

**Endowments, Fiscal Federalism, and the Cost of Capital for States: Evidence from Brazil,
1891-1930**

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Abstract

Economists and economic historians believe that much of the inequality we observe today in Brazil is a byproduct of the colonization pattern followed by the Portuguese at the time of arrival. In this paper we contribute to the debate by arguing that endowments did matter to determine the inequality we observe in state expenditures and living standards. Yet, instead of looking at endowments and institutions at the time of colonization, we argue that it was during the first republican period (1890-1930) that inequality among states got accentuated as a consequence of the differences in endowments across states and because of the extreme form of fiscal federalism that the Brazilian government adopted in the Constitution of 1891. Since states got the right to tax exports, we show that state endowments led to differences in revenues per capita that ended up determining differences in the cost of capital states faced when they issued debt in international markets. For our empirical analysis we use a newly created database of state debt quotations and a series of state level fiscal variables. In the first part of the paper we argue that having specific commodities gave states access to issue foreign debt in better terms (i.e., lower cost). We also use instrumental variables to examine the relationship between commodity exports, state revenue per capita, and the cost of capital for states.

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I. Introduction

For economists and economic historians much of the inequality we observe today in Brazil is a byproduct of endowments and the colonization pattern followed by the Portuguese at the time of arrival (Acemoglu, Johnson, and Robinson, 2001; Sokoloff and Engerman, 1997; Naritomi, Soares, and Assunção, 2007; Bruhn and Gallego, 2007). In this paper we contribute to the debate by arguing that endowments did matter to determine the inequality we observe in state expenditures and living standards among states in Brazil. Yet we partly dispute the idea that it was the endowments or the institutions established at the time of colonization what actually promoted inequality. We argue that it was during the first republican period (1890-1930) that inequality among states got accentuated as a consequence of the differences in endowments across the country. We further show that there was an increase in inequality among states as a consequence of the extreme form of fiscal federalism adopted in Brazil in the constitution of 1891. In the Constitution of 1891 Brazil was divided into 20 states with very autonomous spending powers and with the capacity to collect most taxes, including export taxes. The fact that states could tax commodity exports allowed states that could export more valuable commodities to collect higher revenues per capita. Higher revenues per capita at the state level usually translated also into higher capacity to issue domestic and foreign debt and higher capacity overall to spend on public goods.

Rather than taking endowments as given and as having effects only after the interaction with colonial institutions (e.g., as in Sokoloff and Engerman, 1997), we view the importance of endowments as changing over time according to the demand for international commodities (mostly determined in international markets). For instance, Brazilian states with the capacity to produce sugar may have had valuable endowments in the 17th and 18th centuries, but by the nineteenth century new sugar producers abroad drove the price down and created a long decline in the economic supremacy of sugar states in Brazil. In the second half of the nineteenth century commodities such as coffee, rubber, mate, and cotton had unexpected booms that provided advantages for rapid growth to some states over others. Of course those advantages did not translate into higher state revenues or higher provision of public goods until after the constitution gave states autonomy to pursue their own policies and tax their own exports.

Therefore our counterfactual is that without the 1891 Constitution, inequality among states would have been lower.

In this paper we examine if the differences in endowments were translated into significant differences in the cost of capital for Brazilian states and on the capacity states had to issue debt over time. For this purpose we use a newly created database of state bond quotations and a series of state-level fiscal variables. We show that given the capacity states had to tax exports, states with endowments that allowed them to export precious commodities ended up having larger state revenues per capita and could issue more debt in international markets at a lower cost. Using different econometric techniques we show how states with higher revenues per capita faced lower cost of capital abroad. Moreover, in some of our specifications we show that state revenues per capita were indeed related to the kind of commodities states exported, which in turn were correlated with geographical variables at the state level. Therefore we show that states that exported more valuable commodities (e.g., coffee and rubber) had larger state revenues per capita. In fact, we show that the export of certain commodities was correlated with specific geographical and climatic features (e.g., temperatures, soil types, rainfall, etc.) Since we do not have a good series for the variation of geographical and climatic variables we cannot instrument properly for state revenue per capita using those variables. Instead, we use a series of instrumental variable techniques using the composition of exports at the state level, using the export shares of each commodity as instrument. These export shares are highly correlated with geographical variables and, thus, should be relatively exogenous to revenues. Moreover, we try to make those export shares even more exogenous using a simulated instruments technique, in which we model the growth in exports of commodities for each state using the national growth rates in exports. Our instruments are imperfect, but they are the best we can do with the information at hand. In our second stage we show that our estimated state revenue per capita (using different instruments) explains a lot of the variation in the cost of capital states faced when issuing international debt. We provide a series of further robustness checks that confirm our results.

The paper is divided into five sections. Section II provides a quick review of the literature explaining development and inequality as a byproduct of colonial institutions or endowments and examines other literature related to the paper. Section III provides a brief

explanation of the Constitution of 1891 and the configuration of the fiscal system in Brazil. Section IV presents the findings and Section V concludes.

II. Colonial Institutions, Endowments, and Fiscal Federalism

Our paper contributes to the debate of the recent origins of inequality within Brazil by focusing on fiscal variables as a source of regional variation. We are confident that regional inequality increased during the First Republic (1889 and 1930) because most of the available data shows a change in inequality among states during that period. For instance, in 2005 per capita income in the state of Rio de Janeiro, in the 90th percentile of GDP per capita, was 3.42 times that of the state of Alagoas, in the 10th percentile of GDP per capita. If the ratio were computed using data from 1939 instead of 2005, the result would be very similar (4.62). In fact, the correlation in GDP per capita at the state level in 1939 and 2005 is 0.80, with little change in the ranking among states. Yet, crude measures of relative prosperity across states using the 1872 census are not strongly correlated with regional disparities today and the ranking of states according to these measures looks significantly different in 1872 than today. That means that a lot of the regional inequality we observe today in Brazil is a byproduct of something that happened between 1872 (the last census in the nineteenth century) and 1939. Moreover, recent studies show an increase in national income inequality in this same period (Bertola, et. al. 2008).

Thus, by focusing on the relationship between endowments and the public finances of the states during the First Republic, our view contrasts with that of works that have focused on the importance of colonial institutions as determinants of inequality in the long run. Acemoglu, Johnson, and Robinson (2001) argue that it was the disease environment at the time of colonization what determined the type of institutions Latin American colonies developed and maintain that in places where there was high settler mortality, colonizers established “extractive institutions” that led to the concentration of power in a privileged elite. In their view colonial institutions had persistent effects over time and explain outcomes today. Sokoloff and Engerman (1997) argue that, in Latin America, the institutions that promoted the concentration of economic and political power were the product of the endowments the colonizers faced at the time of arrival. For these authors, in places where large scale agriculture was possible,

settlers developed large plantations and gave themselves disproportionate economic and political power, while in places where the endowments facilitated small-scale agriculture the distribution of land and the institutions per se ended up being more democratic and egalitarian. Sokoloff and Zolt (2006) argue that these differences in the institutions adopted after colonization are correlated with differences in fiscal systems across countries in Latin America.

In an extension of Sokoloff and Engerman, the work of Naritomi, Soares, and Assunção (2007) shows that municipalities with sugar plantations during colonial times ended up having more inequality in the distribution of land in the long run, while municipalities where gold mining was the main colonial activity had more intervention of the Portuguese state and ended up having worse governance practices and less access to justice.

Now, in all these views there is an implicit political and fiscal channel. Endowments (or settler mortality), led to specific institutions that then led the elites to spend more or less on public goods, depending on how concentrated power was. Whatever those fiscal and political arrangements were, they were determined during colonial times and some of the effects of those institutions had persistent effects. In our view, endowments have an effect on inequality, but the institutions that matter are not necessarily colonial institutions. Fiscal institutions can be modified over time and that can have perverse effects, depending on the interaction of endowments, international prices, and those fiscal institutions.¹

According to the literature that studies the effects of federalism in the United States, a federalist system that promotes competition should lead to income equalization across states. Yet these results take place the more factor mobility there is within the country (Weingast ,1995; Weingast and Qian, 1997; McKinnon, 1997; and McKinnon and Nechyba, 1997). For instance, in the United States, Wright (1986; 1987) shows that after the Civil War the South was an isolated labor market with low wages in a high-wage country. It was not until the New Deal that income convergence between the South and the North and Northeast took place. In Wright's view this was a consequence of the lack of labor mobility within these regions. In Brazil, the lack of

¹ Other studies blamed inequality on either the colonizers (Stein and Stein, 1970), the dependency developed with foreign capitalists (Cardoso & Faletto, 1979), or the unfavorable trade relations with richer countries (Furtado, 1974). More recently, Bates, Coatsworth and Williamson (2007) and others admit that what happened after independence determined to a large extent the outcomes we observe today. See for instance Bertola (2008) and Coatsworth (2008) for a review of the literature.

mobility of labor and capital across states and regions (e.g., between the Northeast and the Southeast) also contributed to the development of regions and states as relatively isolated economies, with independent labor markets (Leff, 1982).

Moreover this paper contributes to the literature that studies the determinants of the cost of capital during the two latest waves of globalization (1870-1914 and the 1990s to today). Part of the literature on sovereign risk has emphasized the importance of macroeconomic variables such as capacity to pay or adherence to the gold standard to explain differences in perceived risk premia across countries. Others have focused on how winning wars or being under the umbrella of the British Empire or the United States reduced cost of capital for sovereigns before 1914 (Sussman and Yafeh, 2000; Mauro, Sussman, and Yafeh, 2006; Ferguson and Schularick, 2006; Flandreau and Zumer, 2004; Bordo and Rockoff, 1996; Mitchener and Weidenmier, 2005).

The current paper contributes to the literature by bringing endowments into the debate. Even if most of the literature on globalization before 1914 acknowledges the importance of commodities for the development of emerging markets, few studies have actually used commodities to explain why some countries had a lower cost of capital than others. In fact, for most emerging markets of the time taxes on exports and imports were the main source of revenue for the government. Therefore, countries with more precious endowments, i.e., with the capacity to export commodities that were in high demand in the world, were able to collect higher revenues and thus had more capacity to pay their foreign debt. In fact, Flandreau and Zumer (2004) argue that capacity to pay measured as a combination of debt burden and debt service to revenues was the most important determinant of the cost of capital across countries before 1914. We agree with Flandreau and Zumer and add that perhaps what determined the capacity to pay was the capacity that countries (or states in our case) had to extract revenues from their endowments. Mauro, Sussman, and Yafeh (2006) acknowledge the importance of commodity prices in driving spreads in the past and in the 1990s, but they do not control for either the price or type of commodities countries exported.

Finally, our paper diverges significantly from the long literature looking at the risk premium implicit in government bond quotations (the literature described above) in that we think there is an endogeneity problem with most of the estimates that try to explain the country risk or spread or risk premium of the bonds of a country using current government revenue as a

control. The capacity to collect revenue depended to a large extent on the capacity that countries had to export and that capacity was, in turn, dependent on the infrastructure of each nation. Since most of the infrastructure was financed through debt issues, we think the cost of capital in a way determined the level of revenues per capita. This problem is obviously hard to solve and we provide some instrumental variable estimates where we endogenize the level of revenue using information on the type of commodities states exported.

III. A Brief History of Fiscal Federalism in Brazil

After independence in 1821 Brazil had a constitutional monarchy, with a two-tiered parliament, and a council of ministers running the central government. The power of provincial governments was extremely weak until 1889 as these governments had little control over fiscal revenues.

Since independence the fiscal structure was very centralized and depended heavily on trade taxes. The constitution of 1824 gave the central government the right to tax imports and exports. Trade taxes accounted for more than two thirds of the public revenue during all the second part of the imperial period (1840-1889). As in many Latin American countries, the Brazilian government relied on trade taxes because the costs of collection were low and governments avoided the politically painful process of collecting land or income taxes from local elites. The provinces were not allowed to collect import taxes or inter-provincial trade taxes, but implicitly they had the right to collect export taxes (Abreu and Correa, 1997). Nevertheless, in practice interstate taxes existed until the 1890s and throughout the imperial period (1821-1889) states collected small amounts of revenue from import and export taxes.² The Imperial export tax rate fluctuated between 5% and 9% of the value of exports and stabilized at 7% in the mid 1870s (after the war with Paraguay). There was some variation in export taxes across states. Some of the coffee exporting provinces (Minas Gerais, Rio de Janeiro, and São Paulo) and Rio Grande do Sul charged a 4% tax rate, while the northern state of Para (later on a rubber exporter) charged 13% (Abreu and Correa, 1997). Finally, import taxes tended to be relatively large.

²For instance, in northeast provinces the import taxes represented between 20% and 33% of the provincial revenue, with tax rates of 30% in Pernambuco for inter-provincial imports. See Mello (1984).

Villela (2005) estimates that the federal import tax revenue as percentage of imports was around one third from 1869 to 1889.

In sum, the fiscal system of Brazil before 1889 was relatively centralized. The imperial government collected around 80-85% of the total public revenue in Brazil and spent most of the revenues in the capital of the country, the city of Rio de Janeiro (which received more than two thirds of total expenditure).

As a consequence, most provinces in Brazil received less than what they contributed to the federal pool of tax revenues. São Paulo was the main contributor in this regard, sending more than three times of what it received in federal expenditure. For instance, the Ministry of Agriculture and Public Works (responsible for “improvements” such as railroads, ports, colonization, etc) in 1888 spent 66% of its total budget in the Rio de Janeiro area and only 3.14% in the state of Sao Paulo (Villela, 2007). The northeast and northern regions also paid more than what they received, while the south was a net beneficiary, receiving large amounts of money for the military bases on the border with Argentina and Uruguay.

The limited capacity of provincial governments to collect their own public revenue and the little effort of Imperial Government made to redistribute fiscal resources across regions generated permanent conflicts between the center and the provincial elites. For instance, in Sao Paulo (exporting one fifth of the Brazilian exports), elites complained that the “revenues in 1870’s were totally inadequate to meet the provincial government’s responsibilities for road construction and maintenance, public health and education.” Moreover, “[t]he Republicans of Sao Paulo called for a distribution of revenues that would allow the province to meet the requirements of the expanding export economy, and for political autonomy to maximize Sao Paulo’s economic potential”. The discontent among these elites was such that “[s]ome Paulista Republicans even threatened to set a separatist course for the province if a federation was not achieved” (Love ,1980, pp. 103–104). Elites in São Paulo also felt underrepresented in the congress, because only 7.25% of the deputies and 3 out of 69 senators came from Sao Paulo.³ Although Sao Paulo was the main supporter of the republican and federalist movement, the

³ Each Sao Paulo deputy represented 145 141 inhabitants, a Pernambuco deputy 85,488 and the ones from Amazonas 40, 327. The relative representation in the Senate had similar numbers. See Carvalho, 1980 and Viotti da Costa, 1989

discontent against the centralist monarchy was widespread across the country, e.g., there were significant separatist or republican movements in Pará, Rio Grande do Sul and Pernambuco (Mello, 1984; Viotti da Costa, 1989). Common denominators in the provincial attacks against the Empire were complaints on fiscal centralization.

In 1889, a republican movement overthrew the emperor in a peaceful revolution and established a provisional government in charge of drafting a new constitution. The provisional government nominated a commission of legal specialists to write the first draft of a new constitution. Once the first draft was finished, the government would have the right to review and improve the project and then would send it over to the actual Constitutional Congress for a final approval. This congress would also be in charge of electing the president and vice president of the new republic. The draft submitted by the central government was revised in two stages by the constitutional assembly. First, the “Commission of 21” (21 representatives, one per state) would have the right to look at the proposal. Second, the plenary would vote for the final proposal (Costa, 1998).

One of the most important issues discussed at all levels was the distribution of tax revenues among the federation and the states. The debate did not revolve around the issue of whether Brazil should be a federalist republic, but how decentralized the federalist system was going to be. The federal Government made an initial proposal, in which it outlined that export taxes would be the exclusive responsibility of the state governments only until between 1891 and 1898. In addition, the proposal forbade states from taxing exports in transit from other states, but did not include an explicit prohibition of interstate taxes. Finally the central government’s proposal allowed states to levy taxes on rural land and property transfers.

Yet when the central government’s proposed constitution reached the Commission of 21, state representatives modified it significantly, making all state export taxes perpetual and pushing for more fiscal autonomy for state governments. For instance, the northeastern states, aware of their disadvantage when it came to export commodities, proposed that states should get the right to impose a 10% duty on imports of foreign goods consumed in the state on top of any federal import duties. The representative of Rio Grande do Sul, Julio de Castilhos, went even further and proposed that all taxation powers not explicitly given to the central

government in the constitution should remain within the realm of state policy.⁴ Both proposals were rejected by a narrow margin in the Constitutional Assembly (the initial proposal was defeated 123 to 98 and the proposal of the Commission of 21 was defeated 123 to 103).

The Constitutional Assembly passed a new Constitution on February 24, 1891. The exporter states of Sao Paulo, Minas Gerais, Rio de Janeiro, Bahia, Para and Amazonas integrated the winning coalition, defeated a more disorganized opposition that included sugar exporting states from the Northeast and the cattle-exporting state of Rio Grande do Sul. The new constitution gave states the right to tax exports, to have their own armed forces, and to organize gubernatorial elections (Costa 1998). More importantly for the current paper, by not including any provision to limit the capacity of state debts, the Constitution implicitly gave states the right to issue debt domestically and abroad. Love (1993) points out that even some of the states that wanted more fiscal autonomy supported a relatively strong central government (with the right to collect all import duties) because they understood the benefits of having a national authority in charge of monetary policy, negotiating trade treaties with other countries, and backing states on certain programs with positive spillovers across states (e.g., the coffee valorization program).

Once the state governments got the right to tax exports, they left the tax rates unchanged and instead focused on reshuffling the revenue sharing schemes they had with the central government. For instance, in Sao Paulo and Minas Gerais the state governments charged a tax rate for coffee exports of 11%. Before the Constitution of 1891 the central government collected 7% out of the 11% and left 4% for state governments. After the Constitution the entire 11% was kept at the state level (Love, 1980 and Topik, 1987).

Yet there was no uniformity in tax rates across states or over time. Table 3 shows the ad valorem rates charged for commodity exports (by type of commodity). It is clear that there is significant variation in tax rates by commodity. A good case in point is rubber. In states where rubber exports were not that large, the state governments charged a low tax rate, while in states with significant exports, such as Amazonas (AM) or Pará (PA), the tax rates on rubber exports were 20% and 22% of the market price, respectively (Lyra, 1914). Moreover, there was also

⁴ These kind of activities states could tax under this proposal included: import taxes, taxes on the entry and exit of ships, stamp taxes, fees on postal and telegraph communications, and other rights like the creation and maintenance of custom offices and the right to regulate emission banks.

variation in tax rates over time. For instance, some states moved tax rates in a countercyclical way. The governments of Minas Gerais and São Paulo lowered the tax rates on coffee exports from 11% to 9% as a way to lower the tax burden of coffee planters when international prices declined.

After the 1891 Constitution, states relied on export taxes as an important source of revenue. State public revenues from export taxes represented on average around 60% of total revenue between 1914 and 1919. States such as Espírito Santo and Rio Grande do Norte collected more than 85% of their revenues from export taxes. São Paulo increased its collection capacity per capita three times after 1891, collecting almost 40% of what all the states collected with only half of the total exports and less than one fifth of the population. In contrast, Góias and Rio Grande do Sul collected only 24% and 29% of their revenues from export taxes.

We argue that this fiscal federalism scheme created a problem because the poorer northeastern region exported less than 15% of the total exports in the country, but had a large population since the beginning of the century. Given that the federal government did not pursue policies of regional redistribution, and since the mobility of labor was restricted by the cost of transportation within the country (and the racism of the Southeast against the inhabitants of the Northeast), inequality in fiscal revenues per capita was translated into differences in expenditures on public goods (per capita) and may explain why there are clear differences in development levels across states in general.

The lack of redistribution can be partially blamed on the central government, which focused its expenditures in the capital of the country, Rio de Janeiro city. For instance, in 1914 the federal government spent 61% of its budget on the capital of the country, with some of the expenditures going to national public goods, such as the army and the navy, but with a large proportion going use to improve the capital of the country. A more concrete example is the case of the Ministry of Transportation and Public Works, which spent 81% of its budget in the city of Rio de Janeiro alone.

For all of these reasons, it is important to study whether the fiscal capacity at the state level had an impact on the kinds of public goods that states could fund. In this paper we examine whether fiscal capacity determined the cost of capital to fund some of those expenditures on public goods.

IV. Data and Methodology

The Data

Compiling fiscal and debt data for the different states of the Brazilian federation between 1890 and 1930 required us to compile statistics from a variety of archival sources and published materials. The Appendix describes in detail the source and methodology to estimate the key variables used in the present analysis. Below is an explanation of how we construct our main dependent variables and of the empirical strategy we use to estimate the determinants of cost of capital for Brazilian states.

Yields

Since the yield of the bonds issued by Brazilian states is our main dependent variable it is worth explaining clearly how we estimate it. So far, we have constructed two measures for yields, one is the coupon yield, or the yield implicit in bond quotations according to the coupon payments of that bond. That is, the yield is just the coupon payment of a bond over the average price of that bond in a given year. For example, a 4% bond with face value of £100 quoted at £80 would have a yield of 5% (because $4/80 = 0.05$). Since part of the return is to compensate for the opportunity cost of investors if they had invested in a risk-free asset, the yields we report subtract the average annual yield for UK consols. In that way the yields we study reflect the risk premium investors demanded to buy debt issued by Brazilian states. This method, however, assumes that bonds are perpetuities. According to Mauro, Sussman and Yafeh (2006), “this approximation was reasonable, given that the bonds were usually of very long maturity [in our state bonds sample the average maturity is 33 years] , and probably seemed natural to the large proportion of investors who were *rentiers* living off the fixed income provided by the bonds” (p.41). Moreover, these authors point out that the most sophisticated methods for calculating exact yield were developed until the second half of the twentieth Century and that investors usually estimated their yields using prices and coupon rates, which were always published in the press, rather than by using a more complex yield estimate that takes into account the maturity of the bond.

Our second measure of yield is an approximation of the yield to maturity of debt issued by Brazilian states. Yield to maturity is a rate which reflects the flow of all the revenue (the

gains/losses from bond appreciation/depreciation plus interests) derived from a given bond relative to the price that investors pay for the bond today. To estimate it we first subtract the current bond value (i.e., its current price) from the par value to obtain the discount that investors get when they buy the bond. Then, we assume that the profit/loss from purchasing a bond today is only realized at maturity, when the bond is redeemed. Thus we assume that the profit/loss of purchasing a bond today and having it redeemed at face value tomorrow is realized evenly over time. So if an investor buys a \$100 bond at \$80 today and the bond matures in 20 years, we assume the investor makes \$20 of profit over 20 years and for simplicity we just assume the return per year is \$1. Next, we sum up this profit with the actual annual coupon payment of the bond, which is simply the coupon rate multiplied by the par value of the bond. This gives us the annual return for the investor, which we then divide by the current bond price to obtain another measure of yield. This ratio is the yield to maturity.

Given that we need the maturity to be able to estimate yield to maturity and we do not have this information for all the bonds, our sample for yield to maturity is smaller than that for the yield calculated by using coupon rates only. Yet using yield to maturity instead of coupon yields introduces another bias. Since many of the poorest states in Brazil could not issue bonds with long maturities (or at least we do not observe those), we end up estimating really high yield to maturity rates for those states when they were sold at a discount from par value. Therefore, our yield to maturity estimates are biased *in favor* of our hypothesis that richer states faced lower cost of capital. Since the first set of yield estimates (using the coupon and price) do not bias the data in favor of our hypothesis, we make most of our inferences based on those estimates and present some estimates using yield to maturity as a robustness check.

Descriptive statistics

Table 1 shows data on the distribution of debt (or bond issues) by state. The table depicts clearly the concentration of debt issues in four states: São Paulo, Minas Gerais, the Federal District (in Rio de Janeiro), and Bahia. All of these states, except Bahia, had coffee as their largest export. In fact, these were the states with the largest populations in the Brazilian federation, so we would expect them to have a higher demand for external financing to pay for infrastructure and other improvements. In fact, in our multivariate analysis we will control for population and scale state revenues by population. The second thing to note in Table 1 is that

the column with data for the average year of bond issues per state shows that most debt issues happened between 1909 and 1917, perhaps because this was the peak period for international capital flows to Latin America (Stone, 1999; Obstfeld and Taylor, 2004).

We study the cost of capital for state debt issues for two reasons. First investor perceptions of capacity to pay were based on the fiscal capacity of the states and indirectly on the kinds of endowments the states had. Second, the cost of capital (the spread over the risk-free rate, i.e., the UK consols rate) reflects the cost state governments in Brazil faced to pay for public goods. This the largest share of the capital obtained through foreign bond issues was used to pay for infrastructure (18%) and other urban improvements, such as waterworks, sewage, and other projects (39%). Also, a large part of all bond issues abroad were used to roll over past debts (39%).

Figure 2 shows that most of the states' debt was denominated in pounds sterling and traded in the London Stock Exchange (47%). Yet we also found that states issued 24% of the total debt in French francs (traded in Paris and Brussels). Finally, in the 1920s, many of the new state bond issues were denominated in US dollars and were traded in the New York Stock Exchange.

Table 2 shows the variation in the cost of capital by state between 1890 and 1931. There was significant variation in yields (in this case estimated as the bond coupon rate over the average price of the bond) across states. In fact, yields for different states are relatively independent from one another. There does not seem to be any contagion effect after one of the states defaults. For instance, Espirito Santo (ES) defaulted in 1900 and in that same year (and the following) the yield of bonds issued by the Federal District and São Paulo actually go down. In the 1920s many states in the north of Brazil defaulted on their debts and the yields implicit in their bonds skyrocketed. However, the yields of other states like Rio de Janeiro (RJ), São Paulo (SP), the Federal District (DF) or Minas Gerais (MG) do not seem to react to those events. That is, we believe that the investors who were trading these bonds in fact separated the risk implicit in each state from the risk implicit in the debt of other states.

Table 4 shows, in a nutshell, that states that had higher revenue per capita also had lower spreads. This table shows the summary statistics of our complete dataset, separating the data into two categories, rich states (with revenues per capita above the median) and poor states

(those below the median). According to the last columns there are significant differences in cost of capital and state revenues per capita among rich and poor states, especially in the size of the variation around the mean of the former. Richer states had a very tight distribution of spreads (cost of capital), with a mean of 0.04 (400 basis points) and a standard deviation of 0.04 (also 400 basis points), while poor states had a mean of 0.06 (600 basis points) and a standard deviation of 0.13 (1300 basis points).

Empirical Strategy

As the descriptive statistics in Table 1 show, 15 out of 20 states (16 out of 21 if we consider the Federal District as state) issued foreign debt. Around half of the bonds issued in foreign markets, representing more than 70 % of the capital raised by states, were issued by 4 states. Our empirical strategy tries to deal with this bias in the data first and then looks at the determinants of the cost of capital in a panel setting. Our preliminary way to deal with the bias is to generate a dummy indicating the years when each state issued a bond in international markets. That is, any state-year observation will take the value of 1 if the state issued a new foreign bond *on* that year and zero if not. We then run two different models to study whether having higher state public expenditures per capita affected the probability of issuing a bond in any given year.

Our first approach to study how much state public revenue per capita affects the probability of issuing debt is very simple. We just run a Probit estimate to examine whether richer states had higher probability to be actively engaged in the international bond market. The basic specification for this estimation is:

$$Pr(y_{it}=1) = \beta s_{it} + \delta X_{it} + \varphi_i$$

where y_{it} is whether the state i in period t has issued debt in the past or at time t . The independent variable is state public revenue per capita (s_{it}) lagged one period. We use the one period lag of the state public revenue because the expectations of the value of the bond and its yield are formed with the information available at the time of buying the debt instrument in the secondary market. The vector of control variables X includes imports (also lagged one period), population, debt, and a dummy for when the state is on the gold standard. Imports and population are used to control as a proxy for the demand of public goods, which is supposed to be the final use of the capital derived from the bond issues. On the other hand, the state budget

deficit is measured as the percentage of the difference between the state public expenditure and state public revenue divided by the state public revenue. This ratio could be interpreted as a proxy of risk as it may be interpreted as how responsible is each state in the administration of their finances, but at the same time it could just reflect the fact that some states were able to sustain deficits precisely because they issued debt. Thus we do not make too much out of the interpretation of this coefficient. Finally we add time dummy variables (φ_t) to control for time fixed effects common for all the states.

Now, since the states that issued debt may be biasing the results of the probit (given how skewed is the data with some states issuing debt many times and some issuing nothing), we also run a Cox proportional hazard model to look at whether the relationship between state revenue per capita and the probability of issuing debt is still intact once the sample is less biased in favor of debt issuing states. The Cox hazard model has the advantage of only taking into account the effect of issuing states up until the point where they issue debt for the first time, leaving them out of the estimation afterwards. We define the dependent variable as the time in years until the state issues a bond in international markets and examine the change in relative risk of issuing the first bond by state i , in any given year t , if the state had an additional unit of state public revenue per capita. The estimated model is as follows:

$$\log\left(\frac{h_i(t)}{h_0(t)}\right) = \beta_1 \text{lag}(spr_{i,t}) + \beta X,$$

where $h_0(t)$ is the baseline hazard function, which is common for all states, it has no particular specification, and provides the shape of the hazard function. $h_i(t)$ is the hazard function specific to the state i . We are interested in the relative risk of state i issuing a foreign bond in any year relative to the baseline risk (common to all the states) of issuing a bond in foreign markets in any given year. Since the Cox model is exponential, we take the log of all of our variables to avoid negative probabilities. In our case, we are interested in the value and sign of the parameter β_1 , which indicates the effect of an additional unit of state public revenue, lagged one period, on the relative risk of issuing for first time a bond relative to the baseline risk of any state issuing foreign bonds in any given year.

In sum, the reason why we first run these two estimations, one with a Cox hazard model and another one with a Probit, is that they allow us to include all the states of Brazil in the

sample (those which issued debt and those that did not). Also, because of the way we design the Cox hazard model test, we give more weight to the states that never issued debt, thus giving us a less biased view of the importance of state revenues per capita on the capacity to issue bonds in foreign markets.

Explaining the Cost of Capital (Yields)

Our main objective is to estimate the determinants of the cost of capital (measured as the difference between the yields of Brazilian state bonds issued abroad and the yield of the UK consols). Our hypothesis is that richer states were able to issue debt at a lower cost and in larger amounts in international capital markets. We measure the states' capacity to pay using state public revenue per capita. This is a good indicator of the economic characteristics of each state since it is correlated with total exports per capita by state (see Figure 3) and with a variety of geographical and geological variables at the state level. Moreover, most of the bonds issued during the period had diverse sources of state public revenue as guarantee, such as service fees (lighting, sewage, water, etc) and taxes (export taxes, professional ,industry, etc). Therefore, state revenues per capita are a good measure of state capacity to pay international debts.

Our basic specification to examine the determinants of the cost of capital by state is of the following form:

$$r_{it} = \beta s_{it-1} + \delta X_{it} + \zeta_i + \varphi_t + \varepsilon_{it}$$

where r_{it} is the risk premium of state i at time t , measured as the difference between the state's bond yield and the yield of British Consols. s_{it-1} is the state public revenue for each state i lagged one period. X is a vector of control variables that includes imports, population, fiscal deficit, and debt per state. We also use fixed effects for states (ζ_i) to control for state unobservable characteristics and time dummy variables (φ_t), accounting for time varying trends common for all states. When a state had more than one bond being traded in the secondary market we use the average of all the yields. We repeat this exercise with our estimates of yield to maturity as well.

Instrumental Variables Approach

A large literature in economic and financial history has studied the risk premium or spreads of the bonds of "emerging markets" before 1914 using revenues or exports as an

independent variable. We believe that there is potential endogeneity in those estimates because the yield that investors assigned to each bond issue was based on the expectations they had about that country's capacity to either export or to obtain revenues in gold or silver (when silver was valuable). The problem is that the capacity that countries had to export and/or collect revenue depended to a large extent on the infrastructure that was put in place to integrate markets or facilitate trade. Thus, a lower cost of capital could lead to a larger debt burden to finance infrastructure. More infrastructure could lead to higher revenues as economic activity increases. Higher revenues or exports would make investors more confident of the repayment prospects of the debt, which in turn would lower yields (the cost of capital) even further. It is for this reason that we believe perhaps an instrumental variable approach is in order to reduce the potential endogeneity problem.

In order to address this potential endogeneity problem in the case of Brazil we would want to find a variable that affected the cost of capital but through revenues per capita alone. Since a lot of the revenue came from the taxes on commodity exports, we would want to find an exogenous factor that determined the export capacity of every state (without affecting bond yields directly). Ideally we would want to use geographical or climate-related variables to explain the variation in state revenues per capita across states (i.e., why some states specialized in some commodities and not in others) and the variation over time in revenues, since exports followed cycles determined either by international conditions or internal changes in the weather. So, for instance, we would need a panel with climatic variables such as rainfall, temperatures, and/or barometric pressure; with geographical variables such as altitude and distance to the equator; and, with perhaps other geological variables such as soil types (which determine which crops can be produced in each state). But most of this information is unavailable for the period 1891-1930. We have only some of the variables that do not change over time, such as altitude and distance to the equator. In fact, we found the average of these variables for a later period and we have used them to see if the average explains a lot of the cross-sectional variation. It actually does explain cross-sectional variation, but for a panel estimation like ours, having these variables is equivalent to having fixed effects for the states.

Therefore, we look for an alternative way to create an instrument. Table 9 shows the correlations between our geographical and climatic variables with the export share of each commodity (to total exports). We can see that there are some high correlations between some of

these geographical variables and the kind of commodities states specialized in. We then assume that the export shares reflect this heterogeneity across states and also captures some of the variation over time in the capacity states had to export different commodities.

Using the share of total exports that each commodity exports represented as an instrument is imperfect, but we believe captures the variation in these geographical and climatic variables. Still there could be some endogeneity between the cost of capital for states and the export share of each commodity. If a state faces low cost of capital it can issue debt to finance a railway, which in turn can facilitate the export of, say, coffee. This would increase exports and revenues per capita at the state level and would in turn reduce the cost of capital for that state. Therefore, at the end of the paper we propose a way to try to make the variation over time in our instruments more exogenous to what happened at the state level.

Simulated Instruments Approach

Since some of the variation over time in our current instruments (the share of exports that each commodity has) could be indirectly driven by the cost of capital we want to make the variation over time in the instrument less endogenous to what happens in each of the states. Therefore, we use a simulated instruments estimation in which we take as initial observation the share of exports that each commodity represented in 1901 for each state. Then, in order to simulate the growth in those commodity exports over time we take the growth rate of the exports of those same commodities at the national level. That is, we try to separate the growth path of commodity exports in each state from what happened in each state and just assume that commodity exports in each state follows the path of national exports. Still this assumes that states do not influence the growth rate of commodity exports at the national level, which is not necessarily the case, but it is probably a better way to try to make the export of commodities by state exogenous. This is problematic because the state of São Paulo, Minas Gerais, and Rio de Janeiro were price setters in the international coffee market and thus the growth rate of national coffee exports was determined, to a large extent, by the actions of those states. Even if imperfect, this approach may be better than just using the share of exports by commodity (which we used in Table 7).

The first year with available data for commodity exports at state level is 1901. Most of the state foreign bonds were issued after 1901. So, we are confident that the shares of exports

that we use as the initial point are exogenous to the cost of capital faced by states in international markets after 1901. Moreover, there is no evidence of compositional changes in the state exports during the decade of the 1890's, so 1901 should be representative of the state of commodity exports in 1890. The idea, as in our IV approach described in the previous section is that the share of exports that each commodity represents at the state level reflects regional heterogeneity in geography, climate, and soils in Brazil.

The strategy to simulate exports is as follows. Brazil has I commodities, $i=1, \dots, 8$, there are J states, $j=1, \dots, 19$, and we have T periods $t=0, \dots, 1$; where $t=0$ represents 1901. SH_{ij0} is the export share of commodity i at the beginning of the period ($t=0$) for state i ; and X_{j0} is the total export by state j in the first period, which is the sum of each commodity exports. Alternatively, the share of commodity exports is defined as: $SH_{ij0} = x_{ij0}/X_{j0}$ where x_{ij0} represents the exports of commodity i in state j . At the national level, we observe the growth rate (g) of exports for each commodity and it is defined as $g_{iNt} = [(X_{iNt} - X_{iNt-1}) / (X_{iNt-1} - 1)]$, where i and t are defined as usual and N represents the national exports. Then we use g_{iNt} to predict exports at state level using SH_{ij0} as weights, following the following formula

$$\hat{X}_{jt} = \hat{X}_{jt-1} \left[\sum_{i=1}^I SH_{ij0} * g_{iNt} + 1 \right],$$

where \hat{X}_{jt} is our simulated instrument for state public revenue per capita in the first stage. In the second stage we use our estimated state public revenues per capita as independent variable to estimate the cost of capital or spread of the states that traded bonds in international markets.

V. Findings

Table 5 and 6 show the basic argument of the paper: that states with higher revenues per capita were more likely to issue bonds in international capital markets. Since state public revenue per capita was highly correlated with the level of exports per capita by state (see Figures 3 and 4), then we can confidently say that having commodities that were in high demand in international markets actually led states to have higher revenues. Therefore, most of our empirical work shows the last part of this connection, that is that revenues per capita increase the probability of issuing bonds abroad and also were correlated with lower cost of capital for state debt.

Table 5 shows the result for the Cox hazard model estimations. We can see that state public revenue per capita has a consistent, positive and significant effect over the hazard rate of issuing a new bond. In the last regression we control for the size of the debt burden using the debt/exports ratio, which reduced considerably our sample and the coefficient still has the expected sign and it is significant at 10%. The coefficient in the lag of the state public revenue indicates that those states collecting an additional unit of revenue increases their relative risk of issuing their first international bond in any year by a range between 0.036 and 0.089 (3% and 8%, respectively).

We find similar conclusions in the Probit estimations (Table 6). The marginal effect of increasing the public revenue per capita infinitesimally increases the probability of issuing an international bond by a range between 0.023% and 0.035%. The significance of this coefficient is consistent at 5% significant level and the size does not change after we include a variety of controls. Unlike the Cox estimations, we find that the size of the population also increases the probability of issuing a bond. It also seems that having a high cost of capital in the past or a history of default is taken into account by investors and made it more difficult for defaulting states to issue new bonds. In sum, our findings show that effectively those states with higher capacity to collect tax revenue increased considerably the likelihood of issuing bonds in international markets.

In Table 7 we examine the cost of capital for Brazilian states using the spread between the yield of state bonds and the yield of the British Consols (which we refer to simply as “spread”). In Table 7 we use our simple measure of cost of capital (which estimates the yield as the coupon over the price of the bond) and find that it is negatively correlated with state public revenue per capita. We find that states collecting an additional unit of Brazilian currency (the mil reis) per capita had, on average, a lower spread of between 20 and 28 basis points in the OLS. The coefficients are similar even when we use Feasible Generalized Least Squares (FGLS) and Panel Corrected Standard Errors (PCSE) to correct for autocorrelation (Obstfeld and Taylor, 2003). When we restrict our sample to include only the observations with risk premium or cost of capital of less than 1500 basis points (15% over the UK British consol yield), in specification 3, we find significantly lower coefficients.

Our coefficient of state public revenue per capita (lagged) is consistent across specifications in Table 7, except when we expand our sample to include state bonds traded in the Rio de

Janeiro Stock Exchange. The main difference is that this sample includes the debt of smaller states, which sometimes were traded only in one year or two (this sample includes debt from the states of Paraíba, Sergipe, and Góias). The coefficient in this specification is not significant and has the opposite sign of what we would expect. This result is hard to explain, but we believe it has to do with the fact that, in general, yields for state bonds traded in Brazil were lower than the yields for debt traded in London, the United States, or Paris. That means that there was either home bias or arbitrage opportunities that investors could not reap because trading in the Rio was relatively thin.

In Table 8 we run a series of robustness checks using different lags of our main independent variable (state public revenue per capita). The logic of the specifications in this table is that perhaps investors looked at state revenues per capita in previous years to update their expectations of the probability of default (the spread over the British Consols). This problem, for instance, could be a consequence of the fact that publications like the *Investor's Monthly Manual* did not update their financial and exports data every year. For some countries (and states) we would expect it to be a lag in the publication of fiscal statistics. In any case, we get very similar results to those of Table 7 no matter what lag we use. That is, an additional mil reis in revenue per capita reduced the spread over the British Consols in about 20 to 30 basis points, or 0.2%-0.3%.

Instrumental Variables Approach

Table 10 shows our first attempt at using IV to correct for some of the possible endogeneity problems (i.e., that state public revenue per capita depends on the infrastructure that is financed with debt issues). Table 10 shows the first stage regression with state revenue per capita as dependent variable, using the share of each of the commodities exported by state as instruments. This is a rather imperfect instrument because the shares of each commodity could depend on the kind of infrastructure that the state develops to facilitate exports (if the cost of capital is low there is going to be more infrastructure, etc.). Now, states are constrained as to which commodities they can export, according to geographical and climatic conditions. Thus, export shares have an important exogenous component. The states of the northeast of Brazil could have wanted to export coffee, but they did not have the altitude and low temperatures necessary to do so.

Table 9 shows the correlations between geographical and climatic variables with the share of exports of each commodity. For example, states with higher average temperature exported less coffee as a proportion of total exports and more of the high-temperature crops like sugar, cacao, or cotton. Also in Table 9 we can see that the different soil types have strong correlations with the share of exports of each commodity. Therefore, our instruments in Table 7, even if imperfect, are good proxies for these geographical and climatic variables.

Table 11 shows the second stage regression, using different measures of the cost of capital, or spread, for the state bonds. The coefficients seem to be too big in the second stage, but the signs and significance are very similar to what we get in the simple panel estimate of Table 7. This effort to endogenize the main variable measuring capacity to pay (state public revenues per capita) has not been used in the literature that looks at bond spreads over time. Thus, even if imperfect, our approach shows that even endogenizing state public revenue we get the results expected (at least the sign and significance of the coefficient). The results in Table 11 would imply that an increase in revenue per capita of 1 mil reis (about 10% of the mean in Table 3) would reduce the cost of capital or the spread over the UK consols in almost 80 basis points or 0.8%

Now, one could argue that we should use geographical, geological, and climatic variables as instruments in the first stage, instead of using the shares of exports that each commodity represented. Yet there is no complete available on geological, climatic, and geographic variables that we can use for the period under study. The data we have comes from surveys and averages of temperature by state (see Appendix) after 1950. Since they represent averages we just have one observation per state for the whole period. That is, these geographical and geological variables are like state fixed effects with no variation over time. Since we are using panel data to explain the cost of capital implicit in the prices of bonds traded in foreign markets we would want to have a more dynamic variable to instrument state revenues per capita. Our empirical approach is based on the idea that investors priced default risk and capacity to pay for each of the state bonds in foreign markets based on current information they had about the state revenues and about the kinds of commodities each state could produce and export. Therefore, investor expectations were adjusted over time and if we want to create and instrument for state public revenue per capita, it would have to be dynamic enough to explain not only cross-sectional variation, but also variation over time. We know our current approach is imperfect,

but we believe is more powerful than using only the cross-sectional variation provided by the geographical variables. We are currently collecting some geographical variables that were reported on a yearly basis and we will incorporate them in future versions of the paper.

Table 12 shows different estimates of the reduced form and we can see that the share of exports that each commodity represented or exports per capita at the state level are significantly correlated with the spreads of the state bonds.

Simulated Instruments Approach

The results of the simulated instruments estimation are presented in Table 13. Panel A of this table shows the second stage of the regression. We do not like the results too much because again the size of the coefficient for state public revenues per capita are too big (more than two standard deviations above the coefficient for the OLS estimate in Table 7). Yet the sign is the correct one and we get significant coefficients in most of the specifications (except for 4 and 6). Panel B shows the first stage of our simulated instruments approach, with and without fixed effects (state dummies). Even if the size of the coefficients in the second stage are not what we would expect, both of our instrumental variable approaches confirm that the basic relation between commodity exports, state revenue per capita, and the spread of state bonds holds no matter how we run the estimation. Additionally, using simulated instruments is perhaps better than our regular IV approach and is preferable to the simple approach used in Table 7, which is the approach used in most of the literature that looks at the determinants of spreads of sovereign bonds.

VI. Conclusions

The results of our study show that the cost of capital for Brazilian states and the probability of issuing state debt in international capital markets were highly correlated with state revenues per capita. Our argument is that revenues per capita are highly correlated with exports per capita by state and that the level of exports per capita actually depends on the kind of commodities each state was able to export between 1890 and 1930. We argue that the relations among endowments and the cost of capital for states or the capacity to issue debt led to marked differences in the access to capital and the capacity that states had to spend on public goods. Since differences in expenditures on public goods can lead to market differences in

economic development among states we sustain that the set up of the 1891 Constitution promoted some of the regional inequality that we still observe today in Brazil. We do not argue that a federalist system with broad taxation powers for states should inexorably lead to inequality among states. If there is mobility of labor and capital, competition among states should lead to the equalization of living standards just like Weingast (1995), Weingast and Qian (1997) or McKinnon (1997) predict. Yet when there are frictions complicating the mobility of labor and capital across states, fiscal federalism can lead to inequality among states and markedly different development paths.

In Brazil, since some states were able to export commodities that had higher demand in international markets they were also able to extract more export revenue and ended up issuing more debt in international markets. Because the debt was used to pay for public goods, these states ended up having better infrastructure, better schools, and richer populations (on average). This perhaps extends the argument of Cano (1987) to all states. He explained that because the system that prevailed between 1890 and 1930 benefited São Paulo more than any other state, there was a higher industrialization in that, while other states did not have enough time to catch up with São Paulo during the republican period (1889-1930). After 1930 the government of Getulio Vargas changed the federalist pact, named some of his allies as supervisors of the actions of state governments and centralized the collection of revenues. Moreover, after 1928 Brazilian states defaulted en masse and the federal government had to assume all state debts. That was the end of state debt issues in international markets. By 1934 a new constitution was drafted and in 1937 Vargas himself rewrote the constitution to give the central government more powers, including a new fiscal pact destroying the federalist pact of 1891-1930.

Lastly, our results suggest that we need to take into account the importance of commodities when studying state capacity to pay external debts. Most studies of the determinants of cost of capital across countries acknowledged the importance of commodities but overlooked them in their empirical work. Our results suggest that using these commodities as instruments of state revenue per capita are perhaps a viable way of incorporating endowments into these studies.

VII. References

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Methodological Appendix Sources and Methodology to Construct the Dataset

Variable	Source	Comments
Bonds' Characteristics	<p>Information about year of issue, state, currency, nominal value, type, coupon interest rate and liquid entry of capital for each state and municipal bonds comes from Paiva (1985).</p> <p>Maturity, date and place of issue, bank, use of the debt and guarantees from bonds issued before 1910 is from AEB I. For bonds issued after 1912, see Boucas (1942).</p> <p>Maturity for state bonds issued between 1919 and 1924, see Conty (1926). Maturities of most of the state bonds issued in United States see Young (1930).</p>	
Bond Quotation	<p>London. <i>Investor's Monthly Manual</i> (IMM) and completed with Mathieson and Sons (MS) for the period 1929-1931. Also from MS we got data for Alagoas and 1907 and 1915' loans to Para. Unlike the IMM, MS also contains the prices of bonds issued by municipalities. The quotes from IMM were, as the availability of data allowed, from the last day of the year. When this data is unreported we used the average between the highest and lowest quotes of December. Particularly for the last month of 1914, there is no data reported. In this case, we looked for the closest quotation available either the months before December of 1914 or the first months of 1915. MS publication only reports the highest and the lowest quotes for every year. In this case, the used quote was the average of both extremes. The issue price of the bonds is available for the data available for the IMM quotations but not for the MS ones.</p> <p>New York See <i>Bank and quotation record</i>, for prices between 1928 and 1931; and the <i>Commercial and financial chronicle (Bank and quotation section)</i> for the 1921-1927 period. Most of the quotations are as of December 31. The data for 1927 is as of January 3rd, 1928 and for 1930 is as of November 30th, 1930. Data was preferably taken from Monthly and Yearly Record and, in case of some missing quotations, we took prices from the Section General Quotations of Bonds and Stocks, which list "those [bonds] dealt in on the exchanges but also leading unlisted and inactive securities" (see any introductory section of "Quotations" in any issue of Chronicle). Initial prices for these bonds were taken from the Handbook on American Underwritten. Some reported prices are the bid and ask. In this case we use the average of both.</p> <p>Paris and Burssels: The main source is <i>Moniteur des Interets Materiels</i>. We use the information in the sections "Titres a Revenu Fixe. Fonds Publics, Emprunts et Obligations" and "Ours General des Fonds Publics, Obligations et Actions". The data reported is, in general, as of the last day of the year (December 31st). However, for the data extracted from "Ours..." there are slight variations in the dates along the first days of January (not later than the first week though). Unfortunately, so far we have just had access to the issues published between 1901 and 1913. We also use <i>Annuaire Des Valeurs Admises a la Cote Officielle (Annuaire)</i> issue of 1922-23 for some bonds traded in Brussels and Paris. In this issue, historical information came of the lowest and highest price of the security traded in any year. We use the average of both extremes. Initial price is available in the two sources.</p> <p>Rio de Janeiro: <i>Camara Sindical de Corretores de Fundos Públicos do Rio de Janeiro, Relatório...</i>, contains information about the quotations of the "apolices" issued by the states. Available information is the highest and lowest quotation for every year. The coverage is between 1890 and 1930.</p>	<p>In some cases, the same bond is reported in more than one source. For instance, a bond issued by São Paulo might be reported in the IMM, <i>Moniteur</i> and <i>Annuaire</i> because it was traded in Paris and London (see annex of sources for each bond). Thus, for some bonds we will have the average of the lowest and highest prices, as well the last day of the year's quotation. In these cases, we privilege the use of the source with the longest series.</p>
State Public Finances	<p>For data before 1897, we use Brazil (1914). For data from 1897 to 1939, see AEB V (1939/40).</p>	<p>Few data for some years and some states, the data is the budgeted and not the "actual". Some data reported was not for 1 year (either 6 or 18 months) and it was adjusted to be of 12</p>

		months (multiplying by 2 or 2/3 respectively). Finally, missing data for some years was filled out with linear interpolation between the closest data points available.
Debt	Brazilian Yearbook, Willeman (1909) has unbalanced data until 1908. For 1912 we take the information from AEB I. For 1922, we take the information from Directoria Geral de Estatistica (1926) and finally for 1930 the source is Boucas, (1932). We also have also added data compiled for São Paulo (Love (1980)); Minas Gerais, Carteira Estatística de Minas Gerais (1929) and Pernambuco (Levine (1978)), which constructed a data series for the studied period.	In order to fill the data gaps we perform some estimation in order to incorporate debt data in some of the empirical specifications. We constructed 3 measures of debt: 1. Data as it is found in the sources (many gaps) (debt1); 2. Filling gaps with lineal interpolation between the available data points (debt2); 3. Filling gaps with lineal interpolation and considering the years when states issued international debt. We use a combination of yearly amortization (between 0.5% and 1% depending on the bonds' characteristics issued for the states); the amount of debt issued in international markets in the years when the state did so; and linear interpolation. (debt3) With these 3 different debt measures are included in the regressions as debt per capita, debt/ exports ratio and debt/state public revenue ratio.
International Data	Trade Data from 1888, Ministerio da Fazenda (1888) Data from 1887, 1892 to 1897 and 1903-1907 is from Directoria Geral de Estatistica (1908). Data from 1902 (imports) and 1901 and 1902 (exports) from Servico de Estatistica Commercial ,(1904) 1908-1912 comes from AEB I Data from 1913-1927 and 1935-40 comes from Commercio Exterior do Brasil, several years. Information from 1928-1934 is from Serviço de Estatística Econômica e Financeira (1938). Overall data of exports and imports for the whole country from 1889-92 and 1898-1901 was taken from AEB V. Data from Minas Gerais is Servico de Estatistica Geral (1929). Yearly information since 1839-1840 until 1927.	1.. To fill out data gaps from 1889 to 1892 and 1898 to 1900 for exports and 1898 to 1901 for imports we followed the following strategy: We have data for total exports and imports of Brazil for these years, so we calculated the values for each state making a linear interpolation of the shares between the two known points of time and multiplying this share by the total imports and exports respectively. 3. Information includes only 18 states, the ones which have customs offices (usually the states with river or sea ports). For this reason, no data available data for Goias and Minas Gerais (MG). The later one, however, has reported exports but not from which ports they were shipped from. However, we know that most of the exports were shipped from Santos (in São Paulo, SP) and Rio de Janeiro (RJ). So, in order to include this important state in the sample, we assume that the same share in the total exports for RJ and SP corresponds to the exports from MG in each port. So in this case, we subtract from the SP and RJ exports, the MG's share and recalculate the export values for these 3 states. For the MG export data for 1927-1931, we assume that the MG average export share between 1923 and 1927 will prevail for the rest of the studied period and we proceed with the same methodology as explained above. In order to show that results of the estimations do not change, we also use the exports as reported by the federal publications (excluding MG). Unfortunately, data for imports for MG is not available. So, all the estimations including imports exclude MG. 4. Rio de Janeiro/DF. Federal District is located in Rio de Janeiro city, which is in Rio de Janeiro state. Both the city and the states

		collected their own public revenue, but the federal revenue public revenue is consolidated. Moreover, the port of the state is in Federal District and it is not until the twenties when other ports were open in the state (eg. Angra dos Reis). So we can not distinguish the exports made by the city in itself or the state. However, we are confident that most of the state exports were shipped from the RJ port and most of the RJ port's exports come from the commodities produced in the state. Furthermore, we consider that the state was benefited from the exports and economic activity made in the port of Rio de Janeiro and vice versa and for this reason we use the same level of international trade activity for both state and city.
<i>Commodities dummies.</i>	We generate the dummies from 3 years: 1903 (Wileman, 1909) 1912 (AEB I) and 1930 (Boucas, 1932).	The commodity dummy is equal to 1 if commodity k represents $>35\%$ of state exports at year t . Commodities: coffee, sugar rubber, sugar, cotton, animal and mate tea. We assume that the neighbors years of the available information behave in similar way. This makes sense since there are no great variations in the three data points available.
<i>Population</i>	The sources for the population are from the Population Census 1890 and 1900; and AEB V which contains data from 1900 to 1939.	Data from 1873 to 1899 was estimated through interpolation: We assumed a linear trend between censuses points for each state. Used to calculate the variables at per capita terms.
<i>Prices</i>	Index prices before 1913 were taken from Catao (1992) and from then on, see Contador and Haddad (1975).	Used to deflate the variables at 1913 prices.
<i>Exchange rates</i>	For exchange rates between mil reis and foreign currencies, see Musacchio (2008)	
<i>Dummy Gold Standard</i>	Brazil was under a gold standard regime between 1906 and 1913 (Meissner (2002)); and from December 1926 to December 1929 (See Obstfeld and Taylor (2003))	The gold standard dummy takes 1 if Brazil is in the gold standard or 0 otherwise. As Brazil entered almost at the end of 1926, this variable takes 0 in this year.
<i>GDP Average France, US and UK.</i>	The information for the GDP per capita of France, US and UK, the countries that lent Brazil states were taken from Maddison (2003). GDP is measured in 1990 international Geary-Khamis dollars	
<i>Default History</i>		We assume that those states with a spread above 15% were in troubles to pay their obligations. We assume that once this happens, the state has incurred in default and this variable takes 1 in the following years after the spread reach the threshold.

Figure 1. Uses of International Debt by Brazilian States(1889-1931)

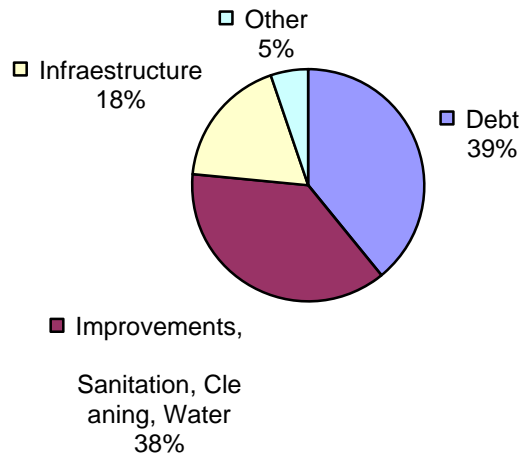
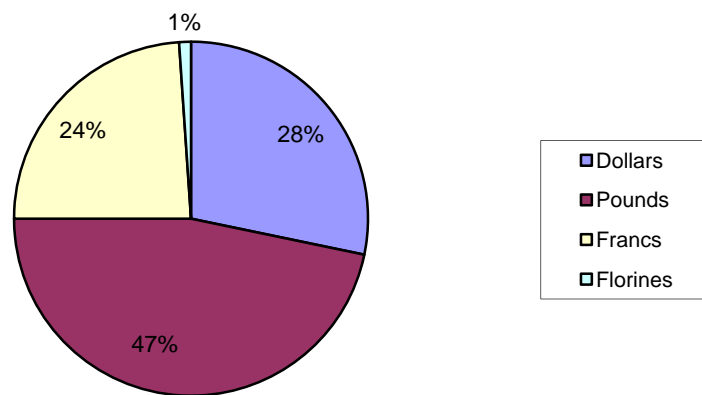


Figure 1. Currency of the State Bonds Issued by Brazilian States(1889-1931)



Source: Adapted from Paiva (1985), AEB 1, vol.II and Boucas (1942)

Figure 3. Correlation between exports, state public revenue and spread coupon



Table 1. State Distribution of Bonds Issued in Brazil. 1889-1930

	Number of debt Issues	State revenue per capita per year	Exports per capita per year	Total debt in pounds sterling	Amount received in pounds sterling (debt minus fees)	Amount received %	Amount received per capita in 1913 reis (accumulated)	Date of first state bond issue
Sao Paulo	22	21.5	80.9	65,241,076	58,694,000	41.5%	163.1	1888
Federal District	10	37.9		24,205,082	21,828,000	15.4%	248.1	1889
Minas Gerais	10	6.2	47.3	16,284,143	13,880,000	9.8%	35.5	1896
Rio Grande do Sul	4	12.1	24.9	11,532,235	10,491,000	7.4%	61.0	1919
Rio de Janeiro	4	9.7	89.4	8,052,371	7,515,000	5.3%	64.8	1912
Bahia	7	5.4	26.6	6,076,129	5,258,000	3.7%	23.4	1888
Amazonas	4	36.3	237.5	5,742,976	4,772,000	3.4%	210.5	1902
Parana	5	11.1	43.7	5,210,477	4,744,000	3.4%	84.5	1905
Pernambuco	4	6.8	18.1	3,832,178	3,289,000	2.3%	21.5	1905
Espirito Santo	6	15.5	85.1	3,337,825	2,879,000	2.0%	80.9	1894
Para	4	18.1	109.8	3,292,453	2,720,000	1.9%	39.4	1901
Santa Catarina	3	5.7	11.9	2,405,556	2,157,000	1.5%	36.5	1909
Maranhao	4	4.1	14.1	1,579,254	1,326,000	0.9%	23.1	1910
Ceara	2	3.4	11.0	1,040,881	882,000	0.6%	10.5	1910
Alagoas	2	3.4	7.8	871,250	697,000	0.5%	10.6	1906
Rio Grande do Norte	1	4.7	5.7	343,373	285,000	0.2%	7.0	1910
Total	92	9.5	45.9	159,047,256	141,417,000	100.0%	67.0	

Source: Own elaboration with information from Paiva (1985), AEB 1, vol.II and Boucas (1942)

Amounts received per capita represent the ratio of the total amount actually received to state population in 1931.

Table 2. Spread of State Bonds over the UK Consold Yield, 1890-1931

year	AL		AM		BA		CE		DF		ES		MA		MG		PR		PARA		PE		RJ		RS		SP		RN		SC		PB	GO	SE	
	yield to maturity	coupon/price	yield to maturity	coupon/price	yield to maturity	coupon/price	yield to maturity	coupon/price	yield to maturity	coupon/price	yield to maturity	coupon/price	yield to maturity	coupon/price	yield to maturity	coupon/price	yield to maturity	coupon/price	yield to maturity	coupon/price	yield to maturity	coupon/price	yield to maturity	coupon/price	yield to maturity	coupon/price	yield to maturity	coupon/price	yield to maturity	coupon/price	yield to maturity	coupon/price	yield to maturity	coupon/price		
1890																																				
1891																																				
1892																																				
1893																																				
1894																																				
1895					3.47%	3.02%						4.44%	3.61%																							
1896																																				
1897					3.81%	3.14%						6.36%	4.66%			6.45%	4.72%																			4.1%
1898					4.21%	3.35%										6.61%	4.77%																			
1899					5.45%	4.03%										5.40%	4.03%																			4.0%
1900										3.03%													4.9%													
1901					3.72%	3.01%				2.40%	8.16%	5.49%			5.10%	3.79%																				
1902					2.77%	2.50%				2.08%	4.91%	3.67%			3.64%	2.98%																				
1903					2.26%	2.19%				1.96%	3.77%	3.01%			2.84%	2.51%																				
1904					2.15%	2.13%				1.96%	2.65%	2.50%			2.31%	2.21%							5.2%													
1905					2.13%	2.07%				2.13%	2.69%	2.36%			2.15%	2.08%																				
1906	3.05%	2.76%	2.99%	2.72%	2.49%	2.35%				2.06%	2.40%	2.22%			2.01%	2.02%																				
1907	4.56%	3.82%	4.08%	3.48%	2.43%	2.31%				2.23%	2.22%	2.12%			1.66%	1.85%																				
1908	4.01%	3.41%	4.85%	4.01%	2.13%	2.10%				2.12%	2.20%	2.09%			2.02%	2.02%																				
1909	2.89%	2.61%	3.19%	2.83%	2.07%	2.05%				1.97%	1.70%	1.85%			1.78%	1.88%																				
1910	2.57%	2.34%	2.85%	2.55%	1.79%	1.82%				1.67%	1.79%	1.82%			1.63%	1.67%																				
1911	2.58%	2.31%	2.69%	2.40%	1.73%	1.74%	2.30%	2.10%		1.52%	1.60%	1.69%			1.74%	1.66%																				
1912	2.75%	2.40%	3.02%	2.59%	1.67%	1.67%	2.58%	2.25%		1.51%	1.61%	1.64%			1.77%	1.65%																				
1913	2.62%	2.25%	5.89%	4.50%	1.75%	1.69%	2.59%	2.20%		1.54%	1.91%	1.67%			2.19%	1.89%																				
1914	4.34%	3.42%	7.28%	5.47%	4.53%	3.65%	3.51%	2.81%		1.78%	3.31%	2.28%			3.30%	2.70%																				
1915	4.21%	3.30%			6.88%	4.95%				2.17%		5.0%			4.99%	3.84%																				
1916	3.77%	2.68%			7.44%	4.52%	6.17%	4.03%		1.84%		4.2%			6.08%	4.13%																				
1917	4.22%	2.84%			6.41%	3.34%	6.98%	4.36%		1.51%		3.9%			6.36%	4.16%																				
1918	3.49%	2.40%			6.48%	3.46%	7.27%	4.53%		1.45%		2.9%			4.36%	2.88%																				
1919	2.90%	2.05%			6.60%	3.64%	6.10%	3.83%		1.19%		1.5%			3.03%	2.09%																				
1920	4.74%	3.03%	17.77%	11.53%	10.58%	5.94%	4.28%	2.58%		1.61%		1.6%			3.32%	2.09%																				
1921	8.49%	5.48%	36.60%	23.58%	10.63%	6.44%	6.70%	4.14%	2.64%	2.16%	9.82%	7.31%	9.25%	5.03%	5.08%	3.39%	10.91%	7.94%	33.73%	20.27%	3.00%	2.04%	4.81%	3.49%												
1922	22.50%	13.71%	33.31%	21.17%	19.01%	9.98%	3.31%	2.08%	3.94%	2.07%		3.3%	10.55%	5.41%	4.69%	2.96%	11.85%	8.48%	53.89%	31.64%	4.28%	0.77%	4.48%	3.16%												
1923	19.26%	11.59%	21.11%	13.32%	18.48%	9.15%	8.27%	0.09%	5.37%	2.49%	7.46%	5.46%	6.66%	3.40%	2.94%	1.88%	2.33%	1.73%	68.60%	39.62%	0.66%	1.40%	4.62%	3.21%												
1924	7.66%	4.69%	46.22%	28.65%	17.22%	6.63%	11.74%	1.03%	4.20%	2.29%	9.59%	6.97%	4.94%	2.56%	1.77%	1.14%	6.63%	4.75%	82.78%	46.95%	0.25%	0.62%	3.97%	2.79%												
1925	5.78%	3.60%	18.22%	11.34%	12.56%	7.39%	2.04%	1.39%	3.89%	1.87%	8.20%	5.99%	3.58%	1.96%	2.87%	1.88%	4.82%	3.50%	32.74%	18.22%	5.32%	1.22%	3.37%	2.42%												
1926	4.50%	2.70%	24.21%	14.68%	10.47%	5.86%	2.11%	1.26%	3.16%	1.41%		3.8%			24.17%	13.12%	3.77%	7.49%	2.50%	1.74%	2.91%	3.09%	2.22%	2.33%												
1927	6.87%	4.00%	10.54%	6.41%	4.47%	2.67%	2.41%	1.42%	2.73%	1.28%	7.59%	5.42%	4.28%	2.01%	3.24%	1.92%	1.99%	1.44%	48.42%	25.35%	5.67%	3.47%	1.64%	1.49%												
1928	7.71%	4.40%			6.68%	3.78%			2.95%	1.33%	9.29%	6.56%	5.61%	3.16%	2.98%	2.06%	3.31%	2.80%	38.92%	20.04%	7.01%	3.79%	1.67%	1.51%												
1929	12.68%	6.90%			17.64%	10.21%			9.80%	3.01%		5.1%	6.73%	5.25%	6.49%	4.87%	5.89%	4.69%	68.78%	34.31%	5.89%	3.86%	2.46%	2.09%												
1930	25.87%	13.58%			21.44%	11.86%			19.35%	4.37%		5.3%	11.07%	8.03%	9.18%	6.51%	9.26%	6.83%	136.19%	66.55%	8.78%	4.49%	4.43%	3.21%												
1931	49.63%	25.42%			33.36%	15.65%			6.33%						11.30%	7.75%	15.49%	10.82%	272.17%	126.49%			13.52%	8.60%												

Source: See Methodological Appendix

Note: The rate reported is the average spread yield for each state in the international markets. Bolded figures are spread yields quoted in the Stock Exchange Market in Rio de Janeiro and it is missing from the international resources.

Table 3. Ad Valorem Tax Rates on Commodity Exports by State (percentage points), circa 1912

	BA	SE	AL	PE	Paraiba	RN	CE	PI	MA	PA	AM	RJ	SP	MG	PR ^c	SC	Rs ^e	MG	MT	GO
Sand	35																			
Wood	20		25				10			3					4	10				
Hides	14	12	15	15				12		17						10			12	
Skins	14	12	10		10	8	7			10					10				12	
Cocoa	12									6	5									
Rubber	9	10			6	8		12	3	22	20^a								20^d	
Tobacco	8				8		6									8				
Coffee	7	8			8							8.5	9^b	8	4	8		8		6
Coconuts	5																			
Gold	2			20																
Sugar	1	7	6	2	5	8	4	12				2.5				5				6
Cotton		8	9	10	8	8	6	12	8							0				6
Wine and liquor		10	9	6	8		7					7								
Salt		10																		
Fruits		10																		
Wax				6		8		12												
Mate															0	0				
Meat																6				
Other/non specified			10	4	6		7	12			10					0.5			5	

Source: Lyra (1914).

Note: This table shows only ad valorem taxes and not lump some taxes that were charged on some products.

The main commodities exported by each state appear in bold.

a. Rubber from the remote Javary River basin paid only 10%

b. Love (1980)

c. There is also an additional tax of 10% on all products except mate.

d. Rubber from Mato Grosso (MT) exported through Pará and Amazonas paid only 12%.

e. Tax rates not reported

Table 4. Summary Statistics											
Variable	All					Rich			Poor		
	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.
Dummy issue bond	880	0.078	0.269	0	1.000	264	0.15	0.36	616	0.05	0.22
Coupon spread	305	0.051	0.096	0.001	1.265	142	0.04	0.04	163	0.06	0.13
Yield to maturity spread	305	0.082	0.197	0	2.722	142	0.05	0.06	163	0.11	0.26
State public revenue per capita (1000's of reis)	880	9.5	10.5	1.3	76.7	264	16.9	14.6	616	6.4	5.8
Exports per capita (1000's of reis)	787	45.9	68.6	0.0	711.0	262	90.6	93.0	525	23.6	35.5
Imports per capita (1000's of reis)	791	31.7	58.8	0.5	418.2	220	77.5	93.9	571	14.0	16.8
Population (millions)	880	1.2	1.3	0.1	7.1	264	2.0	1.8	616	0.8	0.7
Deficit ratio	880	0.06	0.24	-0.62	2.07	264	0.10	0.3	616	0.05	0.21
Debt per capita lineal interpolation (1000's reis) ^a	662	32.21	43.99	0	284.68	215	62.5	60.4	447	2.3	2.6
Debt1/state public revenue	661	2.99	3.17	0	25.99	215	4.3	3.8	371	9.6	139.3
Debt1/exports	585	1.82	10.47	0	206.76	215	0.8	0.6	457	17.2	20.6

Note: Rich States are those with revenue per capita are above the median for almost all years. Among the rich states are Rio de Janeiro, São Paulo, Minas Gerais, Espitio Santo, Rio Grande do Sul and Amazonas. Poor states are Alagoas, Bahia, Ceara, Goias, Maranhão, Mato Grosso, Pará, Paraíba, Parana, Pernambuco, Piaui, Rio Grande do Norte, Santa Catarina and Sergipe

a) We estimate these figures by simple linear interpolation between the data points available. See details in the Methodological Appendix.

Table 5. Cox Hazard Model Estimates. Dependent variable is the relative hazard ratio of issuing a state bond for the first time in the international capital markets between 1890 and 1931. The hypothesis is that high capacity to collect revenue increases the likelihood that a state will issue its first bond earlier. A positive sign in the coefficient for lag state public revenue per capita would confirm our hypothesis. Clustered robust standard errors in parentheses. Coefficients marked with: *** indicates significant at 1%, ** at 5% and * at 10%

	Hazard Ratio of Issuing First Bond	Hazard Ratio of Issuing First Bond	Hazard Ratio of Issuing First Bond	Hazard Ratio of Issuing First Bond	Hazard Ratio of Issuing First Bond
	(1)	(2)	(3)	(4)	(5)
Lag State Public Revenue (pc)	0.036*** (0.01)	0.046*** (0.01)	0.050*** (0.01)	0.062** (0.03)	0.072*** (0.02)
Population (millions)		0.96** (0.42)	1.02** (0.45)	0.79 (0.77)	1.25** (0.53)
Lag Imports per capita		0.004 (0.00)	0.005 (0.00)	-0.016*** (0.01)	0.003 (0.00)
Gold Standard Dummy			4.89 0.00	1.78 0.00	0.98 0.00
Average GDP international			0.001*** 0.00	0.002** (0.00)	0.002** (0.00)
Coffee as a % of total exports				3.8*** (1.32)	
Sugar as a % of total exports				-2.74 (2.19)	
Cotton as a % of total exports				-0.05 (1.69)	
Rubber as a % of total exports				-0.23 (1.68)	
Tobacco as a % of total exports				-28.24 (28.94)	
Cacao as a % of total exports				41.83 (36.46)	
Altitude					0.48 (0.34)
Temperature					-0.01 (0.16)
Distance to equator					-0.05 (0.07)
Observations	478	426	426	425	425

Table 6. Probit Estimates of the Probability of Issuing a Bond in a Given Year for any Given State.

Dependent variable is a dummy indicating 1 if a state issues a bond in year t , or zero otherwise. The hypothesis is that states with high capacity to collect revenue have higher probability of issuing a bond in any point of time. A positive sign in the coefficient for the lag of state public revenue per capita would confirm our hypothesis. Regressions 2 to 5 include year dummies. Robust standard errors clustered at state level appear in parentheses. This table reports marginal effects only. For a definition of the controls see the Methodological Appendix. Coefficients marked with: *** indicates significant at 1%, ** at 5%, and * at 10%, respectively.

	Bond Dummy (1)	Bond Dummy (2)	Bond Dummy (3)	Bond Dummy (4)	Bond Dummy (5)
Lag State Public Revenue (pc)	0.0025*** (0.0009)	0.0024** (0.0010)	0.0023** (0.0010)	0.0021* (0.0012)	0.0034*** (0.0009)
Population (millions)		0.051*** (0.0050)	0.051*** (0.0050)	0.035*** (0.0092)	0.048*** (0.0104)
Lag Imports per capita		0.0002* (0.0001)	0.0002* (0.0001)	-0.0002* (0.0001)	0 (0.0002)
Gold Standard Dummy			-0.08 (0.1091)	0.13 (0.1364)	0.17 (0.1541)
Average GDP international			0 (0.000)	0.0001** (0.000)	0 (0.000)
Coffe as a % of total exports				0.102*** (0.02)	
Sugar as a % of total exports				-0.1236* (0.07)	
Cotton as a % of total exports				-0.03 (0.08)	
Rubber as a % of total exports				0.04 (0.05)	
Tobacco as a % of total exports				0.1873* (0.10)	
Cacao as a % of total exports				-0.07 (0.09)	
Altitude					0.002 (0.01)
Temperature					-0.004 (0.01)
Distance to equator					0.001 (0.00)
Observations	923	550	550	492	492

Table 7. Spreads (Brazil states 1891-1928). Dependent variable is the spread of states' yield over the yield of UK consols in basis points. The first 5 specifications are OLS panel data. Specification 6 is a linear regression with panel-corrected standard errors and 7 is Feasible Generalized Least Squares in order to model the autocorrelation of errors within panels. All the regressions are the spreads of state bonds in foreign markets but 5, which include quotations from the Rio de Janeiro Stock Exchange (this increases the number of states by including Paraíba, Sergipe, and Goiás). The hypothesis tested is that those states with higher capacity to collect revenue are perceived by international markets as safer and thus have lower spreads or lower default risk. A negative sign in lag state public revenue per capita would confirm our hypothesis. Robust standard errors shown below the coefficients for equations (1) to (5). Regional dummies and year dummies included in all equations. Constant not reported. Coefficients marked with: *** indicates significant at 1%, ** at 5%, and * at 10%, respectively.

	Coupon Spread	Coupon Spread	Coupon Spread<1500	Yield to Maturity Spread	Including RJ	Coupon Spread (PCSE)	Coupon Spread (FGLS)	Coupon Spread	Coupon Spread
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Lag State Public Revenue pc	-20.835*** (4.4)	-28.045*** (5.5)	-8.607*** (2.5)	-48.975*** (9.5)	7.55 (6.4)	-18.309*** (3.8)	-19.166*** (3.2)	-29.212*** (5.2)	-19.809*** (5.0)
Population (millions)		36.3 (25.6)	-8.2 (14.0)	68.3 (44.7)	150.0 (109.1)	27.9 (37.2)	29.4 (49.5)		(188.99) (115.28)
Debt per capita		2.05** (0.9)	1.61*** (0.4)	2.96* (1.5)	-2.619** (1.2)	0.4 (1.5)	0.6 (0.9)		3.18 (2.15)
Lag Imports pc		-1.104*** (0.4)	-0.613*** (0.2)	-1.975*** (0.7)	-0.4 (0.7)	-0.985** (0.5)	-1.041* (0.6)		-4.982** (2.25)
GDP international		0.111** (0.1)	0.081* (0.0)	0.1 (0.1)	0.0 (0.1)	0.1 (0.1)	0.1 (0.1)		0.06 (0.23)
Gold Standard		694.6 (95524.9)	-4910.8 (37715.2)	-39086.3 (157514.3)	-48834.7 (118862.8)	12554.3 (49663.6)	60970.7 (80599.0)		(2070.99) (90517.36)
Controlling for commodity prices	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
State Dummies	No	No	No	No	No	No	No	Yes	Yes
Observations	278	231	221	231	300	231	231	278	231
R-squared	0.503	0.57	0.427	0.593	0.199	0.611	.	0.575	0.624

Table 8. Spread (Brazil states 1891-1928). Dependent variable is the spread of states' yield over the yield of UK consols in basis points. All the specifications are OLS panel data. The dependent variable is state public revenue per capita at different lags and for specifications 9 and 10 is the inverse of the state public revenue per capita lagged one period. The hypothesis tested is that those states with higher capacity to collect revenue are perceived by international markets as safer and thus have lower spreads or lower default risk. A negative sign in state public revenue per capita would confirm our hypothesis. A positive sign in the coefficient of state public revenue in specifications 9 and 10 is expected. Robust standard errors. Regional dummies and year dummies included in all equations. Constant not reported. Coefficients marked with: *** indicates significant at 1%, ** at 5%, and * at 10%, respectively.

	Coupon Spread	Coupon Spread	Coupon Spread	Coupon Spread	Coupon Spread	Coupon Spread	Coupon Spread	Coupon Spread	Coupon Spread	Coupon Spread
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
State Public Revenue pc	-21.662*** (4.6)	-27.045*** (5.4)								
State Public Revenue pc (2 lags)			-21.887*** (4.7)	-26.657*** (5.6)						
State Public Revenue pc (3 lags)					-21.438*** (4.7)	-27.177*** (5.6)				
State Public Revenue pc (4 lags)							-21.135*** (4.8)	-29.512*** (6.0)		
Inverse of state public revenue pc									2,378*** (630.0)	4,019*** (1,067.0)
Population (millions)		39.973 (27.0)		29.757 (24.7)		22.22 (24.3)		16.205 (24.4)		56.426* (31.8)
Debt per capita		1.646* (0.9)		2.221** (1.0)		2.747*** (1.0)		3.488*** (1.1)		0.43 (0.8)
Lag Imports pc		-1.114*** (0.4)		-1.103*** (0.4)		-1.038*** (0.4)		-0.981*** (0.3)		-1.409*** (0.4)
World GDP		0.114** (0.1)		0.111** (0.1)		0.105** (0.1)		0.103** (0.0)		-0.079 (0.1)
Controlling for commodity prices	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Gold standard dummy		Yes		Yes		Yes		Yes		Yes
Observations	278	231	278	231	277	231	276	231	278	231
R-squared	0.362	0.558	0.383	0.574	0.385	0.579	0.377	0.581	0.312	0.541

Table 9. Correlation between Crop Specialization and Geographical and Soil Variables in Brazil's States. Dependent Variable is the commodity export share average between 1901 and 1931 at state level. The variables for soil are the percentage of the state area that corresponds to the respective type of soil. Correlations marked with * indicates significant at 1%.

	Mate	Tobacco	Cacao	Rubber	Cotton	Sugar	Coffee	Mineral	Cattle
Altitude	0.68*	0.23	0.16	-0.47	-0.15	-0.20	0.23	-0.09	-0.16
Rain	0.27	-0.16	-0.12	0.73*	-0.60*	-0.37	-0.02	-0.08	-0.26
Sun	-0.44	0.22	0.21	-0.38	0.51	0.65*	-0.25	-0.13	0.37
Temperature	-0.56	0.08	0.18	0.46	0.22	0.40	-0.23	-0.16	-0.09
Distance to Equator	0.54	0.06	-0.05	-0.48	-0.50	-0.25	0.49	0.27	0.08
Soil type									
Argissolos	-0.11	-0.04	0.06	0.95*	-0.33	-0.29	-0.16	-0.15	-0.25
Cambissolos	0.73*	0.52	0.45	-0.28	-0.44	-0.35	0.19	0.00	-0.15
Chernossolos	-0.128	0.84*	0.78*	-0.14	-0.24	-0.18	-0.15	0.13	0.39
Latosolos	0.00	0.17	0.23	0.73*	-0.39	-0.35	-0.12	-0.13	-0.15
Luvissolos	-0.24	-0.03	-0.02	-0.11	0.61*	0.09	-0.28	-0.17	0.20
Neossolos	0.10	0.23	0.25	0.21	-0.20	-0.29	-0.35	-0.16	0.36
Nitossolos	0.77*	-0.09	-0.09	0.02	-0.30	-0.26	-0.22	-0.16	-0.14
Vertissolos	-0.06	0.04	-0.07	-0.13	-0.17	-0.13	-0.14	-0.05	0.74*
Plintossolos	-0.03	-0.14	-0.12	0.56	-0.22	-0.27	-0.25	-0.14	-0.08
Planossolos	-0.12	0.83*	0.78*	-0.16	-0.19	-0.10	-0.20	0.10	0.37

Table 10. State Public Revenue per capita (Brazil states 1891-1928). First Stage. Dependent variable is state public revenue per capita and we want to estimates the magnitude of the reliance in the different types of commodities exported by the states. Robust Standard errors are reported. Time and State dummies include. Coefficients marked with: *** indicates significant at 1%, ** at 5%, and * at 10%, respectively

	State public revenue per capita (1)	State public revenue per capita (2)	State public revenue per capita (3)	State public revenue per capita (4)	State public revenue per capita (5)
Cattle	11.931** (6.00)	13.426 (8.40)	11.659 (7.10)	13.426 (8.40)	2.247 (3.82)
Mineral	-4.643 (11.15)	-16.08 (21.24)	-13.512 (18.32)	-16.08 (21.24)	-12.244 (16.61)
Coffee as a % of total exports	9.925** (4.52)	9.684 (6.74)	8.415** (3.42)	9.684 (6.74)	0.266 (4.99)
Sugar as a % of total exports	12.849** (5.62)	13.917* (7.56)	12.054** (5.67)	13.917* (7.56)	2.507 (3.12)
Cotton as a % of total exports	13.446** (6.22)	9.607 (8.33)	9.481 (6.79)	9.607 (8.33)	-0.146 (4.08)
Rubber as a % of total exports	50.350*** (7.27)	45.895*** (7.71)	53.418*** (13.89)	45.895*** (7.71)	50.388*** (6.55)
Cacao as a % of total exports	22.217 (15.04)	32.071* (18.63)	34.064* (19.00)	32.071* (18.63)	20.568 (16.98)
Tobacco as a % of total exports	16.105 (10.67)	12.384 (16.18)	15.648 (15.75)	12.384 (16.18)	16.457 (13.59)
Mate as a % of total exports	7.477 (4.75)	11.759 (8.91)	6.632 (6.79)	11.759 (8.91)	5.178 (11.42)
Observations	248	240	249	240	313
R-squared	0.703	0.77	0.796	0.77	0.75

Table 11. Coupon Spreads (Brazil states 1891-1928). IV approach Second Stage. First stage estimates the lag of state public revenue using export commodity shares. The second stage dependent variable is the state yield spread relative to the UK consol yield at basis points. Regressions 1 and 2 dependent variables is the coupon spread. Sample 3 includes only observations with coupon spread lower than 1500 basis points. Dependent variable in (4) and (5) is yield to maturity and yield coupon spreads with the quotations in Rio de Janeiro Stock Exchange, respectively. Regressions include state and year dummies. The hypothesis tested is that those states with higher revenue collection have lower cost of capital. A negative sign in lag state public revenue per capita confirms our hypothesis. Robust Standard errors are reported. Three different tests of overidentification are performed in order to test for the validity of the instruments. Coefficients marked with: *** indicates significant at 1%, ** at 5% and * at 10%

	Coupon Spread (1)	Coupon Spread (2)	Coupon Spread <1500 (3)	Yield to maturity Spread (4)	Coupon Spread with RJ (5)
State Public Revenue (pc)	-84.373*** (16.6)	-79.626*** (16.7)	-17.173*** (6.1)	-142.321*** (29.1)	10.448 (7.4)
Population (millions)		129.642 (294.7)	-104.594* (62.6)	207.066 (543.8)	453.049 (554.4)
Debt per capita		4.708 (5.0)	0.479 (0.8)	9.097 (9.2)	-6.479 (4.9)
Average GDP international		0.093 (0.23)	-0.196 (0.13)	0.198 (0.40)	0.262 (0.24)
Gold Standard		385.11 (556.7)	-50.36 (87.6)	722.984 (989.2)	13.425 (168.0)
Constant	2,441.*** (647.4)	2,081.*** (486.3)	1,400*** (393.9)	4,072*** (1,028.6)	2,871*** (751.0)
Observations	248	240	249	240	313
R-squared	.	0.243	0.549	0.229	0.226
Sargan (p-value)	0.8947	0.5464	0.5296	0.5347	0.9819
Basman (p-value)	0.916	0.7179	0.712	0.7083	0.991
Score (p-value)	0.0231	0.173	0.5199	0.1198	0.5193

Table 12. Spread (Brazil states 1891-1928). Dependent variable is the spread of states' yield over the yield of UK consols in basis points. All the specifications are OLS panel data. The dependent variable is the export commodities share and exports per capita lagged one period. The hypothesis tested is that those states with higher capacity to export are perceived by international markets as safer and thus have lower spreads or lower default risk. Robust standard errors. State dummies and year dummies are included in all equations. Constant not reported. Coefficients marked with: *** indicates significant at 1%, ** at 5%, and * at 10%, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(15)	(12)	(13)	(14)	(16)
	Coupon Spread	Coupon Spread	Coupon Spread	Coupon Spread	Coupon Spread	Coupon Spread	Coupon Spread	Coupon Spread	Coupon Spread	Coupon Spread	Coupon Spread	Coupon Spread	Coupon Spread <1500	Yield to maturity spread	Coupon Spread with RJ	Coupon Spread
Lag exports per capita pc											-4.194***	-3.405***	-1.131***	-5.645***	-0.021	-0.686
											(0.88)	(0.80)	(0.26)	(1.39)	(0.59)	(0.60)
Mineral as a % of total exports	-711.678	210.601	3,417.961**													-2.917
	(680.75)	(905.43)	(1355.96)													(941.42)
Coffee as a % of total exports	-49.032	-570.884		-585.079**												-423.824
	(231.15)	(437.42)		(293.44)												(443.15)
Sugar as a % of total exports	-123.963	-439.63			-826.283***											-371.958
	(243.96)	(331.38)			(301.70)											(320.91)
Cotton as a % of total exports	-544.767*	-996.248**				203.953										-949.593**
	(284.53)	(397.55)				(344.37)										(383.42)
Rubber as a % of total exports	-4,264.114***	-4,008.263***														-3,910.376***
	(639.71)	(746.29)														(891.41)
Cacao as a % of total exports	-2,512.384**	-2,416.754**						399.377								-2,091.16
	(1261.20)	(1221.74)						(819.62)								(1268.32)
Tobacco as a % of total exports	-2,349.248***	-2,252.420**							683.954*							-2,071.874**
	(871.02)	(934.84)							(388.36)							(926.72)
Mate as a % of total exports	393.05	-84.783									752.267*					-65.359
	(348.44)	(550.26)									(410.05)					(567.82)
Population (millions)		-136.390**	-543.820***	-518.025***	-566.940***	-520.618***	-129.943**	-514.608***	-528.767***	-522.351***			-293.822***	-148.845***	-567.779***	282.157
		(64.82)	(121.89)	(103.58)	(126.03)	(117.92)	(62.25)	(117.67)	(119.64)	(117.74)			(79.19)	(30.72)	(142.91)	(332.33)
Debt per capita		-0.102	2.329	2.368	2.949*	2.388	-0.632	2.481	2.329	2.52			2.927*	0.056	5.664*	-3.635
		(0.86)	(1.66)	(1.45)	(1.75)	(1.68)	(0.92)	(1.70)	(1.68)	(1.71)			(1.66)	(0.42)	(3.00)	(2.72)
GDP international		0.268	0.094	0.03	0.217	-0.028	0.019	-0.028	-0.023	-0.027			-0.052	-0.313**	-0.071	0.254
		(0.28)	(0.27)	(0.25)	(0.26)	(0.24)	(0.19)	(0.24)	(0.24)	(0.24)			(0.20)	(0.15)	(0.34)	(0.23)
Gold standard		-101.374	33.865	290.195*	33.617	62.774	-49.048	57.041	62.961	92.241			1,240.039***	208.122	422.011**	-225.066
		(171.85)	(122.25)	(147.48)	(113.30)	(125.49)	(143.03)	(124.49)	(124.42)	(131.57)			(320.89)	(405.55)	(213.81)	(350.14)
Constant		155.69	-547.09	126.224	-246.975	-465.808	624.082	434.787	603.08	611.253	35.184	633.787***	-153.228	1,002.564***	-640.335	-212.606
		(260.58)	(1108.71)	(1171.76)	(799.54)	(1145.50)	(1036.52)	(823.19)	(1045.54)	(1047.01)	(1106.44)	(105.34)	(592.50)	(384.17)	(1005.35)	(528.37)
Observations	248	240	240	268	240	240	240	240	240	240	278	262	282	270	342	235
R-squared	0.723	0.772	0.515	0.508	0.518	0.503	0.754	0.503	0.504	0.504	0.45	0.595	0.656	0.601	0.205	0.784

Table 13. Coupon Spreads (Brazil states 1891-1928). Panel A. Second stage of the simulated instruments approach; Equations 1 to 3 and 6 shows second stage estimations for coupon spread. Equations 4 and 5 use spread lower than 1500 only and the spreads using yield to maturity spread, respectively. The dependent variable in the second stage is the spread between the yield of state bonds and the UK consol yield in basis points. Robust Standard errors are reported Coefficient for the constant term is suppressed. Coefficients marked with: *** indicates significance at 1%, ** at 5%, and * at 10%, respectively.

Panel A

	Simulated Second Stage: Spreads using yield=coupon/price					
	Coupon Spread	Coupon Spread	Coupon Spread	Coupon Spread <1500	Yield to maturity Spread	Coupon Spread
	(1)	(2)	(3)	(4)	(5)	(6)
Lag State Revenue pc	-15.05** (7.05)	-39.37*** (7.12)	-48.57*** (12.00)	-28.71*** (7.83)	-78.03*** (20.76)	-80.56*** (17.72)
Population			-93.89 (165.01)	-55.51 (81.02)	-221.98 (287.83)	-2.88 (261.85)
Debt pc capita			3.92 (3.17)	0.75 (1.28)	7.54 (5.54)	4.62 (4.80)
Lag imports pc			0.05 (0.20)	-0.21 (0.14)	0.13 (0.35)	-0.05 (0.22)
GDP Average			126.43 (132.0)	-1.74 (106.6)	760.48 (667.7)	311.19 (505.9)
Gold Standard			0.03 (2.06)	1.6 (1.47)	-1.21 (3.48)	6.15* (3.48)
Year Dummies	No	No	Yes	Yes	Yes	Yes
State Dummies	No	Yes	Yes	Yes	Yes	Yes
Observations	254	254	228	218	228	228
R-squared	0.12	0.456	0.54	0.367	0.569	0.284

Table 13. PANEL B: First stage of the simulated instruments approach. The dependent variable is state public revenues per capita. Robust Standard errors are reported in parenthesis. Coefficient for the constant term is suppressed. Coefficients marked with: *** indicates significance at 1%, ** at 5% and * at 10% , respectively.

	Dep. Var: State Public Revenue Per Capita					
	Coupon Spread	Coupon Spread	Coupon Spread	Coupon Spread <1500	Yield to maturity Spread	Coupon Spread
	(1)	(2)	(3)	(4)	(5)	(6)
Lag exports pc	0.018** (0.01)	0.019*** (0.01)	0.013*** (0.00)	0.011*** (0.00)	0.013*** (0.00)	0.012*** (0.00)
Population			1.999 (3.19)	2.094 (3.07)	1.999 (3.19)	0.09 (4.07)
Debt pc capita			0.032 (0.06)	0.027 (0.06)	0.032 (0.06)	0.048 (0.07)
Lag imports pc			0.157*** (0.04)	0.139*** (0.04)	0.157*** (0.04)	0.134*** (0.05)
GDP Average			-0.003 (0.00)	-0.002 (0.00)	-0.003 (0.00)	-0.001 (0.00)
Gold Standard			1.573 (3.79)	1.554 (3.61)	1.573 (3.79)	1.739 (3.61)
Cattle as a % of total exports						1.423 (6.55)
Mineral as a % of total exports						15.04 (26.16)
Coffee as a % of total exports						-4.307 (7.07)
Sugar as a % of total exports						0.982 (5.68)
Cotton as a % of total exports						6.22 (5.56)
Rubber as a % of total exports						21.7*** (7.96)
Cacao as a % of total exports						24.3* (14.64)
Tobacco as a % of total exports						9.6 (15.26)
Mate as a % of total exports						-4.86 (7.56)
Year Dummies	No	No	Yes	Yes	Yes	Yes
State Dummies	No	Yes	Yes	Yes	Yes	Yes
Observations	254	254	228	218	228	228
R-squared	0.121	0.628	0.812	0.824	0.812	0.829