

# Beyond Banks and Stocks: A Study of Industrial Mortgages for the City of São Paulo, Brazil (1866-1914)\*

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## Abstract

The objective of this paper is to show the relation between the mortgage credit market and the industrial activities in the City of São Paulo, considering mortgages as an unusual form of industrial funding. Mortgages register different alternatives of funding. Through them we can find out if industries were funded by foreign or national banks, private individuals, or by debenture emission. The analyzed period is inserted in a context of intense transformation of the Brazilian economy, which includes the expansion of coffee exportations, urbanization process, investments in infra-structure. By analyzing the data, we affirm that the native capital is preponderant in industrial mortgages and that the size of industries matters for the funding conditions. Notwithstanding, although banks and stocks are important to explain the industrial funding, the mortgages showed that most of the credit operations were performed by non-banking agents.

Key-Words: mortgage credit, industry, financial markets

## Resumo

O objetivo deste artigo é mostrar a relação entre o mercado de crédito hipotecário e as atividades industriais da Cidade de São Paulo, considerando as hipotecas uma forma não-usual de financiamento industrial. Hipotecas registram diferentes formas de financiamento. Por meio delas, podemos descobrir se as indústrias foram financiadas por bancos nacionais ou estrangeiros, indivíduos privados ou emissão de debêntures. O período analisado está inserido em um contexto de intensa transformação da economia brasileira, que inclui: expansão das exportações cafeeiras, urbanização e investimentos em infra-estrutura. Analisando os dados, afirmamos que o capital nativo é preponderante em hipotecas industriais e que os tamanhos das indústrias importam para determinar as condições de financiamento. Não obstante, embora bancos e títulos sejam importantes para se explicar o financiamento industrial, as hipotecas mostraram que a maior parte das operações de crédito foram realizadas por agentes não-bancários.

Palavras-Chave: crédito hipotecário, indústria, mercados financeiros

Classificação ANPEC: História Econômica; Classificação JEL: N26; N66; N86.

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## Introduction

Brazilian industry performed extraordinary growth in the twentieth century, becoming the main economic activity in the end of the 1960s.<sup>1</sup> Capital mobilization was one of the most important challenges that enabled the growth in this sector. Industrials combined diverse sources to fund their investments, including profits, banking loans, debentures and stocks emission.<sup>2</sup> The scarcity of information, data, and studies make difficult to understand the factors that enabled the industrial funding.<sup>3</sup> In Brazil, mortgages consisted in a valuable source of information about the funding of various sectors of the economy, including the industrial sector.<sup>4</sup> The mortgage credit market only had a more organized and formal structure after the Mortgage Legislation of 1864. It amplified the information on mortgages and increased its publicity, through its registration in specific books.<sup>5</sup> Mortgages register different alternatives of funding. Through them we can find out if industries were funded by (foreign or national) banks, private individuals (such as capitalists) or by debenture emission.<sup>6</sup> The period of the study begins in 1866 and finishes in the starting year of the WWI. We analyzed the City of São Paulo, one of the main industrial centers in Brazil.<sup>7</sup> Thus, the mortgages analyzed in our study bring to light an expressive amount of new information about the funding in early Brazilian industrialization.

The coffee economy's growth in the State of São Paulo through the Nineteenth Century enabled a strong demographic and economic development. The City of São Paulo – as capital of the State – was the administrative, commercial, and financial center to this dynamic process. It is the increasing demand for new products and the infra-structure created by the coffee economy that guaranteed the adequate conditions for the establishment of the industry, especially in the City of São Paulo. (Dean, 1969; Suzigan, 2000).<sup>8</sup> Many authors mention the importance of the resources created by the coffee economy to fund industrial activities (Dean, 1969; Saes, 1986; Suzigan, 2000; Hanley, 2005). Hanley (2005) shows the relevance of domestic capital on financing diverse economic activities, such as industries. A sort of instruments was used in order to fund these activities: stocks emissions, banking loans, and debentures.<sup>9</sup> Saes (1986) also contributed for understanding the relationship between the development of the banking and financial system and the productive activities in São Paulo. Capital accumulation demanded the improvement of the financial system through banks, brokers, and stock exchange. The number and types of banks in the City of São Paulo rose, as well as the emissions of bonds and debentures by the larger industries. All this financial development occurred with larger participation of the domestic rather than foreign capital in the funding of productive activities. (Hanley, 2005). Relating to the companies' size, there is evidence that large companies have more favorable credit conditions than small and medium enterprises. (Cull et al., 2006). In this paper, we construct a more detailed framework of initial industrialization and its financing in São Paulo. The study of the mortgage credit turns possible a rich and objective analysis on the

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<sup>1</sup>Stein (1957), Baer (1965), Fishlow (1972), Suzigan (2000), Baer (2008).

<sup>2</sup>Dean (1969), Hanley (2005), Levy (1977), Triner (2000), Saes (1986), Levy (1991).

<sup>3</sup>As stated by Lewis (1999).

<sup>4</sup>Sweigart (1987) affirms that the mortgage credit consisted in an important type of credit for the coffee economy in the Nineteenth Century Paraíba Valley, Rio de Janeiro. On the other hand, the international literature states that industrial development in advanced countries occurred mainly through banking, bonds, and stocks emissions mechanisms. (Lamoreaux, 1996). The mortgages were studied for other sectors, e.g., the agriculture. (Redish, 2003; Snowden, 1987; Eichengreen, 1984).

<sup>5</sup>Only then was possible to obtain more details about the mortgage, specifying the value, the defined term and the interest rate of each loan. The primary documentation utilized in this study comes from these specific books, available in the *Arquivo Público do Estado de São Paulo* (APESP).

<sup>6</sup>The source has no information about funding by stocks emission or profits.

<sup>7</sup>Despite the Mortgage Legislation dates from 1865, the first industrial registry would appear only in 1866. Therefore, we use the referred year as the initial chronological mark of our work. The ending chronological mark was chosen to limit the analysis to the earliest phase of Brazilian industrialization process. After the WWI and, especially, during the decade of 1930, there were substantial changes in the governmental economic policy and its manners to deal with the national industry. (Baer, 1965; 2008).

<sup>8</sup>The economic growth of coffee sector produced the diversification of investments, such as railway construction, public services and industry. Warren Dean affirms that the European immigrants that came to work on the coffee plantations were important to the genesis of the industrial class in Brazil. (Dean, 1969; Suzigan, 2000).

<sup>9</sup>"Debentures, or bonds of corporate debt, were also issued and traded by brokers during this period. Companies raised capital initially through the issue of equity shares, but when finances were low and infusion of capital was required, debentures appeared to be the preferred solution". (Hanley, 2005, p.80).

relations between credit and industrial firms when we look at the qualitative (the creditor and debtors of those loans, their professions, their place of origin, aspects of the collateral etc.) and quantitative (value of the credit, the defined interest rate and terms, and, especially, industries' size, etc.) information available on the mortgage registration books.

## 1 Industry and Mortgages

Despite of the non-frequent utilization of mortgages as mechanism of industrial funding in other countries, in Brazil it is observed that creditors used this instrument as warranty against defaults on every type of funding, including industrial funding. As a first evidence we compared the mortgage credit with the Brazilian industrial census of 1907 in order to justify the relevance of the mortgage as industrial funding mechanism. By crossing the data from the census in São Paulo and our total mortgage sample we can find 45 firms in our dataset, which we defined *restricted sample*.<sup>10</sup> Both the census and the sample indicate that the most significant industrial sectors are Textile, Beer, Foundry, Pottery, and Milling – totalling 73% of all the registered industrial capital. (See Table 1).

**Table 1: Capital by Sector – Industrial Census versus Mortgage Sample (1890-1914)**

Sector	Industrial Census		Restricted Sample		(Sample/Census)	
	N (%)	Capital (%)	N (%)	Capital (%)	N (%)	Capital (%)
Textile	11%	35%	20%	42%	50%	83%
Beer	11%	15%	11%	19%	28%	91%
Foundry	11%	10%	18%	11%	44%	81%
Pottery	5%	8%	11%	5%	56%	42%
Milling	2%	6%	2%	7%	33%	89%
Subtotal	39%	73%	62%	84%		
Miscellaneous	61%	27%	38%	16%		
Total	100%	100%	100%	100%		

Source: Brazilian industrial census of 1907 and Mortgage Registration Books of the First Notary's Office of the Capital. *Arquivo Público do Estado de São Paulo* (APESP).

In spite of the difference in number of registries, we verify that by looking at the capital, the restricted sample is representative, as we can notice the similar share of the industrial sectors analyzed. Notice that in the case of the Textile sector, the industries of the sample had capital corresponding to 83% of all the registered industries. The largest observed share occurred in the Beer sector, on which 91% of the capital registered in the Census could be identified on industries included in the restricted sample. An unlikely situation occurred in the Pottery sector, on which the capital relation represents less than half of the census. Table 2 has the relative value of the set of industries from the restricted sample. We verify that in the case of the Textile sector – the most important industry in Brazil – the relationship between mortgage loans and capital reaches 96%. In other sectors, the relationship between loans and capital is lower. We can see that the average relationship between mortgages and capital is around 65%.

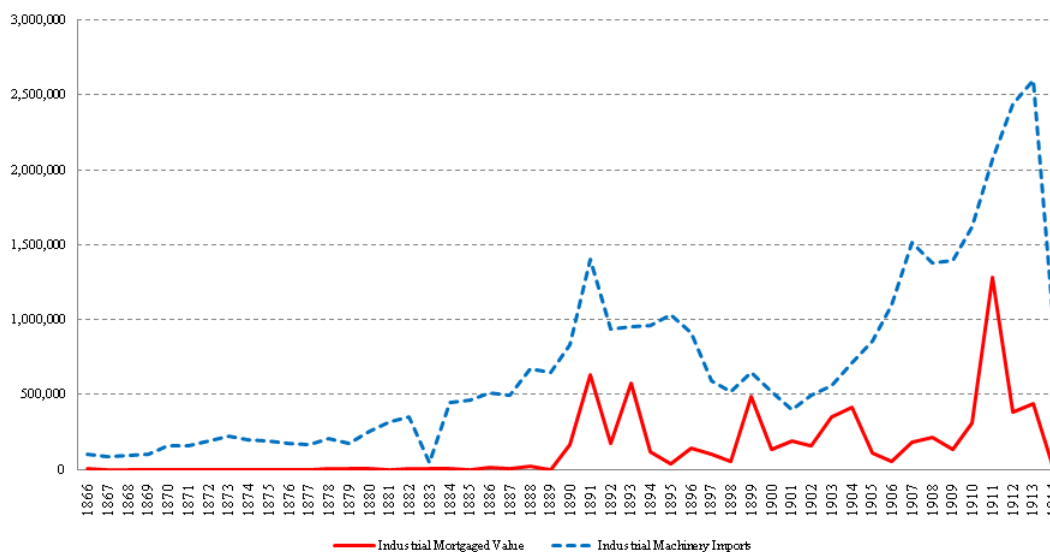
<sup>10</sup>To evaluate the relative importance of the mortgage credit in relation to the capital of each sector, we chose a sample within the period 1890-1914. The choice of the period was made due to a couple of reasons: the first one is to ensure chronological proximity to the year of the industrial census (1907); and the second one is that most of industrial mortgages are concentrated on the period above.

**Table 2: Share of Mortgage Loans on Industrial Capital by Sector (in contos)**

Sector	Mortgage Loans	Capital	Mortgage Loans/Capital
Textile	21,876.66	22,890	96%
Beer	4,040	10,338	39%
Foundry	1,548	6,159	25%
Pottery	1,275.64	2,550	50%
Milling	942.16	4,000	24%
Total (Average)	29,681.97	45,937.15	65%

Source: See Table 1. Observation: all values are from the restricted sample.

An additional evidence for the total sample relating mortgage credit and industrial investment can be obtained by time series analysis. We can compare the registered values of mortgages in the city of São Paulo (our data) to the importation of industrial machinery in Brazil.<sup>11</sup> The evolution of each series along the period can be viewed in Figure 1:

**Figure 1: Industrial Machinery Imports and Industrial Mortgaged Value (1866-1914):**

Source: Industrial Machinery: Suzigan (2000). Mortgaged Value: Mortgage Registration Books of the First Notary's Office of the Capital. *Arquivo Público do Estado de São Paulo* (APESP).

The industrial machinery importation series is traditionally associated to the industrial investment. Thus if there is a relationship between the mortgage credit and the referred series, then we can suggest that mortgage credit is also a representative of the industrial investment. A good manner to test if the relation is relevant is by performing a cointegration test between both series. We tested for cointegration the variables *Value Invested in Machines* and *Industrial Mortgaged Value*. Given the presence of heteroskedasticity, variables were analyzed in logs. Then a model with deterministic trend (restricted constant) and lags was estimated.<sup>12</sup> The results of both the Trace Test for the Max-Eigenvalue test indicates the presence of one cointegrating equation at 5% level. The table of the results is presented in the annex. Although the international and national historiography does not suggest the mortgage as a traditional mechanism of industrial funding, in the case of São Paulo we verified an expressive relevance of this alternative.

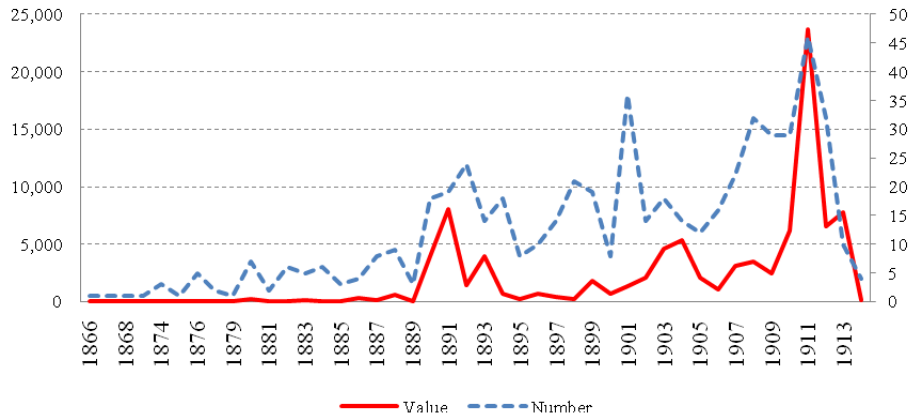
<sup>11</sup>The importation series is in Suzigan (2000), in which the author considers the four major exporters of capital goods to Brazil: England, Germany, France and USA.

<sup>12</sup>Before testing cointegration, we ran unit root tests (Augmented Dickey-Fuller and Ng-Perron), that showed that both series do not reject the null hypothesis of unit root at the 1% level.

## 2 Mortgage Credit and Industry: Empirical Analysis

In this section, we analyze empirically the industrial mortgage data for the period 1866-1914 available in the registry books, totalling 531 mortgages (total sample). Our interest is to understand the financing conditions of the early Brazilian industry. This period saw remarkable events of Brazilian economic and political history, including the monetary-credit crisis period known as *Encilhamento* and the beginning of the WWI. The first evidence that draws attention is the growing evolution in the number of mortgage registries granted to industries in the studied period, as we can see in Figure 2:

**Figure 2: Number and Value (in *contos*) of Industrial Mortgages (1866-1914)**



Source: Mortgage Registration Books of the First Notary's Office of the Capital. *Arquivo Público do Estado de São Paulo* (APESP).

Despite of a fall in 1892, with partial recovery in 1893, it is noticeable the rise of 95.7% in the industrial mortgaged value in 1886-1891, as well as the rise of about 80% of the number of registries. The evidence shows that there was a larger credit access for industries in the years of *Encilhamento*, i.e., the industrials of that time took enjoyed good funding conditions to increase their investments and production.<sup>13</sup> The period marked by the restrictive monetary policy of Joaquim D. Murinho (1898-1902), in turn, did not have too much impact on industrial mortgages in its period itself, except for the decline in the year of 1900. A bigger impact would happen on the following years (between 1902 and 1905). Thus, we can see a delay of the monetary policy's effects on mortgage industrial investments. It is also remarkable the recovery of mortgage investments in the beginning of the Twentieth Century. Another relevant observation is the convergence of the results in the direction of contributing to the thesis of Stein (1957) when we refer to the controversy of the *Encilhamento*, and the thesis of Dean (1969) when dealing with the positive relation between exportation coffee commerce and industrial investment in São Paulo. About the antecedents of the WWI (1912-14), it is also noticeable the vertiginous decline in the industrial financing. From a peak of 46 industrial registries in 1911, to only 4 registries in the year that marks the beginning of the WWI. It is considered the minor amount in 22 years, i.e., since the year of the Brazilian Republic's Proclamation (1889). Looking closer at the profile of the creditors, we can notice that the most important lenders were banks (about 37%), capitalists (about 15%), and negotiators (about 10%), totaling 63.5% of all mortgaged value for industries. Despite representing 11.8% of the mortgaged value for industries, the occupation of *proprietary* is too generic to define any specific category below in Table 3:

<sup>13</sup>Levy (1977), Triner & Wandschneider (2005).

**Table 3: Number and Values of Industrial Mortgages by Occupation of the Creditor (1866-1914):**

Occupation	Number of Cases		Mortgaged Value	
	N	(%)	( <i>contos</i> )	(%)
Artist	1	0.2	4.95	0.0
Capitalist	40	8.4	10,350.81	15.3
Industrial	6	1.3	277.39	0.4
Public broker	12	2.5	13,445.03	19.9
Farmers	5	1.0	296.33	0.4
Bank	45	9.4	25,442.27	37.6
Negotiator	79	16.5	7,198.59	10.6
Enterprise	6	1.3	1,038.43	1.5
Pottery	4	0.8	376.12	0.6
Liberal professional	7	1.5	323.75	0.5
Retirement savings bank	9	1.9	496.54	0.7
Worker	2	0.4	29.13	0.0
Ecclesiastic	1	0.2	20.68	0.0
Proprietary	248	51.9	8,014.12	11.8
Lawyer	13	2.7	396.86	0.6
Total	478	100.0	4.95	100.0

Source: Mortgage Registration Books of the First Notary's Office of the Capital. *Arquivo Público do Estado de São Paulo* (APESP).

Concerning the residence of the creditors, we can analyze if it is from international or domestic locations. Our research shows that, from all the industrial mortgages, only 5.97% percent came from creditors that lived outside Brazil. The native capital – term created by Hanley (2005) – represented 94.03%. If the observed variable is the mortgaged value, the international capital becomes even less relevant: only 1.35% of the total mortgaged value concern to foreign creditors, although the latter lended (in average) larger values than national creditors. Thus, the empirical evidence reinforces the thesis that there is preponderance of the national capital in the financing of industrial activities, as state Dean (1969) and Hanley (2005). Nevertheless, it is important to go deeper in the exam of the international capital's presence in Brazilian industrial activities. Table 4 shows the magnitude of the concentration of international capital in the largest industries:

**Table 4: International Loans by Industry Size (1866-1914)**

Industry Size	N	(%)	Value (in <i>contos</i> )	(%)
Small	1	3.1	1,215.20	1.15
Medium	9	28.1	4,446.57	4.20
Large	22	68.8	100,075.25	94.65
Total	32	100.0	105,737.03	100.00

Source: See Table 4.

We can see that more than two-thirds of the large industries took their loans from international creditors. It is partly explained by the presence of large international banks, such as: *London and Brazilian Bank*, from England, with nine registries; *Société Financière et Commerciale Franco-Bresilienne* and *Caisse Generale de Prêts Fonciers et Industriels* from France, with one registry each; *Banque Belge de Prêts Fonciers*, from Belgium, one registry; *Banco Francese e Italiana per l'America del Sud*, from Italy, one registry; *Brasilianische Bank für Deutschland* and *Banco Allemão Transatlântico*, from Germany, one registry. According to the proportion of

each country in total international investment through mortgage credit in Brazil, we observe a huge presence of the English investors that totalize 66% of the total international mortgaged value in Brazil.<sup>14</sup> The result reinforces the importance of British capital in Brazil – as stated by Graham (1968), Stone (1977), and Levy (1991) – on the remaining countries in the composition of foreign direct investment in Brazil.

Another analysis that turns even more careful the exam of financing conditions is the division of industries according to its proportions: Small, Medium and Large. The differentials of size for interest rates, average terms, capital, energy, and workers are shown in Table 5:

**Table 5: Average Values of Selected Variables (1866-1914)**

Industries (size)	Total Sample			Restricted Sample					
	Value ( <i>contos</i> )	Interest Rate (%)	Term (months)	Value ( <i>contos</i> )	Interest Rate (%)	Term (months)	Capital ( <i>contos</i> )	Energy (HP)	Workers (N)
Small	5.38	12.94	23.27	95.49	11.33	30.00	57.33	21.67	23.67
Medium	27.73	11.30	35.93	438.18	11.88	26.00	269.33	30.33	96.42
Large	562.22	9.64	81.41	639.79	9.80	97.73	1755.20	145.76	241.38
Observations	468	468	468	41	41	41	41	41	41

Source: Mortgage Registration Books of the First Notary’s Office of the Capital. Arquivo Público do Estado de São Paulo (APESP). Observation: For the division, we adopted the following criteria: we divided the total sample of mortgaged values in percentiles of 33.33%, defining values from zero to 12:123\$284 as Small industries; values between 12:123\$284 and 47:349\$858 as Medium industries; and values bigger than 47:349\$858 as Large industries.

By considering the lack of information about the size of the industries in our mortgage database we used another source: information on capital, energy, and workers available on the Brazilian industrial census of 1907. We crossed this information within the mortgage sample period 1890-1914. Due to this reason, the number of observations is distinct, but mainly the profile of the restricted sample is slightly different as can be seen in Table 5. Thus, for example, the group Large has average length well over the observed in the full sample. The variable interest rate also does not decrease consistently with firm size. But the largest difference lies on the mortgaged values for each sample: the values on the Restricted Sample are always bigger than the ones in Total Sample, especially on the Small and Medium groups. For this reason, it is expected that the models produced from the restricted sample are useful only to indicate the relevance of the dimension size of the industry (for which there is sufficient variability in the sample), and not for all the other variables, which only will be included as possible controls.

Notice that given the size of the industries – and consequently their difference of mortgaged values – there is a very relevant distance between their interest rates and terms. The interest rates can reach a value 33% superior for the small industries, in comparison to the large ones in the Total Sample. This result indicates that large industrial mortgagers had “privileged” financing conditions. It is also true when we consider general mortgager and the industrial mortgage: the latter always has better loan conditions due to a higher mortgaged value. The differentials were similar to those inter-industrial cited above. More specifically, interest rates were about two-thirds and terms were twice bigger for industries relatively to an average non-industrial registry. As we can notice from Table 5, the capital, energy, and workers increase over the three categories: small, medium and large. Following the criteria of the census’ variables, large companies would be those ones with a capital value larger than 1,709.64 contos de réis, 160.45 horse-powers of energy utilized, and 233.70 workers employed. Given these facts, it is important to test if size matters to explain the amount of credit raised.

<sup>14</sup>France represented 15% and Germany 14%.

### 3 Testing a Model for Mortgage Credit and Industry

Supposing that the value of the loans are related to the industrial investment, it would be interesting to analyze the real value as dependent variable to see which other variables explain variations on it and probably on industrial investment.<sup>15</sup> We tested a model that relates the logarithm of the real value paid for the mortgage loans depending on factors such as the logarithms of interest rates and terms, and dummy variables, as it follows:

$$\ln(\text{value}) = \beta_0 + \beta_1 \ln(\text{interest}) + \beta_2 \ln(\text{term}) + \beta_3 \text{company} + \beta_4 \text{textile} + \beta_5 \text{bank} + \beta_6 \text{debenture} + \beta_7 \text{specialty} + \beta_8 \text{enc}_{\text{permanent}}$$

Let  $\ln(\text{interest})$  be the variable that represents the natural logarithm of interest rate for the period and  $\ln(\text{term})$  a variable that represents the same for the term. The remaining variables are dummies: *company* is defined as 1 if the debtor is a formal company and 0 on the contrary case; *textile* is 1 for textile sector industries and 0 for any other activity sector; *bank* is 1 if the creditor is bank and 0 on the contrary; *debenture* is 1 if the loan was done using the debenture emission procedure, 0 if not; *specialty* is 1 if the debtor is specialized in only one industrial productive activity, 0 if not; *enc<sub>period</sub>* is an institutional dummy variable that refers to the period of the *Encilhamento*, which assumes value 1 for the strict period 1890-94 and 0 for years not included in this period; *enc<sub>permanent</sub>* is another alternative to represent the institutional changes of the *Encilhamento*, i.e., to assume value 1 for years after 1890 and value 0 for years before it. These two forms of representing can evidence if the institutional effects were punctual (*enc<sub>period</sub>*) or if they lasted through the whole period afterwards (*enc<sub>permanent</sub>*). The regression models were estimated using the OLS methodology. Then, through the White's test, we found characteristics of heteroskedasticity in the model. Correcting it by the White's method, we obtained the results summarized in Table 6:

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<sup>15</sup>The mortgage values were deflated using the price index proposed by Catão (1992).



**Table 6: OLS Regression Models for  $\ln(value)$  as dependent variable (1866-1914)**

Variable	(1)	(2)
constant	18,84*** (18,57)	18,70*** (18,52)
$\ln(interest)$	-1,864*** (-5,388)	-1,890*** (-5,428)
$\ln(term)$	0,4574*** (5,726)	0,4532*** (5,663)
company	0,8098*** (5,490)	0,7863*** (5,319)
textile	0,8009*** (4,436)	0,7989*** (4,332)
bank	0,7687*** (3,188)	0,7398*** (3,139)
debenture	1,205*** (4,125)	1,201*** (4,106)
specialty	0,9698*** (7,671)	0,9319*** (7,380)
$enc_{period}$	-0,0237 (-0,1670)	
$enc_{permanent}$		0,2831* (1,684)
n	468	468
Adj R <sup>2</sup>	0.5962	0.5985
lnL	-739.6	-738.2

Obs: t-statistics in parentheses. Significance at the 1% level (\*\*\*), at the 5% level (\*\*) and at the 10% level (\*).

Concerning the statistical significance, we can notice that most of our variables are significant for the critical value of 1% and one is significant for 10%. About the parameters, we can affirm that all of the significant variables are positively related to the dependent variable ( $\ln(value)$ ), except the variable that represents the interest rate ( $\ln(interest)$ ), a result already expected. An increase of 1% in the interest rates has as consequence a 2.08% decrease in the industrial mortgaged value. Also notice that the positive correlation of each dummy variable shows that their presence is important to explain changes in the industrial mortgaged value. Thereby, we infer that being a company (and not a private individual) is a determinant for obtaining larger amounts of money. The same situation for textile sector's industries: their investments are higher than the ones from other sectors. Another fact is that industrial investment trends to be higher for industries which have banks as their creditors. The financing by debentures emission has a positive correlation with industrial investment, i.e., it means that these operations trended to have higher values of mortgage credit involved. Finally, we have that industries specialized in only one activity had higher values of industrial investment than others with larger variety in their fields of production. The institutional evidences are linked to the analysis of the dummies  $enc_{period}$  (regression 1) and  $enc_{permanent}$  (regression 2), which only the latter had statistical significance. It shows that the effects of institutional changes from *Encilhamento* remained after the strict period of its occurrence. In other words, these changes were continuous along the remaining period of the study, i.e., the institutional improvements occurred on *Encilhamento* were important to explain part of the expansion on industrial investment along the following years. As stated above, we used a second source to obtain new information and control the regression model by the size dimension of industries (capital, energy and workers). It adds new information to understand the relationship between the size variables and the mortgaged value, but our sample becomes restrict. Table 7 presents the results for other OLS regressions controlled by the three variables of *size* available on the industrial

census: *capital* (regression 1), *energy* (regression 2) and number of *workers* (regression 3).

**Table 7: OLS Regression Models Controlled by Industry Size (1890-1914)**

Variable	(1)	(2)	(3)
<i>constant</i>	15.36*** (8.091)	14.36*** (5.240)	15.16*** (7.606)
<i>ln(interest)</i>	-0.2230 (-0.4012)	-0.1220 (-0.1397)	-0.3226 (-0.5219)
<i>ln(term)</i>	0.9154*** (4.157)	1.123*** (4.893)	0.9819*** (4.484)
<i>company</i>	-0.1441 (-0.3534)	-0.2046 (-0.4195)	-0.1146 (-0.2777)
<i>textile</i>	0.0579 (0.1455)	0.05436 (0.1240)	-1.135* (-1.824)
<i>bank</i>	0.3325 (1.178)	0.4705* (1.909)	0.6067 (1.680)
<i>debenture</i>	2.2040*** (6.434)	2.502*** (6.085)	2.180*** (6.473)
<i>specialty</i>	-0.1897 (-0.4674)	-0.2352 (-0.5746)	-0.1750 (-0.4471)
<i>enc<sub>permanent</sub></i>	-0.8452** (-2.338)	-0.9333** (-2.575)	-0.7003* (-1.921)
<i>capital</i>	0.0003*** (4.845)		
<i>energy</i>		0.0044*** (5.464)	
<i>workers</i>			0.0038*** (5.497)
n	41	40	41
Adj R <sup>2</sup>	0.7016	0.6881	0.6991
lnL	-52.93	-52.80	-53.10

Obs: t-statistics in parentheses. Significance at the 1% level (\*\*\*), at the 5% level (\*\*) and at the 10% level (\*).

As we can see, all of the size variables were significant for (at least) the 10% level. The variable *workers* seems to be the most well-fitted for the *size* dimension we wanted to add to the analysis. It suggests that larger industries had more access to mortgage credit. In other words, they could raise larger amounts of money in the mortgage credit market to fund their investments. However, as previously mentioned, this restricted sample – given the possible existence of selection bias – prevents the carrying out of any more conclusive analysis, especially in relation to other variables.

## 4 Concluding remarks

The empirical analysis guides us to conclude that the primary source is valuable to understanding the conditions of financing that the national industry had to face in its very beginning. It also helps to understand its

behavior along the periods of economic normality, as well as instability. An important result is the differential of financing conditions between different-sized industries. While smaller industries obtain credit with interest rates and terms similar to the rest of the population, industries of large size (for mortgaging larger values) obtain longer terms and smaller interest rates. The study also reinforces the importance of the native capital in the funding of industrial activities, as defended by Hanley (2005). Finally, although banks are important to explain the industrial funding, the analysis showed that most of the credit operations were performed by non-banking agents. By testing a model for mortgage credit and industries, we found a significant positive relationship between the size, debentures, lengths, and the *Encilhamento* variables and the mortgaged value.

## 5 Annex

**Table 8: Johansen Cointegration Test:**

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Sample (adjusted): 1867-1914  
 Included Observations: 48 after adjustments  
 Trend assumption: no deterministic trend (restricted constant)  
 Series: *l\_value* ; *l\_industrial\_machinery*  
 Lag intervals (in first differences): No lags

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5% Critical Value	1% Critical Value
None *	0.325201	23.38391	19.96	24.60
At most 1	0.089557	4.503545	9.24	12.97

Trace test indicates 1 cointegrating equation at the 5% level

Trace test indicates no cointegration at the 1% level

\*(\*\*) Denotes rejection of the hypothesis at the 5% (1%) level

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	5% Critical Value	1% Critical Value
None *	0.325201	18.88036	15.67	20.20
At most 1	0.089557	4.503545	9.24	12.97

Max-Eigenvalue test indicates 1 cointegrating equation at the 5% level

Max-Eigenvalue test indicates no cointegration at the 1% level

\*(\*\*) Denotes rejection of the hypothesis at the 5% (1%) level

Unrestricted Cointegrating Coefficients (normalized by  $b'S_{11}b=I$ ):

<i>l_value</i>	<i>l_industrial_machinery</i>	<i>C</i>
0.407066	-1.553794	16.72446
0.040093	0.683628	-9.962486

Unrestricted Adjustment Coefficients (alpha):

$d(l\_value)$		
	-1.504768	-0.187615
$d(l\_industrial\_machinery)$	-0.00531	-0.073890

1 Cointegrating Equation(s):

Log Likelihood -106.2083

Normalized cointegrating coefficients (standard error in parentheses)

<i>l_value</i>	<i>l_industrial_machinery</i>	<i>C</i>
1.000000	-3.817054	41.08536
	(0.57440)	(7.53055)

Adjustment coefficients (standard error in parentheses)

$d(l\_value)$	
	-0.612540
	(0.13398)
$d(l\_industrial\_machinery)$	-0.00216
	(0.01466)

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