Depression may have differed on the two sectors and that there is a need to study them separately during the period of transition.

In this paper, we study the developments in the production of capital goods following the Depression by looking at alternative sources of information. We use the machinery producing sector as the focus of our analysis. Although capital goods refer to machinery as well as electrical and transport equipment, the dynamics of production of capital goods in Brazil in the interwar period was dominated by machinery. While the share of machinery in industrial output increased from 0.1% in 1919 to 3.8% in 1939, that of electrical equipment rose to 1.2% in 1939 and that of transport equipment declined from 2.1% to 0.6% (*Industrial census*, 1920 and 1940). From these statistics it may be inferred that production of transport equipment declined substantially whereas the production of machinery increased. In the state of São Paulo, which accounted for nearly half the domestic output, the production of transport equipment appears to have increased rapidly in the period 1932-33 (Villela & Suzigan, 1977:297, table 90). It is possible therefore that most of the decline took place in the 1920s. The import of transport equipment increased phenomenally after 1919, probably leading to the decline in domestic production.

We confine our attention to machinery production. This sector is a good example of the favorable effects of an export boom. The problem of measurement arises due to the lack of annual statistics for the different components of capital goods. At best, it is possible to get annual output indices for the sector known as metallurgy (IBGE, *Anuário Estatístico do Brasil*). We discuss the different measurements used to assess the growth of this sector and finally use the microlevel data from São Paulo to throw additional light on the subject.

3. Data on date of establishment of surviving firms

Our first source of more detailed information on trends in the capital goods sector is the 1940 census, which tells us the date of establishment of firms. This may be used in order to estimate the entry of firms into the capital goods sector for various sub-periods. This source has indeed been used in the literature (see, for example, Lago, 1979:63-7). However, the existing literature has not, in making inferences, made allowances for the fact that the 1940 data do not tell us the number of firms established in any given earlier period, but only the number of those established which survived up to 1940. In order to make inferences about the rate at which firms were founded in different periods, one has to make some allowance for the fact that some of the firms did not survive up to 1940. This point is relevant for comparisons of the rates of entry of firms into the industry in different decades. If firms have a positive probability of going out of business in any period, the rate of entry of firms would be systematically understated and the degree of understatement would be greater the earlier the sub-period. Consequently, a reliance upon the uncorrected census figures would tend to downplay the rate of expansion of the industry into the earlier decades such as the 1900s as compared to the 1930s.

In order to correct for this bias, let us assume that, in each year, a firm has a probability p of continuing in business and a probability $(1 - p)$ of exiting.⁴ Hence, if $N(k, t)$ is the number of firms founded in year k which survive to year t , and $N(k, k)$ is the number of firms founded in year k which we would like to estimate, we have:

$$N(k, t) = N(k, k) p^{(t-k)} \quad (1)$$

From equation (1) we can derive $N(k, k)$, the number of firms established in year k , from the data on $N(k, t)$, i.e., the year k firms observed in year t , provided that we have some estimate of p , the probability of survival. We can obtain an estimate of p provided that we have data on the year k firms at two distinct points of time. Suppose that we have a census of the number of firms established in year k taken at years s and t , where $t > s$. We have:

$$N(k, t) = N(k, s) p^{(t-s)} \quad (2)$$

Since we have data on $N(k, t)$ and $N(k, s)$, our estimate of p is given by:

$$p = [N(k, t)/N(k, s)]^{1/(t-s)} \quad (3)$$

Our estimates of p are derived by combining the data on the foundation of firms in the 1920 and the 1940 censuses. Both these censuses report the number of firms founded in the period 1900-09, and the period 1910-19. As the preceding argument would lead us to expect, the number of firms in each category is lower in the 1940 census as compared to the 1920 census. Table 3 reports these figures and the estimates of p , the survival probability, which have been computed using these figures. The different estimates we have are remarkably

⁴ This is an average exit probability. The probability of exit may vary over time, depending on economic conditions. However, our data sources do not permit the estimation of time-varying probabilities.

close, differing only in the third decimal place, by at most 0.002. The estimate of p we use is 0.979, which is obtained by using the data on all the firms founded between 1900 and 1919.

Table 3
Estimates of the probability of survival

Period of entry	1920 Census	1940 Census	p
1900-09	28	18	0.978
1910-19	74	49	0.980
1900-19	102	67	0.979

Notes: Columns 1 and 2 refer to the number of metal working firms by period of foundation reported in the 1920 and 1940 censuses. Column 3 reports the corresponding estimate of p , the annual probability of survival, which has been computed using equation (3).

By using our estimate of p and the 1940 census data on the number of surviving firms by year of foundation, we arrive at an estimate of the "corrected" annual rate of foundation. This is reported in table 4, which also reports the raw data on the number of surviving firms according to their year of foundation. The figures show that the rate of entry increased steadily over the years, more or less doubling from one decade to the other. The figures nevertheless show considerable growth in the industry in the period before 1929. Reliance upon the uncorrected annual rate of foundation would suggest that fewer firms entered the industry in the early years of the century.

Table 4
Metal working firms in the 1940 census according to date of foundation

	1900-09	1910-19	1920-29	1930-39
(1) No. of surviving firms founded	18	49	116	344
(2) Uncorrected annual rate of foundation	1.8	4.9	11.6	34.4
(3) "Corrected" annual rate of foundation	3.8	8.3	16.0	38.3

Notes: While the sector included concerns producing electrical and transport equipment, there is an overestimation since all metal working concerns did not produce capital goods. On the other hand, some firms producing equipment were listed under the metallurgy sector, but cannot be separated due to lack of disaggregation. (1) is the number of firms in 1940 census according to their reported year of establishment. (2) is obtained by dividing this number (1) by the number of years in each period. (3) is obtained from (2) by "correcting" for the rate at which firms perish. The reported figure is derived by dividing (2) by 0.979^{40-k} , where $(40-k)$ is the number of years between the mid-point of the period and 1940.

Source: Calculated from *Industrial census*, 1940.

4. Machinery imports

Lago et alii (1979:67) use the rate of growth of imports of capital goods to make inferences about the growth of the sector, the argument being that lower imports are likely to imply greater growth of the domestic sector. Comparing the indices of import of capital goods, Lago et alii conclude that while imports of capital goods increased in the 1920s, the rate of growth was low compared to the period before the First World War. Since both periods saw

high capital formation, Lago et al. argue that this indicates relatively fast growth in domestic production of capital goods in the 1920s. However, it is likely that imports of machinery fluctuate in response to the overall demand for machinery for investment, so that periods of high imports are also periods of high domestic production of machinery. A second problem is that machines are also required to make machines, and the aggregate data does not distinguish between machinery used in the production of consumer goods and those in the production of capital goods. Hence it is difficult to use aggregate import data to infer about trends in capital formation in the machinery industry. To the extent that investment goods for the production of capital goods are not domestically produced at all, a decline in imports could have an adverse effect. In the 1920s, when imports entered on favorable terms as a result of the appreciation of the currency, many sectors experienced a sustained period of capital formation. This may well be the case for the capital goods sector producing equipment for the booming coffee economy. In the absence of disaggregated data, inferences drawn on the basis of an aggregate index may be questionable.

From this point of view, Suzigan's data (1984) on the quantum of export of machinery to Brazil from France, Germany, the United Kingdom and the United States are more useful since they are disaggregated by sectors. Such exports of metal-working machinery have been used to estimate the quantum of imports by Brazil and this can be an indicator of the level of investment in the metallurgy and capital goods sectors.

Table 5 shows that after the disruption caused by the First World War, imports of metal-working machinery by Brazil increased rapidly in the 1920s, trebling in volume between 1919 and 1929. With the Depression there was a drastic fall, and it is only in 1935 that the 1929 level was re-established. The subsequent years show rapid growth. However, at the end of the 1930s, imports of metal-working machinery were on average double of the level of 1929, a smaller order of increase over the decade as a whole as compared to the 1920s. However, as Suzigan points out, they include machinery for metallurgical operations, which would meet the investment needs of sectors like iron and steel. This creates a problem, since the metallurgy sector was larger than the sector producing machinery. Consequently, movements in the former may obscure or outweigh that of the latter. We shall see that data from São Paulo show that in the period 1929-37, growth in metallurgy was much faster than in machinery.

Table 5
Index of import of metal-working machinery by Brazil
from the UK, the USA, Germany and France at 1913 prices

Year	Index	Year	Index	Year	Index
1919	33.3	1926	84.7	1933	57.5
1920	31.7	1927	88.6	1934	76.1
1921	57.3	1928	95.4	1935	105.1
1922	55.4	1929	110.8	1936	156.8
1923	53.8	1930	100.0	1937	161.2
1924	60.9	1931	29.2	1938	253.5
1925	82.8	1932	16.3	1939	181.0

Base: 1930 = 100

Source: Calculated from Suzigan (1984:320-7, appendix 1).

5. Steel consumption

Leff's (1968) analysis of the Brazilian capital goods sector is based entirely on the consumption of iron and steel for the period 1929-40. Referring to the metallurgical and equipment industries, he writes (1968:11-2):

"These industries already had a significant portion of value added in Brazilian manufacturing as early as 1920. By 1940, however, they had grown rapidly enough to double their share. The equipment industry grew at a particularly disproportionate rate, almost trebling the percentage. The growth of equipment production seems to have been especially rapid in the period 1933-40. Output statistics are not available for those years, but the table shows data on the Brazilian consumption of iron and steel. Because this was before the extensive use of iron and steel either in construction or in consumer durables, these input figures are an indication of the extent of equipment production. The annual compound growth rate was 10.4%."

Again, Leff's arguments are based firstly upon a comparison of the 1920 and 1940 censuses, and secondly upon the rapid growth in consumption of iron and steel between 1933 and 1940. As we have already argued, the first comparison does not allow us to disentangle the changes before 1929 and those taking place afterwards. Regarding the second, it is somewhat misleading to compute growth rates from 1933, a point where steel consumption had fallen substantially. A part of the 10.4% growth attributed to this period does not reflect any additions to capacity, but merely a recovery to earlier levels of production. If instead we compute the annual rate of growth between 1929 and 1940, the figure is only 5.8%. Further, due to the use of iron and steel in the construction industry, for railway construction and other infrastructure development, inferring trends in capital goods production from steel consumption is problematic.

6. Firm-level data from São Paulo

Given the weakness of the aggregate and indirect data sources, we turn to some firm level data on machinery producers in the state of São Paulo. This data source of industrial firms in the state of São Paulo has been used by Suzigan to analyze industrial developments in the state. However, data specific to the capital good sector has not been used to assess the impact of the Depression on the small workshops producing machinery for the export economy. In this paper we focus on the machinery-producers. We use annual data on output and employment for each firm during the period 1928-37, which allows us to quantify the changes in the industry. The data also list the products manufactured by the firms, so that we are able to see the changes in the product composition in the industry. In general, the use of firm-level statistics from São Paulo enables us to have a much more detailed picture of the industry in this period.

By 1919, São Paulo had become the leading industrial center in the country. It accounted for 35.3% of the total industrial value added, and by 1939 the figure had risen to 40.9%. The industrial concentration in the state was particularly noticeable in the category "machinery, electrical and transport equipment". The share of the state in the national value added had been 48% in 1919. In 1939 it stood at 78%. Moreover, the state of São Paulo in the 1920s

was the center of the export boom, and industrial growth was mainly in response to expansion in the export sector.

The data used in our analysis comprise a list of firms producing “machinery for agriculture and industry” between 1928 and 1937.⁵ This category is a subsector of the metallurgy industry which includes foundries and workshops producing metal products, workshops producing transport and electrical equipment and parts for these, and various types of repair workshops. Thus, while a part of the sector would approximate the category “metallurgy” as defined in the industrial census of 1940, another part represents the sector “metal working”. We distinguish between the two, since the output of the metallurgy sector comprises intermediate goods, while the metal working sector produces capital goods. Our analysis relates to the capital goods industry, and consequently we select the subsector “machinery for agriculture and industry” as the closest approximation. However, machinery was also produced in foundries and in repair workshops, but it is impossible to separate the magnitude of such production from the output of intermediate goods and repair work. Our category excludes production of electrical and transport equipment as well as machinery produced in workshops mainly engaged in repair work and those produced in foundries, and consequently underestimates the extent of capital goods production. However, there are considerable advantages in using this source. It provides information about the types of products manufactured by these firms, the level of employment in each firm and the total value of output in the sector. This is the only source of annual output statistics within the capital goods sector.

In 1929 the metallurgy sector as a whole had 486 establishments and employed 15,160 workers. The subsector producing machinery accounted for approximately one-fifth the number of establishments under metallurgy, a third of employment, a quarter of output and about 30% of the capital invested. The sector produced primarily agricultural machinery, which included equipment for processing coffee, cotton, sugar and rice and various types of farming equipment. Among the firms in the category employing over 50 workers, 14 produced machinery for agriculture and agro-industries, while there were single firms specializing in producing machinery for saw mills, bakeries and the hat industry and parts for textile machinery. One firm manufactured elevators. This confirms the picture of a capital goods industry developing in response to an expansion in the export sector. The industry produced mainly equipment for the export sector and only certain types of simple machinery required in the production of consumer goods.

Table 6 shows the changes in employment and output in the metallurgy sector and in the subsector “machinery” between 1929 and 1937. While real output and employment in metallurgy tripled in this period, growth in the machinery industry was much slower — real output increased by only 22% and employment by 21.6%. This contrast is striking, and particularly relevant since other indirect estimates of machinery production are often forced to rely upon the assumption that machinery production moved in line with metallurgy. For instance, Suzigan’s use of the exports of metal working machinery to Brazil has the problem that such machines may be used either in metallurgy or in machinery production proper. Our data indicate that, at least for the period 1929-37 in the premier state of São Paulo, trends in the two diverged substantially.

⁵ Secretaria de Agricultura, Indústria e Comércio de São Paulo, Diretoria de Estatística, Indústria e Comércio, 1928-37.

Table 6
Indices of gross output and employment in metallurgy and machinery in São Paulo
(1929-37)

Year	Employment		Gross output	
	Metallurgy	Machinery	Metallurgy	Machinery
1929	35.5	100.0	34.4	87.9
1930	37.9	60.3	41.3	56.2
1937	123.2	111.6	148.6	107.2

Base: 1935 = 100

Source: Directory of statistics for the state of São Paulo, years 1929-37.

These data also allow us to analyze the process of structural change within the sector. Table 7 shows the size-distribution of firms (in terms of employment) over the period. There was a decline in the number of firms in the sector between 1929 and 1937, mainly due to the exit of small firms. The number of firms employing less than 20 workers declined from 92 to 54, due to the disappearance of many small workshops catering to the export sector. There was also a major change in output composition. Of the 19 firms employing more than 50 workers in 1929, 14 produced machinery for agriculture and agro-industries, whereas in 1937 only 10 of the 23 firms in this category did so, the rest producing industrial machinery. There was also a diversification of output, with firms entering the production of machinery for metallurgy, chemical and paper industries, as well as equipment for power generation and transmission. The contrast is best expressed through a single statistic — employment in the large firms (with more than 50 workers) producing for agriculture and agro-industries rose by only 8.4% between 1929 and 1937, but rose by 84% in large firms producing industrial machinery.

Table 7
Distribution of firms in the machinery sector in São Paulo
according to number of employees
(1929-37)

Year	1-20	20-50	51-100	101-200	Above 200
1929	92	19	8	7	4
1933	66	18	7	6	0
1937	54	23	10	8	5

Source: Diretoria de Estatística, Secretaria de Agricultura, Indústria e Comércio, state of São Paulo, years 1929-37.

Over the 1930s there emerged a great diversification in Brazil's capital goods industry. Not only did production of industrial machinery assume greater importance, but it was also the firms producing industrial machinery which showed greater dynamism. The gains in the production of equipment for the textile industry were most significant. The number of firms producing machinery for other consumer goods was fewer, but here too there was an expansion over this period. In the mid-1930s, firms began to produce machinery for metallurgical and chemical works as well as equipment for printing. Their successful transition depended on the ability to diversify and cater more and more to the dynamic sectors of the economy,

as is also seen from a history of firms within the sector (Gupta, 1989:47-60). Romi, which used to repair automobiles and agricultural machinery, entered into the production of machine tools. Similarly, Bardella diversified into industrial machinery, in response to the changing structure of demand. Dedini continued to be linked to the primary sector, but produced machinery for the expanding sugar economy. Andrighetti and Villares were involved in the production of industrial machinery from the 1920s.

At the beginning of the Depression, the Brazilian capital goods industry had essentially catered to the export economy. By the end of the next decade, it showed greater diversity. Although the main source of demand was still the primary sector, production of equipment for consumer and intermediate goods industries had begun. It was the sector producing industrial machinery which proved to be most dynamic in this period. Nevertheless, its share in the domestic production of capital goods remained small, and the dynamism of this segment of the capital goods sector was not reflected in the data on aggregate output and employment. The more important segment of the capital goods industry catered to agriculture and was adversely affected by the decline in the export economy. Although cotton production expanded rapidly in the state of São Paulo, the export boom was over and the emergence of cotton as the second largest export crop merely reduced the impact of the crisis. The 1930s need to be seen as a period of structural change within the capital goods industry.

7. Conclusion

An examination of various data sources suggests that the impact of the Great Depression upon the capital goods sector in Brazil was not as positive as has been suggested. Capital goods production catered to a large extent to the primary producing export sector, and was adversely affected by the trade shock. This contrasts with the behavior of the consumer goods sector, especially textiles, which witnessed more rapid development over this period. The major reason for this difference lies in the differential tradability of products between the sectors, and also in the fact that capital goods production itself required imported machinery, which was in short supply in a time of balance of payments difficulty. Our analysis highlights the heterogeneity of the industrial sector, and the need for sufficient disaggregation.

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