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ABSTRACT

This paper analyzes the roots of variation in de facto institutions, within a constant de jure institutional setting. We explore the role of rent-seeking episodes in colonial Brazil as determinants of the quality of current local institutions, and argue that this variation reveals a de facto dimension of institutional quality. We show that municipalities with origins tracing back to the sugar-cane colonial cycle -- characterized by a polarized and oligarchic socioeconomic structure -- display today more inequality in the distribution of land. Municipalities with origins tracing back to the gold colonial cycle -- characterized by an over-bureaucratic and heavily intervening presence of the Portuguese state -- display today worse governance practices and less access to justice. The colonial rent-seeking episodes are also correlated with lower provision of public goods and lower income per capita today, and the latter correlation seems to work partly through worse institutional quality at the local level.

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1. Introduction

This paper analyzes the causes of variation in local institutions, within a constant 'macro-institutional' setting. We show that variation in institutional quality across Brazilian municipalities is partly inherited from the distinct colonial histories experienced by different areas of the country.[1] Specifically, we explore the role of rent-seeking colonial episodes in determining the quality of current local institutions along four dimensions: distribution of economic power through distribution of endowments, persistence of political power, quality of local government practices, and access to the justice system. Our results show that municipalities with origins tracing back to the sugar-cane colonial cycle – characterized by a polarized and oligarchic socioeconomic structure – display today more inequality in the distribution of land. Municipalities with origins connected to the gold colonial cycle – characterized by an over-bureaucratic and heavily intervening presence of the Portuguese state – display today worse governance practices and less access to justice. Areas associated with the colonial rent-seeking episodes also experience lower provision of various types of public goods. In addition, exposure to the colonial rent-seeking episodes is correlated with lower income per capita today, and this correlation seems to work partly through worse governance practices and less access to justice at the local level.

The role of institutions as key determinants of development has received increased attention in recent years. After the initial work of North (1991) and Engerman and Sokoloff (1997), a vast array of cross-country empirical literature developed following the footsteps of the seminal contributions of Acemoglu, Johnson, and Robinson (2001 and 2002).[2] Much of this literature has evolved around the idea that the geographic pattern of development observed across countries – summarized in the relationship between distance to the equator and income per capita reproduced here in Figure 1 – reflects different institutional arrangements, inherited from different experiences of colonization. According to the emerging consensus in this literature, geographic conditions were associated with particular paths of colonization, which in turn translated into the establishment of different types of institutions. Institutions then, through

[1] Municipalities are the smallest political and administrative units in Brazil. They have administrative autonomy, are governed by a mayor and a chamber of representatives, and are something in between US counties and cities. Municipalities raise certain taxes, receive transfers from the federal government, and decide on part of the expenditures along several different dimensions (education, health, infrastructure, etc.).

[2] See, for example, Easterly and Levine (2003), Rodrik, Subramanian, and Trebbi (2004), and Acemoglu and Johnson (2005). Other literature contends that the geographic pattern of development reflects indeed the direct impact of geography on income per capita, through its effects on the disease environment, agricultural productivity, and access to trade (see, for example, Gallup, Sachs, and Mellinger, 1999).

their effects on property rights, political competitiveness, and governance, led to good policies and, ultimately, development. In this view, the adoption of distinct 'macro-institutions' – determined at the country level, and related to the political and judicial systems and to the enforcement of laws – would be the intervening force in the observed correlation between geography and development (see, for example, Acemoglu, Johnson, and Robinson, 2005 and Persson and Tabellini, 2004).

The geographic pattern of development within Brazil raises a series of questions in relation to the interpretation of the cross-country evidence and the conclusions of this literature. Figure 2 replicates the typical scatter-plot of distance to the equator and income per capita for the case of Brazilian municipalities. As in the cross-country context, municipalities closer to the equator have systematically lower income per capita. In fact, the relationship between latitude and income is stronger and tighter within Brazil than across countries: the R^2 of this relation across Brazilian municipalities is 0.56 and the coefficient on latitude is 0.053, while across countries the R^2 is 0.32 and the coefficient is 0.038 (cross-country data from the Penn World Tables; municipality data presented in section 3). As will be seen later on, the geographic pattern of development within Brazil is even more striking than this simple scatter-plot reveals. A more complete set of geographic variables explains up to 65% of the variation in income per capita across municipalities (Table 1, in section 3, presents this result). At the same time, Brazil is a country that shares a single colonizer and a single language, and has a very centralized federal system. The 'macro-institutions' typically highlighted in the interpretation of the cross-country evidence, as well as the historical variables identified as their sources of variation, are, and for the most part have always been, constant within the territory (constraints on executive, legal system, competitiveness of political system, colonizing power, legal tradition, etc).[3] Therefore, the pattern observed within Brazil challenges the understanding that the correlation between geography and development reflects mostly the effect of climate and endowments on the type of 'macro-institutions' that were ultimately adopted at the country level.

Two non-mutually exclusive possibilities arise from this challenge: geographic factors may be important on their own as direct determinants of long-term development, which would contradict the main consensus of the institutional literature; or, even within a constant *de jure*

[3] The Brazilian territory has remained roughly the same since the 18th century. And, apart from brief and localized incursions of other colonial powers (such as Holland and France), virtually the entire country stayed under Portuguese rule from the beginning of colonization until independence.

setting, different geographic characteristics may still be associated with different *de facto* institutional arrangements, which would then be relevant determinants of local development.

In this paper, we focus on the second possibility. As will be seen in section 3, various dimensions of quality of local institutions within Brazil do follow a clear geographic pattern. Given the constant 'macro-institutional' context of the country, variation in local institutions is likely to reveal the effects of changes in *de facto* institutions within a constant *de jure* institutional setting.[4] We therefore try to understand what lies behind the *de facto* variation in institutions revealed by the municipality data, and ask whether this variation has any significant implication for long-term development. Though the recent literature has acknowledged the difference between *de jure* and *de facto* political power and institutions (Acemoglu and Robinson, 2006, and Pande and Udry, 2006), it has yet been unable to empirically distinguish between them and to identify the sources and consequences of variations in the latter.

Specifically, we identify the areas of Brazil that were actively involved in two of its most well-known colonial 'cycles:' the 'sugar-cane cycle' and the 'gold cycle.' The sugar-cane and gold cycles were the main periods of economic expansion during Brazilian colonial history, both associated with the initial occupation of certain areas and intrinsically connected to the development of rent-seeking activities by the colonial power (Portugal). These so-called 'colonial cycles' can be delimited both chronologically and geographically, so that some municipalities today can have their origins traced back to a specific episode of extractive enterprise. We then ask whether municipalities affected by these historical episodes have worse institutions today, and whether the institutional consequences of the colonial cycles seem to have affected development.

Our analysis concentrates on four dimensions of local institutions: distribution of economic power, as related to the distribution of endowments (land) across the local population; concentration and persistence of political power, measured by whether the same family holds mayoral office through successive elections; access to justice, measured by the local availability of courts; and quality of local governance practices, measured by the municipality's administrative efficiency. Each one of these dimensions tries to capture a different way through which local institutional development may manifest itself. A perverse initial distribution of economic power may lead to poor *de facto* institutions, irrespective of the formalities of *de jure* institutional arrangements. Concentration of power may also be reflected in the political system,

[4] Following Pande and Udry (2006), we understand *de facto* institutions as referring to the actual operation of institutions, as opposed to what is formally established by the law (*de jure* institutions).

where oligarchies may effectively control the electoral process even under a seemingly democratic environment. Access to justice may capture the relevance and penetration of the rule of law, and the willingness of the state to protect contracts and property rights. And finally, local governance practices may reflect the efficiency of the local government in the provision of public goods and its potential responsiveness to demands of the local population.

Our results show that areas affected by the rent-seeking cycles of the colonial period, and under stronger influence of Portugal during that time, have systematically worse institutions today. The specific way in which each historical episode affects current institutions also agrees with their socioeconomic and political characteristics, giving additional credibility to our results. Particularly, municipalities with origins linked to the socially polarized and oligarchic economy of the sugar-cane cycle are characterized today by higher concentration of land. Municipalities with origins connected to the gold cycle – with its suffocating and over-bureaucratic and controlling state – have today worse governance practices and less access to justice. In both the sugar-cane and gold episodes, the negative consequences of the colonial cycles are significantly worse the closer the municipalities are to Portugal, highlighting the negative influence of the interference of the metropolis, particularly when associated with rent-seeking activities. Quantitatively, the estimated coefficients imply that if the average city in the historical mining areas had not been affected by the gold cycle, its index of governance today would be better by 6 percent of a standard deviation, while its index of access to justice would improve by 13 percent of a standard deviation. Similarly, if the average municipality in the sugar-cane area had not been affected by the sugar cycle, its index of concentration of land would be smaller by 35 percent of a standard deviation.

Finally, the variables identifying the rent-seeking episodes are also significantly related to lower provision of public goods along various dimensions and to lower overall economic development. If we instrument for local institutions using the historical variables, and analyze the impact of instrumented institutions on current development, we find that better governance practices and better access to justice are both associated with higher income per capita today.

The empirical literature has recently stressed the need and advantages of bringing the institutional discussion to the within country context, highlighting the minimization of problems of omitted variables and comparability of institutional arrangements, and the gains from the potential identification of more specific dimensions of institutions (Iyer, 2003, Banerjee and Iyer, 2004, and Jimeno 2005). Several recent papers have taken advantage of these benefits and analyzed the interaction between institutions, colonial history, and development within countries

(Iyer, 2003, Mitchener and McLean, 2003, Berkowitz and Clay, 2004, Banerjee and Iyer, 2004, Banerjee, Iyer, and Somanathan, 2004, Jimeno, 2005, Lagerlöff, 2005, Bonet and Roca, 2006, Bruhn and Gallego, 2006, and Acemoglu et al, 2007).

This paper contributes to the literature by identifying determinants of variation in current local institutions. The original contributions of our approach can be summarized in three points. First, we are able to measure very specific dimensions of local institutions, within the constant 'macro-institutional' framework of Brazilian society. This allows us to avoid the general and imprecise measures of 'institutional quality' typically used in cross-country studies, and to explicitly identify current institutional variation within a country. Given the extreme centralization of the Brazilian federal system, this variation reveals a dimension of *de facto* institutional quality that had not yet been analyzed in previous empirical studies.[5] Second, instead of looking at broad historical patterns and analyzing their correlation with current economic performance, we focus on particular historical events. These events can be precisely characterized in terms of their political and socioeconomic environments, and therefore in terms of their likely institutional consequences. And lastly, we account for a wide range of geographic characteristics – distance to the equator and to the coast, sunshine, rainfall, altitude, average temperature in each of the twelve months of the year, and types of soil – therefore measuring in an accurate way the specific endowments of a well defined and limited area (municipality). This allows us to isolate the effect of colonial heritage from that of geography and, indeed, to treat geography in a more careful way than that usually seen in the cross-country literature.

The remainder of the paper is structured as follows. Section 2 describes the historical episodes that we analyze, highlighting their chronological period, the types of economic activities involved, and the social, political, and economic structures that evolved from them. Section 3 explains in detail the construction of our historical variables and describes the data on local institutions, as well as the other datasets used in the paper (geographic and economic variables). Section 4 analyzes the impact of the rent-seeking episodes of colonial Brazil on the quality of current local institutions. Section 5 presents the results on the effects of the colonial past and local institutions on long-term development. Section 6 checks the consistency of the results by analyzing whether the institutional effects discussed in sections 4 and 5 also appear through lower provision of public goods. Finally, section 7 concludes the paper.

[5] Though the theoretical literature has stressed the need to understand local variation in institutions and political power within constant *de jure* institutional settings, it has been a problem for applied work to adequately measure and identify such channels (see, for example, Acemoglu and Robinson, 2006, and Bruhn and Gallego, 2006, p.17).

2. The Sugar-Cane and Gold Cycles in Brazilian Colonial History

Brazil has a heterogeneous territory and its various regions have quite distinct colonial histories. The impact of the colonial past on current characteristics depends therefore on the possibilities that geographic location and natural resources offered to the economic interests of the metropolis, and on the type of colonial institutions that were implemented at the local level.

Between 1500 and 1822, Brazil was a colony of Portugal. Through most of the colonial period, Portuguese rule was characterized by the establishment of successive waves of assumedly extractive endeavors, varying in form and institutional characteristic according to the goods being demanded in Europe and to the production possibilities offered by the colony. In the first years of colonization, the main economic activity was the extraction of "pau-brasil," a type of wood that was obtained primarily through barter and exchange with the native population. When Portugal finally decided to occupy and systematically explore Brazil (circa 1530), a system of 'Hereditary Captaincies' was established, dividing the colony into fifteen equally spaced latitudinal stretches of land, each under the rule of an appointed 'captain' (HGCB, 1968). Though the system of Hereditary Captaincies was short-lived, it marked the beginning of the systematic exploitation of Brazil as an effective source of economic rent. Following, a sequence of 'colonial cycles' was inaugurated, involving at different historical moments and locations the production of various commodities, such as sugar-cane, gold, rubber, tobacco, cocoa, cotton, and coffee, among others.

During the first centuries of colonization, proximity to Portugal was an extremely important characteristic. For this reason, and also because of its climatic features, the Northeast was the area first occupied by the metropolis, and throughout the colonial period it had its economic destiny closely linked to decisions coming directly from Portugal. The Southern part of the country did not suffer such direct and constant intervention, and its history was connected to the activities developed by settlers, at the margin of the colonial enterprises supported by the metropolis. Overall, the costs and difficulties related to trade with Portugal constituted an important determinant of the variation in the degree of intervention suffered by each area of the colony. Wheling (1994, p.302, translated by the authors), for example, claims that

> "The physical distance between Lisbon, the main centre of political and administrative decisions, and the coastal cities of Brazil, and from these coastal cities to the countryside, turned into months or years the timing

> of decisions (...). It imposed, therefore, an 'administrative time' that delayed decisions and limited the efficacy of the government apparatus."

In general, the goods that constituted valuable commodities for the Portuguese were determined by European demand. Local climatic and geographic conditions, together with distance to Portugal, determined the viability and location of the different potential activities in the Brazilian territory. Contrary to parts of the Spanish America, there were no complex societies or densely populated areas in Brazil prior to the arrival of the Portuguese. Therefore, there was very little impact of previously existing social arrangements or labor supply on decisions regarding location of production. In this sense, both the activities being developed and their location in the Brazilian territory can be understood as shocks to the economic and political history of the country. If the local institutional setting associated with the rent-seeking activities established by the metropolis persisted through time, in principle it would be possible to capture its long-term effects still today.

In this sense, among the extractive activities developed by Portugal, two deserve particular attention: sugar-cane plantations and gold mining (see, for example, Simonsen, 1937). Even though the idea of colonial cycles implies inevitably some degree of oversimplification, there were periods when these activities were clearly dominant in terms of concentration of efforts of the metropolis. We choose to focus our analysis on these two episodes for three reasons: they are typically regarded as the most important ones, both in terms of economic relevance and area of influence; they were characterized by an essentially extractive socioeconomic organization and an openly rent-seeking logic; and they marked the initial occupation of important areas of the country. These constitute the historical episodes that we analyze in order to try to identify the long-term determinants of local institutions.[6]

During their most prosperous periods, both sugar-cane and gold mobilized the attention of Portugal, marking the initial occupation of, respectively, the Brazilian Northeast and Center-South. The metropolis committed its physical resources, labor, and institutional apparatus in a coordinated way in order to maximize rent extraction. Once these rents started to dwindle, even though the activity itself persisted existing, the mobilization of attention and resources was

[6] Coffee is commonly considered the third most important colonial cycle in Brazil. We choose not to analyze the coffee experience for a series of reasons. First, the coffee expansion takes place at a much later stage (19th century) and over an area already previously occupied. Second, the expansion extends well after Brazilian independence. And third, the organization of production follows more closely an entrepreneurial logic, and not a rent-seeking one. So the coffee cycle does not qualify as the initial institutional shock that we want to capture with the sugar-cane and gold episodes.

dismantled, and a new rent-seeking opportunity was sought. For example, when sugar-cane started loosing its relevance as the most dynamic economic activity and gold mines were discovered in the central part of Brazil, the capital of the colony was shifted from Salvador to Rio de Janeiro (from the Northeast to the Southeast, in 1763). The idea of cycles, therefore, relates more to the prominence of the activity within the enterprises being conducted by the metropolis, rather than to the mere existence and magnitude of the activity itself.

The extractive nature of these colonial cycles is unquestionable.[7] Occupation of the Brazilian territory, up until the early 19th century, was driven by the extractive interests of the metropolis and conducted by settlers who were entirely engaged in the rent-seeking activity itself.[8] Reports abound about the lack of supply of basic types of food and other goods in the areas involved in both the sugar-cane and gold cycles. In the case of sugar-cane, the extensive use of plantations exclusively for sugar production led to very limited supply of any type of crop and also limited cattle. In the case of gold, locations surrounding the mining areas were entirely unprepared to receive the number of people that arrived, most single-mindedly after precious metals (HGCB, 1968 and Simonsen, 1937).

Nevertheless, despite the similarities between the sugar-cane and gold cycles, each has its own characteristics and possibly distinct implications for institutional development. Following, we discuss in further detail the social, political and economic structures associated with the sugar-cane and gold cycles, and briefly suggest the consequences that they may have had for the long-run institutional development of the affected areas.

2.1 The Sugar-Cane Cycle

The initial phase of Brazilian colonization took place mainly along the Northeastern coast. Climatic factors and characteristics of the soil made the region particularly adequate for the cultivation of sugar-cane, and proximity to Portugal made it viable as a source of exports to Europe (see Figure 3 for a map of Brazilian states and the position of the country in relation to

[7] For example, it was forbidden to make public any information on Portuguese trade and profits. In fact, the crown ordered the apprehension and destruction of publications dealing with the sugar business in the colony (see Simonsen, 1937, p.112). Also, certain coastal areas of the Northeast were exclusively reserved for sugar-cane production, being forbidden the development of any other agricultural activity.

[8] Portuguese settlers had such a short-term view of their stay in the colony that, up until the 18th century, it was common for men to go to Brazil leaving their wives in Portugal. During this period, the number of white women in the colony was extremely scarce (Russel-Wood, 1977 and Wehling, 1994). In relation to the sugar industry, Father Manuel da Nóbrega wrote in the 16th century that "this people of Brazil pay attention to nothing but their 'engenhos' [sugar-mills] and wealth even though it be with the perdition of all their souls" (quoted in Schwartz, 1987, p.89).

Portugal). This conjunction of factors turned the period of sugar-cane expansion into the most important economic cycle of colonial times (Fausto, 2006, Schwartz, 1987 and Wehling, 1994).[9]

Until the 17th century, Brazil was the main world producer of sugar (Prado Jr., 1976). In the Northeast, sugar-cane was cultivated all along the stretch of land from the current state of Rio Grande do Norte down to the intermediary latitudes of the state of Bahia ("Recôncavo Bahiano"). The main centers were the areas that correspond today to the states of Bahia and Pernambuco, but even less tropical states such as Espírito Santo and Rio de Janeiro were at certain points involved in production (though mostly in much smaller scales and for the production of "aguardente," the alcoholic beverage derived from sugar-cane and used in exchange for slaves in Africa; see Fausto, 2006). According to Simonsen (1937, p.112), there were roughly 120 sugar-mills in Brazil in 1600: 66 in Pernambuco, 36 in Bahia, and 18 in all other captaincies together.

The cultivation and processing of sugar-cane were extremely important activities throughout Brazilian history. They went through various periods of expansion and contraction, but in reality sugar was always among the main exports during colonial times, so the idea of a cycle is not self-evident. Nevertheless, it is possible to clearly identify periods of great prosperity and of serious crises, and, most importantly, periods over which the efforts of the metropolis were geared almost entirely toward exploitation of rents from sugar. Following Simonsen (1937), we identify the sugar cycle as the period from the beginning of the effective colonization of Brazil until 1760. This includes the so-called 'century of sugar,' the period ranging from 1570 to 1670, which was the height of production and profits in the sugar business. From 1650 on, the value exported started to fall and, by mid 18th century, it was only 60% of what it had been at the height of the cycle (Simonsen, 1937). In this sense, there was a clear movement of expansion, peak, and decline of sugar as the main rent-seeking activity sought by the metropolis between 1530 and 1760.

The economy of the sugar was based on the plantation system, built over three essential elements: the "latifundio" (a large estate of land with a single owner), the monoculture, and slave labor. Sugar-cane brought the large rural estate and the patriarchal and slavery-based society not only to Brazil, but to the entire colonial America, implying an institutional and economic

[9] One could presume that location of the sugar cycle in the Brazilian Northeast was determined exclusively by geographic conditions particularly adequate for sugar-cane cropping. But, in fact, proximity to Portugal played a key role. For example, Brazil remains today the top world producer of sugar, with 18.5% of the 2005 production, but 61% of the current production of the country is located in the Southeastern state of São Paulo. The sugar production of São Paulo today is comparable to that of India, the second largest world producer (data from the Brazilian Census Bureau and the United States Department of Agriculture).

transformation that has sometimes been termed the 'sugar revolution' (see Higman, 2000). Sugar-mills were enterprises that demanded a large amount of resources to be initiated at a productive scale. Therefore, land was given to individuals that had enough funds to make the most of the land in its sugar-producing potential. African slavery, then, appeared as the only possible way to extract rent in a context where the supply of land for subsistence was extremely large (Reis, 2005).[10] The combination of these three factors appeared, from the perspective of the metropolis, as the only feasible way to explore the potential rents from sugar-cane production and processing. According to Simonsen (1937, p.126, translated by the authors):

> "The use of this 'institution' appeared, then, as an unavoidable economic imposition: industrial enterprises, the construction of mills, and expensive colonial expeditions would be allowed only if the corresponding labor supply was guaranteed in quantity and flow. And, at those times and latitudes, only slave labor could give such guarantee."

A typical sugar-mill would have between 60 and 100 slaves. A particularly large one could have more than 200 slaves. In the 18th century, slaves represented more than half of the population in the Northeastern captaincies, and between 65% and 70% in the plantation areas. In the other extreme of the social pyramid, the "senhores de engenho" (literally, sugar-mill lords, usually translated as 'planters') constituted the local landed aristocracy, invariably white and concentrating a wide range of social, economic, and political powers (Schwartz, 1987).

Even though in most cases there was no actual ownership of land, and therefore no formal hereditary transmission of estate (Schwartz, 1987, p.88), possession of sugar-mills and plantations and the position of "senhor de engenho" gave enormous social prestige: "(…) the 'senhor de engenho' is a title aspired by many because it brings with it being served and respected by many. And (…) the esteem given to the landlord in Brazil is proportionate to the esteem given to noblemen in the court" (Father Antonil in 1711, quoted in Simonsen, 1937, p.105; translated by the authors).

In reality, the local power of the sugar-mill lords remains in strong contrast to the weak access that they had to royal power. As metropolis, Portugal restricted its control over sugar related activities to rules and devices targeting, essentially, the constancy of the flow of rents and the preservation of supremacy over the areas of interest (Schwartz, 1987 and Wehling, 1994).

[10] In 1729, Governor Luís Vahia Monteiro wrote that "The most solid properties in Brazil are slaves, and a man's wealth is measured by having more or fewer (…), for there are lands enough, but only he who has slaves can be master of them" (quoted by Schwartz, 1987, p.81).

The political and institutional landscape of the time makes clear the rent-seeking nature of the activity sustaining that entire society. Several reports call attention to the contrast between the frequent and recurrent demands for tax exemptions or debt bailouts of planters, and their extreme opulence and wealth. In the state of Pernambuco during the 17th century, for example, about 80% of government revenues came from a series of different taxes raised over sugar production and trade, which was the only agricultural activity allowed in some areas of the coast during certain historical periods (Schwartz, 1987, p.98).

The polarization between landlord and slave, and the dominance of the plantation system targeted at exports to Europe, constitute the foundations of the social, economic, and political structures associated with sugar production. Following closely the idea of extractive occupation discussed by Engerman and Sokoloff (1997), this particular universe within Brazil had all the elements comprising poor institutional foundations: extreme social inequality, very small economic and political elites with concentrated powers, and establishment of legal and tax systems shaped almost exclusively around extractive goals.

2.2 The Gold Cycle

The gold led mining expansion in the central part of Brazil was extremely intense and concentrated in time. In 1695, explorers made the first significant discoveries of gold in the areas of Sabará and Caeté, in a region corresponding to the current state of Minas Gerais. Following, successive quarries were found in the same region and, after 1720 and 1726, also in areas corresponding to the current states of Mato Grosso and Goiás (Fausto, 2006). In 1728, the first diamond quarries were found, and the height of Brazilian production soon followed in 1760. After that, production started to decline and lost most of its relevance already by the end of the 18th century (Simonsen, 1937).

Despite its brief lifetime, the gold cycle left permanent imprints on the economy and demography of the colony, on the colony-metropolis relationship, and on world markets. From 1700 to 1770, Brazilian gold production corresponded to the entire production of the rest of the Americas between 1492 and 1850, and to roughly 50% of the production of the rest of the world between the 16th and 18th centuries (Simonsen, 1937, p.258).

The news of the discoveries generated a ‘gold-rush’ that led to an unprecedented occupation of the central part of the country. After the first 25 years of the cycle, the Center-South region, which was mostly uninhabited prior to that, already concentrated 50% of the colonial population (Fausto, 2006). The Portuguese crown became seriously concerned with the depopulation of the metropolis, even resorting to legal restrictions in order to limit emigration to

Brazil (Porto, 1967, p.70 and Costa, 1982a). The collapse of the mining economy was similarly fast, highlighting its essentially rent-seeking nature. Despite the formation of urban centers and development of auxiliary activities surrounding the mining areas, other economic initiatives were unable to take-off as independent and profitable enterprises. So, Ouro Preto, the main urban center of the region, went from 20 thousand inhabitants in 1740 to just 7 thousand in 1804. By then, gold production in Brazil had already declined to only 12% of its peak value (Fausto, 2006 and Simonsen, 1937).

In the colony, the main concern of the Portuguese crown was to keep the mining areas under as much control and scrutiny as possible. A series of regulations related to exploration of precious metals, movement of goods and people, and taxation was put in place in order to guarantee to Portugal an amount of rent deemed adequate, given the sudden wealth of the colony. In certain regions during specific periods of time, passports were required for people to be allowed to enter or leave mining areas, but this regulation proved unenforceable and soon was dropped (Boxer, 2000).

At least twelve distinct tax systems were adopted at different moments in time, but two were the most common ones: the fifth (or "quinto"), which established that 20% of all the gold produced in the colony belonged to the crown; and the capitation (or "capitação"), which charged a fixed fee by slave owned (above the age of 12). Gold was considered a monopoly of the Portuguese crown, and exploration depended on access to mining plots. Usually, individuals responsible for the discovery of new quarries had priority in the selection of a fraction of the relevant area, and the remainder was allocated to other candidates through auctions and lotteries, with the size varying according to the number of slaves owned. After the initial allocation, miners were free to sell or trade their plots (Boxer, 2000, p.75, and Reis, 2005).

Individuals were not allowed to circulate with gold in the form of powder. Processing of raw gold and its transformation into bars was used as a tool to enforce taxation, and therefore was also under tight control of the metropolis. For the most part, gold bars could only circulate with the seal of the Portuguese crown, meaning that the raw gold would have been melted in an official establishment ("Casa de Fundição") and due taxes would have been automatically paid.

Nevertheless, despite continuous efforts of Portugal, frauds were constant. The environment created in the mining regions was that of a constant race between individuals and state. As miners tried to evade the grasping hand of the Portuguese crown, the metropolis created more and increasingly oppressive devices to regulate and control production even further. The natural development of this process was the creation of a very heavy and ineffective state

apparatus, and the emergence of an extremely antagonistic environment between state and civil-society.[11] The height of this tension was materialized in the "derrama," an additional tax raised when the aggregate amount of gold collected by the crown as one-fifth of total production did not reach a certain pre-established goal.[12] The "derrama" was raised from the entire population as a tax on virtually any type of activity (trade, ownership of business or slaves, use of public roads, etc.) and also as a tax on wealth, based on more or less arbitrary assessments of personal assets. Tax collection when the "derrama" was actually installed, which might last for several months, made extensive use of the army and involved prisons, apprehension of personal assets and durable goods, and raids into private households (Prado Jr., 1976).

Still, the mining areas were also peculiar in other important ways. Despite the widespread use of slaves, society was not as polarized as that of the sugar-cane. Technology and the scale of production implied a certain degree of horizontality in the social organization of the gold economy. According to Simonsen (1937, p.291, translated by the authors):

> "The miner needed courage, some tools, and a handful of slaves. (…) While the sugar lord needed vast resources to start his business, the alluvium miner could be a man of little wealth. Despite the fact that slave labor was used as the main source of manpower, it is undeniable that a much more intense 'division of labor' developed in the mining areas than could be supported by the social organization in the sugar-cane areas of the Brazilian Northeast."

Furtado (1991, p.74, translated by the authors) highlights the almost technological nature of this social organization: "(...) the mining economy in Brazil opened possibilities to people with limited resources, since exploration was not based on large and deep mines – as in the case of silver in Peru and Mexico – but on alluvium metal deposited in the bottom of rivers."

[11] The antagonistic environment between society and state in the mining areas is illustrated by a series of anecdotal tales from colonial Brazil. The most celebrated independence movement before 1822 was the "Inconfidência Mineira," a movement organized by the local elites in 1789 in the state of Minas Gerais, and planned to burst out on a day scheduled for tax collection. The movement was frustrated by the early warnings of a traitor (rewarded with the cancellation of his debts to the crown). The efforts to smuggle gold out of the mining areas involved entire local communities. For example, a figure that became entrenched in Brazilian popular culture is that of the 'hollow-saints' ("santos do pau-oco"), hollow wooden images of catholic saints. These images were used by the various religious orders active in the area to smuggle powder gold out of the colony. In reality, because of the widespread use of 'hollow-saints,' in 1711 the Portuguese crown forbid the entrance of priests without explicit authorization and the establishment of religious orders in the state of Minas Gerais (Boxer, 2000, p.76; for a general description of the relation between the miners and the Portuguese state, see Costa, 1982b).

[12] The use of the "derrama" became more common with the decline in gold production. The minimum amount required for taxes raised as one-fifth of production corresponded to roughly 1.5 tons of gold.

The actual work performed by slaves was considered more intense and harsher than that performed in the plantations, but the relation between slave and slave-owner was essentially different. First, as mentioned before, slave-owners themselves were of a different kind, but also slaves enjoyed some degree of bargaining power within the relationship. The extent of bad treatment was limited by a series of informational advantages that slaves enjoyed, derived from the close contact between slave and slave-owner and from the very nature of the production technology. Slaves could always denounce their owners for tax frauds, which were a widespread problem for the Portuguese authorities. In reality, even though rarely used, the Portuguese crown instituted a legislation according to which slaves could gain freedom by denouncing tax evasion (Reis, 2005). Such accusations could bring serious problems to miners even when unfounded (Costa, 1982a). In addition, production itself implied a huge degree of informational asymmetry between slaves and slave-owners or supervisors. Slaves could always steal or hide whatever they found, and miners depended on their willingness to report discoveries in order for the enterprise to be profitable (Reis, 2005).

The unusual relationship between slave and slave-owner led to the formation of a very particular social structure during the gold cycle. It became relatively common for slaves to buy their own freedom. Initially, this was achieved through the use of stolen gold, but soon the work system evolved into an incentive compatible set of rules, where slaves could work on their own for part of the time, paying a fixed fraction of whatever they found to owners. The fraction of freed slaves among the population of African descent, which amounted to only 1.4% between 1735 and 1749, increased to 41% by 1786 (34% of the total population; Russell-Wood, 1977).

The gold-cycle, therefore, was associated with the development of a relatively horizontal society. Nevertheless, the emergence of this society was intrinsically connected to a rent-seeking activity and took place under the overreaching and bureaucratically oppressive centralization of the Portuguese state.

2.3 Long-Run Implications of Colonial Cycles

By setting the initial conditions in terms of distribution of economic and political power, and effectiveness of the machine of government and of the legal system, these rent-seeking episodes of colonial times created the environment from which the institutional history of the affected areas evolved. Given the tendency towards persistency of institutions discussed in both the empirical and theoretical literature (Acemoglu, Johnson, and Robinson, 2001 and 2002, and Acemoglu and Robinson, 2001, for example), these initial conditions may have had effects that can be still perceived today.

In this respect, despite their similarities, there are important distinguishing features when we compare the sugar-cane and gold cycles. In the sugar-cane cycle, production technologies led to an extremely polarized society, with economic and political power concentrated in the hands of local leaders who suffered very little interference from any type of central power, and were subject to almost no constraint from external sources (Reis, 2005). The figure of these local leaders appeared throughout Latin America as syntheses of the political landscape created by the agricultural society of colonial times. Their heirs survived well into the 20th century, in the figures of the "Coronel" in Brazil and the "Caudillo" in Spanish America (see, for example, Schwartz, 1987).

Economic and political power was closely related to initial concentration of land and to the persistence of this concentration through time. In Brazil, the highly concentrated land distribution today has its deep roots in the colonization process (see Leal, 1997 and Assunção, 2006).[13] In the areas involved in sugar production, ownership of land meant economic power, which in turn meant actual political power. In the end, this power may have manifested itself in different forms: through the formal absence of the state in areas initially under the influence of planters; through the control of the formal political system by the main economic players; or maybe simply through the overruling of state power and *de jure* institutions by economic power and *de facto* institutions ran by local elites.

The social and political structures associated with the gold cycle were very different. Though slavery and inequality were common factors, the social structure was less rigid, and the distribution of endowments and political power across the civil population was more equal. Particularly striking was the presence of an over-controlling and bureaucratically suffocating central power. The desperate efforts of the Portuguese crown to monitor every single step of the production and trade of precious metals led to an overgrown and extremely inefficient government apparatus, involved in a constant struggle against civil society itself. Quite possibly, these were also associated with the ineffective functioning of the government in other areas, and with the development of a culture of detachment between population and state. Therefore, the implications of the gold cycle are likely to be related to the effectiveness of government and to the relation between local population and state power, which may have persisted in a political equilibrium such as the one described by Acemoglu, Ticchi, and Vindigni (2007).

[13] According to Frankema (2005), the Gini index of concentration of land in Brazil stayed always between 78 and 80 throughout the entire 20th century.

In the next section, we describe in detail our empirical strategy and the construction of the historical variables used to identify the long-term effects of the sugar-cane and gold cycles. We also discuss how the specific institutional variables used in the analysis relate to the different dimensions of institutional development discussed in this section.

3. Empirical Strategy and Data

This section presents the data used in our analysis and discusses our empirical strategy. All variables are defined at the municipality level. Complete and detailed descriptions are contained in the appendix.

3.1 Historical Variables

We study the colonial determinants of current institutions based on the fact that: (i) it is possible to identify the sugar-cane and gold cycles in time and geographic location; and (ii) distance to Portugal was an important determinant of the actual degree of intervention imposed by the metropolis.

We first identify current municipalities that are located in areas that were directly affected by the colonial cycles. In the case of sugar-cane, municipalities are identified from information contained in the historical literature and from year of foundation. Based on Simonsen (1937), we define the sugar cycle as the period ranging from the beginning of Brazilian colonization until 1760. According to Prado Jr. (1976), Simonsen (1937) and Fausto (2006), the regions affected by the cycle correspond to the coastal areas of the current states of Rio Grande do Norte, Paraíba, Pernambuco, Alagoas, Bahia and Espírito Santo, and to the region of Campos dos Goytacazes, in the state of Rio de Janeiro. Nevertheless, there is no precise information on the distribution of sugar-cane production within these states and regions during colonial times. Therefore, we use the year of foundation and location of municipalities in order to identify localities that had their origins connected to the sugar-cane cycle. Specifically, we classify a municipality as being directly affected by the sugar-cane cycle if it is located less than 200 kilometers from the coast in one of the regions enumerated above, and was founded before 1760.[14]

In the case of gold, identification of municipalities is somewhat easier. Based on historical accounts (for example, Russel-Wood, 1977, Simonsen, 1937, Boxer, 2000, and Fausto, 2006), we can determine the current states that had areas directly involved in the gold cycle (Bahia, Goiás, Mato Grosso, Minas Gerais, and Rondônia). Using the historical map presented in

[14] Qualitative results remain unchanged if we define the sugar-cane cycle as corresponding only to the period of most intense sugar activity, ranging from 1536 to 1700.

Simonsen (1937, "Caminhos Antigos, Mineração e Máxima Expansão da Capitania Paulista"), we can delimitate the precise location of the mining areas within each of these states.[15] We then define municipalities directly affected by the gold cycle as those located in these areas today.

From the above definitions, we construct two dummy variables assuming value one if a municipality was directly affected by the respective colonial cycle. Yet, the influence of these historical episodes was not restricted to municipalities directly affected by them. Sugar-cane and gold production and processing were not entirely concentrated on these locations. Similarly, the political and social structures associated with these episodes most likely had a broader geographic influence. In order to capture this continuous pattern, we define, for each municipality and each colonial cycle, the following influence function:

$$I_i = \begin{cases} \left(\frac{200 - d_i}{200}\right)^2 & \text{if } d_i \leq 200 \text{ km}, \\ 0 & \text{otherwise}, \end{cases} \qquad (1)$$

where d_i is the distance from municipality i to the closest municipality directly involved in the respective cycle.

This function gives more weight to municipalities closer to locations directly affected by the rent-seeking episodes, and decays in a quadratic fashion until it reaches zero in a 200 kilometer ray. This influence function varies between 0 and 1 according to the profile described in Figure 4. The figure also presents the profile of three alternative influence functions used in our robustness analysis. These alternative functions consider different thresholds for the same function (100 and 300 kilometers), and a discontinuous dummy variable assuming value 1 within a 50 kilometer ray. Results are not sensitive to the particular specification chosen for the influence function.

In summary, we create two variables – *sugar* and *gold* – indicating the influence of the respective cycle in each municipality (varying between 1 and 0 in a 200 kilometer ray, according to equation (1)).

Figure 4 depicts the sugar-cane influence variable in the Brazilian territory. Darker points refer to municipalities directly affected by the sugar-cane cycle. Sugar-cane influence is concentrated on the Brazilian Northeastern coast. The directly affected area comprises 39 municipalities. Considering the 200 kilometers definition, the entire influence area includes

[15] Results also remain virtually unchanged when we use all the mining areas presented in the historical map (Simonsen, 1937), including some small areas in the Southeast and North that are usually not thought to be directly associated with the historical gold cycle.

1,060 municipalities, with area of 180,000 square-kilometers and 30 million inhabitants in 2000. This area is twice the total area of Portugal. The region affected by the gold cycle is presented in Figure 5. Differently from the sugar-cane cycle, the gold influence area is concentrated inland, with the directly affected area containing 354 municipalities. The entire area of influence includes more than 1,500 municipalities, with area above 480,000 squared kilometers and 34 million inhabitants in 2000.

In addition to the indices of influence of the sugar-cane and gold cycles, we use distance to Portugal to incorporate the active interference of the metropolis during the colonial period. As stressed in the historical discussion, distance to Lisbon imposed important administrative costs that ultimately affected the efficacy of the institutional apparatus of rent extraction.[16] We define distance to Portugal (*dist to Portugal*) as the Euclidian distance between each municipality and Lisbon (38º42'N, 9ºW). Our ideal measure of distance would include transportation costs or time by sea and land during colonial times, but this type of information is simply impossible to obtain for the vast majority of Brazilian municipalities. Despite the fact that our measure may not be ideal, we believe that it is highly correlated with travel distance, even more so because our geographic controls will also include distance to the coast and to the equator.

Our main interest in relation to distance to Portugal rests on the way it affected the intervention of the metropolis during the rent-seeking episodes. For this reason, we consider the interaction between distance to Portugal and the sugar-cane and gold influence functions. We hope that this interaction will capture variation in the degree of control exercised by the metropolis within each cycle (*sugar x dist to Portugal* and *gold x dist to Portugal*).[17]

We thus have five historical variables that can be used to understand the long-term determinants of variations in local institutions: *sugar*, *gold*, *dist to Portugal*, *sugar x dist to Portugal*, and *gold x dist to Portugal*.

3.2 Institutional Variables

The sugar-cane and gold colonial cycles may have affected distinct dimensions of the institutional framework. In order to account for the various potential long-run implications, we consider four indicators of current institutional development.

[16] Freyer and Sacerdote (2006) report a negative influence of the intensity of Portuguese colonization, though the result is associated with the experiences of St. Helena Island (Atlantic) and Huvadu Island (Maldives).

[17] Distance to Portugal may also affect outcomes today because it indicates distance to Europe, and therefore access to international markets. But this direct effect of distance to Europe on development should be negative, since it indicates less access to international trade. Our historical interpretation of this variable generates an effect in the opposite direction, since areas further away from Portugal would be under less strict influence of the metropolis and, therefore, potentially better-off today. The effect of access to international markets will bias the coefficient on the variables related to distance from Portugal against the hypothesis that we want to test.

The first two institutional variables capture the distribution of resources and political power within municipalities. As pointed out by Acemoglu, Johnson and Robinson (2005), even if not directly allocated to formal political institutions, individuals may exert political power. In this sense, the concentration of economic resources in the hands of an elite acts as a source of *de facto* political power. Thus, an environment of high concentration of economic power may determine poor *de facto* political institutions irrespectively of the formalities of the *de jure* institutional setting.

First, we look for a measure of inequality in the distribution of endowments as affecting initial distribution of economic power. We use the Gini coefficient of distribution of land, since agriculture played a key historical role in shaping political forces in Brazil. Ideally, we would like a measure of concentration of land at some historical point in time, but this type of information is not available at the municipality level. In addition, land concentration today is thought to be representative of the historical past, given that its genesis dates back to the colonial period (see Leal, 1997, Frankema, 2005, and Assunção, 2006). So we use the Gini coefficient of distribution of land, computed for each municipality based on the 1996 Brazilian Agricultural Census (*land Gini*).

The second measure of political power is related to the degree of competitiveness in the local political process. It is possible that elites control elections even under a seemingly democratic environment. For this reason, we consider the persistence of political power at the local level as an indicator of the irrelevance of *de jure* political institutions as mechanisms to promote political competition. Our index (*political persistence*) is a discrete variable between 0 and 2 indicating whether the same family won the mayoral elections more than once across the 1996, 2000, and 2004 elections (data from the Brazilian Superior Electoral Court, or "Tribunal Superior Eleitoral").[18] It is important to mention that electoral rules in Brazil are strictly the same for the entire country. Therefore, a high persistence in local executive power may indicate that

[18] The discrete variable is constructed based on at least one common surname across elected mayors. It equals 0 when there is no repetition of family in power (26% of the sample), 1 when the same family won two elections (69% of the sample), and 2 when the same family won three elections (5% of the sample). The number of municipalities in Brazil changes substantially prior to 1996, so we do not look at results of previous elections. We use a measure of political persistence based on families because political parties have not been particularly stable institutions in Brazil, in part because the country returned to democracy only in 1985. So it is common for politicians to change parties, for new parties to be created, and for old parties to be extinguished or renamed. For example, from the 513 congressmen elected in 2002, 193 (or 38%) changed parties before the end of the legislative term in 2006 (Revista Veja, 2007). In any case, we also experimented with several alternative indicators of persistence and concentration of political power based on parties, with very poor results (same party wining mayoral elections, Herfindahl index of concentration of votes for – or seats in – the local legislature, fraction of seats in local legislature held by the mayor's party, and difference in the fraction of votes between the mayor and the runner up, among others). In the case of Brazil, this is a problem intrinsic to any measure of political concentration or persistence based on parties.

political institutions at the local level are controlled by a specific group, reflecting concentration of *de facto* political power even within a competitive *de jure* institutional setting.

The second set of variables includes indices of quality of local administration and penetration of the rule of law. The first variable captures the efficiency of the local executive in terms of administrative capacity, as reflecting its ability to provide public goods and its potential responsiveness to demands of the local population. We use an index of governance practices calculated by the Brazilian Census Bureau (IBGE) and used by the Ministry of Planning as a tool to monitor the administrative performance of municipalities. The index has various components representing different aspects of administrative capabilities at the municipality level, from efficiency in tax collection and information gathering, to adoption of administrative and planning instruments.[19] It is constructed as the simple average of four qualitative indicators, normalized from 1 to 6: the year in which the database of the tax on urban property ("IPTU") was updated, the IPTU payment rate, the number of administrative instruments,[20] and the number of planning instruments.[21] The index (*governance*) is calculated using data between 1997 and 2000.

The last institutional variable measures the penetration of the rule of law at the local level. Formally, there is no municipal judicial system in Brazil. Any court or justice commission in a municipality is either related to the local executive or to the state judicial system. Nevertheless, it is not clear why some municipalities provide different access to justice even if located in the same state and even when certain types of courts are mandatory. For this reason, the existence of courts at the local level represents a *de facto* dimension of the rule of law and of provision of access to justice. In order to capture this notion, we use an index based on the definition of access to justice proposed by the Brazilian Census Bureau (IBGE, 2001). The index (*access to justice*) varies from 0 to 3 according to the existence of courts or justice commissions. It is calculated with data from 2001, as the sum of three binary variables indicating the existence

[19] A complete description of the methodology used to compute the index can be found in IBGE (2001). Some of the components of this index seem better than others for our purposes. Nevertheless, in order to adopt an agnostic approach and trust entirely on an indicator whose conception is exogenous to this study, we focus on the index created by the Brazilian Census Bureau. The same comment applies to the index of access to justice that will be introduced later on. In section 5, we replicate our main exercises for each component of these indices separately.

[20] Computed as the average of binary variables indicating the existence of: (i) City Administrative Districts, (ii) Sub-municipal Administrative Centers, (iii) Urban Plan ("Plano Diretor"), (iv) Law of Soil Use and Division ("Lei de Parcelamento do Solo" or equivalent), (v) Zoning Law ("Lei de Zoneamento" or equivalent), (vi) Building Code ("Código de Obras"), and (vii) Code of Administrative Conduct ("Código de Posturas").

[21] Computed as the average of binary variables indicating the existence of: (i) administrative plan ("Plano de Governo"), (ii) strategic plan ("Plano Estratégico") and (iii) municipal organic law ("Lei Orgânica").

of Small Claims Courts ("Tribunal de Pequenas Causas"), Youth Councils ("Conselho Tutelar"), and Consumer Commissions ("Comissão de Defesa do Consumidor").[22]

Our four measures of institutional quality – *land Gini*, *political persistence*, *governance*, and *access to justice* – cover different aspects of the *de facto* institutional environment in Brazilian municipalities. In addition to identifying this dimension of institutional variation in a way that is not possible in cross-country comparisons, these variables are also more concrete measures of institutional quality than those typically seen in the empirical literature (see the Appendix for detailed definitions and sources).

3.3 Other Variables

Additional variables used in our empirical analysis are briefly enumerated in this section (a detailed description of these variables and their sources is contained in the appendix).

We use, for various purposes, the following variables constructed from the 2000 census files: *income per capita*, *years of schooling* (average for the population aged 25 and above), *illiteracy rate*, and *population*. From the Brazilian Census Bureau, we obtain data on *area*, *age* (year of foundation), and coordinates of each municipality.

Our set of geographic variables, obtained from various different sources, is given by: *distance to equator* (absolute value of the latitude), *distance to coast*, *rainfall*, *sunshine*, *altitude*, *temperatures* (12 monthly averages), and *soils* (12 dummy variables for the types of soil present in a 0.1 degree ray around the municipality's official center).

We also make use of indicators of local provision of public goods, obtained from the 2000 National System of Urban Indicators, from the Brazilian Ministry of Cities. These are: percentage of households with toilet connected to the public sewage system, number of health centers per 10,000 inhabitants, natural logarithm of per capita municipal spending on education and culture, a dummy variable indicating whether the municipality has at least one public library, and a dummy variable indicating whether the municipality has at least one local radio station.

In order to illustrate the degree of detail of our geographic controls, Table 1 presents a series of descriptive results, already referred to in the introduction, related to the pattern of development within Brazil. In the first five columns, we regress income per capita (ln) and our

[22] Small Claims Courts deal with civil cases with relatively low complexity and involving small amounts of money. These special courts aim at determining the rights of the litigants based on merits and avoiding the high costs and long waiting time of the traditional justice system. Youth Councils were designed to promote human development and protect the rights of young people. Even though they are not directly related to the issues discussed in the paper, they reveal an interesting dimension of variation in *de facto* institutions: in 2000, despite being mandatory according to the constitution, they were present in only 68 percent of the municipalities. Consumer Commissions comprise different institutions of protection of consumer rights, with actions covering a wide range of topics including product liability, fraud, misrepresentation, and other consumer-business interactions.

four measures of institutional quality on the complete set of geographic variables. The geographic pattern of economic and institutional development within Brazil is clear: distance to the equator, rainfall, sunshine, average temperatures, and types of soil are all significantly related to both economic and institutional development. Geography alone explains 65, 30, and 20 percent of the variation in, respectively, *ln income per capita*, *governance*, and *land Gini*. In the last column, we add the institutional variables as additional controls in a regression where income per capita is the dependent variable. Municipalities with better governance, more access to justice, lower land Gini's, and lower political persistence have typically higher income per capita. The inclusion of the institutional variables increases substantially the explanatory power of the regression, despite the already high R^2 registered in column 1 (the fraction of the variation explained by the model increases to 74%). Nevertheless, endogeneity between institutional and economic development prevents any causal interpretation of these results.

Finally, Table 2 presents some descriptive statistics for the areas affected by the sugar-cane and gold cycles, and also for the rest of the country. Not surprisingly, the sugar-cane area, which is located in one of poorest areas of Brazil, is on average less developed than the rest of country. Maybe more surprising is the fact that the area directly affected by the gold cycle summarizes extremely well the average level of development observed in Brazil as a whole.

3.4 Empirical Strategy

We investigate the long-run determinants of institutions, analyzing whether the historical episodes from the colonial period explain current variation in local institutions. We estimate the following specification:

$$Z_i = \alpha + \gamma^S S_i + \gamma^{SP} S_i P_i + \gamma^G G_i + \gamma^{GP} G_i P_i + \gamma^P P_i + \beta' \mathbf{X}_i + \varepsilon_i, \qquad (2)$$

where *i* indicates municipality, Z_i is a current institutional indicator (*governance*, *access to justice*, *land Gini* or *political persistence*), S_i is the sugar-cane cycle variable, G_i is the gold cycle variable, P_i is distance to Portugal, $\mathbf{X}_i$ is a vector of geographic attributes (*distance to equator*, *distance to coast*, *rainfall*, *sunshine*, *altitude*, *temperature* and *soils*), and ε_i is an error term. The vector of geographic attributes ($\mathbf{X}_i$) plays an important role in our analysis. Table 1 shows that there is a significant correlation between institutions and geography in our sample. When compared to cross-country analyses, municipality-level data allow us to better account for the role of geographic characteristics. Typically, there is much less geographic variation within municipalities than within countries.

The parameters γ^S and γ^{SP}, under the usual conditions, reflect the effect of the sugar-cane cycle on the institutional indicator. Straightforward manipulation of (2) leads to:

$$E(Z \mid S=1,P,G,\mathbf{X}) - E(Z \mid S=0,P,G,\mathbf{X}) = \gamma^S + \gamma^{SP} P\,. \quad (3)$$

In the cases where higher values of Z are associated with better institutions, $\gamma^S < 0$ indicates that the sugar-cane cycle had a negative influence on current institutions. The parameter γ^{SP} captures how this effect is affected by distance to Portugal. For example, the situation where $\gamma^S < 0$ and $\gamma^{SP} > 0$ indicates that the sugar-cane cycle had a negative effect on institutions, and that this effect was particularly intense for municipalities closer to Portugal.

Similarly, the parameters γ^G and γ^{GP} indicate the effect of the gold-cycle on current institutions. Equation (2) also leads to:

$$E(Z \mid S,P,G=1,\mathbf{X}) - E(Z \mid S,P,G=0,\mathbf{X}) = \gamma^G + \gamma^{GP} P\,. \quad (4)$$

Given the characterization above, we also evaluate whether income per capita is affected by the colonial origins of current institutions. Our strategy relies on an instrumental variables approach, where the sugar-cane and gold cycles, along with distance to Portugal, are used as sources of variation in current institutional quality. The first-stage specification is given by equation (2), while the second-stage regression is the following (we also show results where distance to Portugal is not treated as an instrument, given the concerns expressed in footnote 17):

$$Y_i = \mu + \gamma \mathbf{Z}_i + \delta' \mathbf{X}_i + \nu_i\,, \quad (5)$$

where Y_i is income per capita (ln) in municipality i, $\mathbf{Z}_i$ is a vector of institutional indicators (*governance*, *access to justice*, *land Gini* or *political persistence*), $\mathbf{X}_i$ is a vector of geographic attributes (*distance to equator*, *distance to coast*, *rainfall*, *sunshine*, *altitude*, *temperature* and *soils*), and ν_i is an error term. We postpone the discussion on the limitations of this instrumental variables approach to Section 5.

4. Colonial Cycles and Current Institutions

4.1 Main Results

Table 3 presents the results on the long-term effects of colonial cycles on *land Gini*, *political persistence*, *governance* and *access to justice*. In order to reveal the raw pattern of correlation in the data, the first four columns present regressions for each dependent variable where only the cycle influence variables (*sugar* and *gold*) are included in the right-hand side.

The last four columns present our baseline specification discussed above, including as independent variables the influence of the sugar-cane and gold cycles, distance to Portugal, interactions between each cycle influence and distance to Portugal, and the whole set of geographic controls.

Columns 1 to 4 show that municipalities historically associated with the sugar-cane cycle have, on average, higher concentration of land, higher political persistence, worse governance practices, and less access to justice. Results are similar for municipalities affected by the gold cycle, but for the fact that they seem to be associated with less political persistence (though not very strongly, with the coefficient significant only at the 10% level).

These initial results reflect the simple comparison between municipalities with origins in the colonial cycles and other municipalities in the country. However, municipalities with origins in the colonial cycles also have particular geographic characteristics, which are correlated with the occurrence of the cycles itself. In addition, this simple specification does not capture differences within each cycle, due to distinct degrees of influence of the metropolis. In order to take that into account, columns 5 to 8 depict the full specification presented in equation 2. Thus, taking in to account the geographic characteristics of the different areas of the country, we investigate the relevance of each cycle and test whether the outcome is affected by the degree of intervention of the metropolis. Municipalities within each cycle are not only compared to those outside the influence area, but also to those within the cycle but at different distances from Portugal.

In the complete specification, the *land Gini* increases with the influence of the sugar-cane cycle, and particularly so for areas closer to Portugal (column 5 in Table 3). The effects of the sugar-cane and gold cycles on *political persistence,* on the other hand, are not significant.

The results for *governance* and *access to justice* follow a very different pattern (columns 7 and 8 in Table 3). The influence of the gold cycle is systematically associated with worse quality of the local administration and less access to justice. And, as in the case of sugar-cane in relation to concentration of land, the effect of the gold cycle is stronger for municipalities closer to Portugal. In the case of *access to justice*, distance to Portugal is also positive and statistically significant without the interaction with the gold cycle variable.[23]

[23] Qualitative results remain identical when we estimate the models allowing for censoring of the dependent variables (tobit), to account for the way the indexes are constructed. Also, as mentioned before, results related to *political persistence* remain insignificant when we use alternative indicators of political concentration or persistence based on parties (see footnote 18).

Overall, our main specification paints a picture remarkably consistent with the historical discussion from Section 2. Areas associated with the sugar-cane cycle display higher concentration of land, which can be related to higher concentration of economic power in a historical perspective. This result can be thought of as a long-term consequence of the polarized society created by the plantation system, with its large rural properties and extensive use of slave labor. Areas historically associated with the gold cycle, on their turn, are particularly distinct today in terms of the poor quality of their governments. These areas are characterized by inefficient governments and lack of provision of access to justice. Again, both these dimensions can be understood as heritages from the inefficiently oppressive and over-bureaucratic state apparatus created by the Portuguese crown during the mining period. Finally, it is also true that the negative consequences of the sugar-cane and gold cycles seem to have been particularly relevant for municipalities that were geographically closer to Portugal, and therefore were more subject to direct interference of the metropolis. In this sense, our results come not only from the comparison between municipalities inside and outside the influence areas, but also from municipalities within the influence area closer to and further away from Portugal.

Our statistically significant results from Table 3 imply that if the average municipality in the historical mining areas had not been affected by the gold cycle, its governance index today would be better by 6 percent of a standard deviation, while its index of access to justice would improve by 13 percent of a standard deviation. Similarly, if the average municipality in the sugar-cane area had not been affected by the sugar-cane cycle, its index of concentration of land today would be lower by 35 percent of a standard deviation.

4.2 Caveats and Robustness

Table 4 shows that the results discussed above do not depend on the specific definition of the area of influence of the colonial cycles, or on the particular distance used in our influence function. In the table, we run the most complete specification from Table 3 for each dependent variable, using three alternative definitions of influence of the colonial cycles: the first one where our decaying influence function is defined on a 300 kilometer ray, instead of the 200 kilometer ray adopted before; another one where the same function is defined on a 100 kilometer ray; and a third one where influence is defined simply as a dummy variable assuming value one within a 50 kilometer ray. The significant results from Table 3 remain qualitatively identical, with the additional result that the gold cycle becomes significantly related to lower concentration of land, also consistently with its historical characterization.

Table 5 extends our robustness analysis by including as additional controls municipality characteristics that may be related to colonial cycles and also to current institutions, therefore potentially biasing the results. Some of the municipalities affected by the cycles are among the first colonial settlements of their respective areas, and have become today important regional centers. It may be the case that, because of congestion or returns to scale in the provision of public goods, institutional quality is affected by the size of the municipality. We therefore include two measures of size – population and area – as additional controls (*ln(population)* and *ln(area)*). It is also possible that older municipalities are intrinsically different from new ones, and that this correlation is the driving force behind the results. Therefore, we also include as an additional control the age (in years) of municipalities. Finally, in the last four columns of Table 5, we include controls for unobserved regional effects. The regional dummy variables are defined according to the official classification of Brazil into North, Northeast, Center-West, Southeast, and South regions, which relates to the homogeneity of the different areas of the country in terms of their human and geographic components. The table shows that qualitative results are unaffected by the introduction of these controls.[24]

Finally, Table 6 investigates the nature of the institutional variation generating the main results from Table 3. The first eight columns present the results with the sample restricted to the respective cycle influence area: only the sugar-cane cycle influence area and only the gold cycle influence area, respectively. The number of observations in each regression is greatly reduced by the sample restriction. The effect of the colonial episodes on *land Gini* and *governance* is robust to local variation within each influence area. Restricting the sample to the relevant areas, municipalities closer to the core of each cycle and closer to Portugal display more land concentration (sugar-cane cycle) and worse administrative practices (gold cycle). The effect on *access to justice*, on the other hand, seems to be associated with the variation across areas affected and not affected by the gold cycle, with the correlation being reversed when the analysis is restricted to the influence area.

Analogous results are shown in columns 9 to 12, when 27 state dummies are included as controls. States are political entities endogenous to the process of institutional development that we want to analyze, so it is not clear that they should be included in these regressions. In any case, *land Gini* and *governance* remain significantly related to the sugar-cane and gold cycles,

[24] Qualitative results from Table 5 are also robust to the inclusion of all additional explanatory variables simultaneously, to clustering at state level (27) or "micro-region" level (556 micro-regions, each containing on average 9 municipalities), and to exclusion of the interaction with distance to Portugal or distance to Portugal alone from the right-hand side (results available from the authors upon request).

respectively, even considering only within state variation. The non-significant result for access to justice reinforces the interpretation that its relationship with the colonial episodes is identified through variation across broader areas of the country.

In summary, results are generally unaffected by the methodological choices regarding the construction of the influence function and by the inclusion of relevant municipality characteristics as additional controls. Also, identification of the effect on *access to justice* seems to trust on the contrast between areas affected and areas not affected by the cycles. The effect on *land Gini* and *governance* can be perceived even within each cycle influence area and within states.

5. Colonial Heritage, Current Institutions and Development

5.1 Main Results

We now briefly investigate whether the colonial heritage associated with the rent-seeking episodes seems to have had any noticeable effect on income per capita today, and whether this effect could have worked through its institutional legacy. First, Table 7 presents the results of reduced form estimates, where our specifications from Table 3 are used with income per capita as the dependent variable. When only the variables indicating the influence of the colonial cycles are used, both the sugar-cane and the gold cycles appear as being associated with lower income per capita today. The point estimates imply that, unconditionally, municipalities affected by the sugar-cane cycle have income per capita on average 68% lower than the rest of the country, while municipalities affected by the gold cycle have income per capita 4.4% lower. But when controls and interactions with distance to Portugal are included in the right-hand side, only the variables related to the gold cycle remain significant.

The results from Table 7 illustrate that the institutional consequences of the colonial cycles may have had long-term implications for the development of the various regions of Brazil. From the perspective of our previous discussion, the interesting question is whether these long-term effects worked through the institutional channels mentioned before. We explore this possibility by estimating second stage regressions of income per capita on local institutions, once the different institutional dimensions are instrumented with the historical variables according to the main specification from Table 3. Reverse causation is likely to introduce a positive bias in direct inferences about the relationship between institutions and income per capita. Not only better economic institutions increase income per capita, but also richer municipalities may demand and be able to afford better institutions. In addition, there is the possibility of omitted

variables and measurement error, in which case it is not possible to tell a priori the expected direction of the bias. The dimension of the measurement error independent from other right-hand side variables generates an attenuation bias, bringing the estimated effect of institutions closer to zero. All these reasons suggest that instruments are needed to uncover the causal impact of institutions on development.

But the instrumental variables approach proposed here also has its limitations. Instrumenting our four institutional dimensions with the historical variables is equivalent to assuming that the colonial cycles had no other effect on development apart from that captured by the specific institutional variables chosen. This not only excludes possible direct economic impacts, but also other institutional effects not entirely captured by the dimensions analyzed.[25] This is probably most serious in relation to *de facto* institutions that are difficult to measure, such as those associated with the interaction of individuals within society, trust, and social capital (as, for example, in Hoff and Pandey, 2005).

We cannot hope to solve this problem entirely in this paper. So we see our instrumental variables approach as an exploratory effort in the direction of understanding the role that *de facto* institutions play in the process of economic development. Since we do observe that colonial history shapes certain dimensions of current institutions, and that both current institutions and colonial history are related to economic development, it seems natural to ask whether colonial history affects development through the specific institutional channels analyzed. We follow this strategy, keeping in mind the limitations of the exercise and seeing it as an addendum to the main results of the paper, which were presented in the previous section. In the next section, we also look at various dimensions of public good provision as possibly capturing, in a broader sense, local institutional development. This approach lacks the precision of our institutional measures, but overcomes its narrowness by using public good provision as a "catch-all" indicator of institutional quality.

Columns 1 to 4 in Table 8 present the regressions of income per capita on each dimension of institutional development separately, once they are instrumented with the historical variables. The results related to *governance* and *access to justice* are positive and statistically significant when considered separately. Along these two dimensions, the reduced institutional quality

[25] This same criticism applies to cross-country studies analyzing the effect of institutions on development, such as Acemoglu, Johnson, and Robinson (2001 and 2002). But the problem is likely to be more severe in our case, since we have more specific measures of institutions. What is an advantage in terms of understanding the historical forces shaping local institutions turns into a burden when one tries to analyze the intervening role of institutions in the relationship between colonial heritage and development.

determined by the rent seeking colonial episodes ended up reflected on reduced long-run income per capita. The result related to *land Gini*, on the other hand, is not statistically significant, while the result on *political persistence* is only borderline statistically significant, but with an unexpected sign.[26]

Column 5 shows that, when all the institutional dimensions are included together, only *access to justice* remains significant, while column 6 shows that *governance* and *access to justice* remain statistically significant when they are the only dimensions introduced simultaneously. Quantitatively, the coefficients from column 6 imply that an exogenous improvement in governance practices within the municipality administration from the 25th to the 75th percentile of the observed distribution would lead, in the long-run, to an increase of 44% in income per capita. An analogous movement of a municipality in the observed distribution of access to justice would lead to an increase of 60% in income per capita. To give some perspective into the relevance of these numbers, the difference in income per capita between municipalities in the 25th and 75th percentiles of the income distribution is 170%.[27]

Finally, the inclusion of instrumented institutions as additional controls reduces the role played by some of the main geographic variables discussed in Table 1. The coefficient on *distance to equator*, for example, is reduced from 0.064 to 0.028, while the coefficient on *rainfall* drops from 0.034 to 0.021. At the same time, the F statistic on the joint significance of the twelve monthly temperature variables is reduced from 42.06 to 10.65, while the F statistic on the variables indicating the predominant types of soil drops from 11.99 to 5.65. It does seem to be the case that a significant fraction of the correlation between geography and development across Brazilian municipalities is associated with the different patterns of colonization adopted in distinct regions of the country. Still, the institutional variables are not able to fully account for the geographic pattern of development discussed in the introduction, so we cannot rule out the existence of some causal relationship between endowments and development within Brazil.

[26] The coefficients on *governance* and *access to justice* remain statistically significant and of the same order of magnitude when confidence intervals robust to weak instruments are used, according to the methodology suggested by Moreira (2003) and implemented by Mikusheva and Poi (2006). In this case, the confidence interval for *political persistence* includes the entire real line. The result related to *political persistence* is expected, given the poor performance of this variable in other exercises performed in the paper. Though the non-significant result related to *land Gini* may seem surprising, it is in line with recent historical evidence from the Colombian state of Cundinamarca (see Acemoglu et al, 2007).

[27] The IV coefficients from column 6 are higher than the respective OLS estimates presented in Table 1. This suggests that the IV estimation is minimizing a problem of attenuation bias. Interestingly, the vast majority of cross-country studies have also found similar differences between IV and OLS estimates (see Pande and Udry, 2006).

5.2 Caveats and Robustness

The previous results include *dist to Portugal* as an instrument for the institutional variables. As mentioned, distance to Portugal is also a proxy for distance to European markets. If distance to international markets is correlated with income per capita, distance to Portugal would not be a valid instrument to identify the effect of institutions on long-term development, even ignoring the limitations of our approach discussed previously.[28] Table 9 replicates the exercise from Table 8 using *dist to Portugal* as an additional control, rather than an instrument. The results related to the effects of the institutional variables, when taken separately, remain very similar, increasing slightly in magnitude (as should be expected from the direct effect of distance to Europe on development). The only noticeable change occurs when *governance* and *access to justice* are considered jointly: the absence of *dist to Portugal* as an instrument hinders the ability of the model to distinguish between the effects of *governance* and *access to* justice, and only the latter remains statistically significant.

Another important concern is related to the critique of cross-country studies linking history and institutions put forth by Glaeser et al (2004). In their view, the historical events used to identify institutional variation across countries brought together not only changes in institutions, but also changes along several different dimensions relevant to development. Particularly, they highlight that immigrants brought higher levels of human capital, and that the causal mechanisms described by Acemoglu, Johnson, and Robinson (2001 and 2002) might work just as well through the human capital channel.

In order to test whether our estimated coefficients are indeed capturing historical forces that work through the institutional channel, we check the robustness of the significant results from Table 8 to the human capital mechanism. Table 10 presents the results for two measures of human capital (average schooling and illiteracy rates in the population aged 25 and above). In different specifications, we treat each alternative human capital variable as exogenous and endogenous to income per capita. The results remain very similar to those presented in Table 8. The only exception is the coefficient on *governance*, which ceases to be significant when illiteracy rate is included in the right-hand side and treated as endogenous. Overall, the institutional variables remain significant even in the presence of human capital, so our results do not seem to suffer from the problems raised by Glaeser et al (2004).

[28] The bias in our estimates implied by this argument is negative, meaning that the coefficients presented in Table 6 would underestimate the impact of institutions on development (assuming that distance to international markets is detrimental for development).

5.3 Unbundling Local Institutions

The indexes of *governance* and *access to justice* suggested by the Brazilian Census Bureau – and used here – have different components, some more closely related to the arguments developed in the paper than others. Now, we take advantage of our data and try to identify the specific aspects of *governance* and *access to justice* that drive the results from Table 8. We restrict the analysis to these two institutional dimensions, since they are the only ones that appear consistently as significant in Table 8.

Section 3 explained that *governance* is an index comprised of four different measures of quality of local administration: two measures related to tax administration (the year in which the database of the tax on urban property was updated and its payment rate), the number of administrative instruments, and the number of planning instruments. Table 11 replicates the same exercise from Table 8 substituting *governance* by each of its components, and including only *access to justice* as an additional dimension of institutional quality. The instrumented dimensions of *governance* related to tax administration are the only ones that appear as significantly related to income per capita. In particular, the date of the last revision of the database on the tax on urban property appears as the most important component of *governance*. This variable is related to basic administrative practices at the local level. It is reassuring that the results are driven by a dimension of the index that denotes administrative efficiency at a very simple and obvious level.

The decomposition of *access to justice* is presented in Table 12. As before, *access to justice* is substituted by each of its components: existence of small claims courts, consumer commissions, and youth councils (only *governance* is included as additional dimension of institutional quality). Each instrumented dimension of *access to justice*, when considered separately, is statistically significant (columns 2 to 4). However, when introduced together, the existence of small claims courts is the only one that remains significant (column 5). This result suggests that enforcement of contracts and protection of property rights are the most important components of *access to justice* in terms of its effects on long-term income per capita. Again, it is reassuring that the strongest result comes from the type of court that indeed affects the way local business and interpersonal disputes are resolved.

6. Public Good Provision as Institutional Development

One of the advantages of our data is that our measures of institutions give very concrete meaning to the idea of institutional development. But the precision of these measures also opens the possibility that relevant dimensions of the effect of colonial heritage on long-term

development may not be captured by our strategy. This is particularly worrisome in the two-stage regressions analyzing the effect of institutions on economic development, since this approach assumes that the only channels through which colonial past affects current development are the four specific institutional channels discussed before.

An opposite alternative would be to look for broad, encompassing measures, which even though may not have very concrete and specific meanings, would be "catch-all" indicators of institutional development. From this perspective, good institutions would lead to good policies and to higher provision of public goods. In this section, we adopt this strategy and think of local provision of various dimensions of public goods as indicators of overall institutional development. We look at local public goods related to sanitation, health, education, culture, and information: percentage of households connected to the public sewage system, number of health centers per 10,000 inhabitants, per capita public spending on education and culture (natural logarithm), whether the municipality has at least one public library, and whether the municipality has at least one local radio station.[29]

First, we estimate the main specification from Table 3 – analyzing the effect of the colonial cycles on institutional development – for these five dimensions of public goods. The results are presented on Table 13. The sugar-cane cycle is associated with lower provision of sanitation and lower number of health centers per 10,000 inhabitants. The gold cycle, on its turn, is associated with lower provision of all dimensions of public goods, but for per capita spending on education and culture.[30] Consistently with the results previously obtained, the gold cycle seems to lead to a very poorly functioning public administration also in relation to the provision of sanitation, health, culture, and information.

In Table 14, we repeat the IV exercise from Table 8 – analyzing the effect of local institutions on development – using the four significant results from Table 13 as indicators of institutional quality. The table presents each public good dimension separately, as well as all possible combinations between them. Panel A shows that, when instrumented separately, each public good is positively associated with income per capita. When combined together in the same regression, not always the instruments are able to disentangle the effects of the different dimensions. Still, when included two at a time, several times both public good variables appear

[29] The existence of a local radio station is probably the dimension that has less of a public good, since local stations in Brazil are typically private. Nevertheless, the functioning of a radio station requires a government concession that involves influence and will on the part of local forces.

[30] These results are also robust to the inclusion of the additional controls used in Table 5 (results available from the authors upon request).

as significant. Also, for example, percentage of households connected to the public sewage system, number of health centers per 10,000 inhabitants, and existence of a local radio station all appear as significant when included together in Panel C, column 12. Overall, the dimensions of public good provision associated with the colonial episodes are consistently related to long-term development, giving additional credibility to our previous results.

7. Concluding Remarks

This paper investigates the long-run determinants of *de facto* institutions. Current variation in local institutions is traced back to the colonial origins of Brazilian municipalities, in a within country approach. This approach enables us to control for a large set of geographic characteristics, within a constant *de jure* institutional setting. Even after accounting for a comprehensive characterization of geography, *de facto* institutions appear as closely related to colonial heritage.

Our strategy takes advantage of two remarkable features of our empirical environment. First, the sugar-cane and gold cycles, which were the most important rent-seeking episodes in colonial Brazil, can be seen as historical shocks to local institutional development. Both cycles were relatively well-defined in time and space, were associated with an intensification of the control exercised by the metropolis, and marked the initial occupation of important areas of the country. Second, the within country analysis allows the investigation of four different dimensions of *de facto* institutional quality, holding constant *de jure* institutions. Thus, we provide different pathways through which the influence of extractive episodes can be materialized in terms of current institutions.

We show that municipalities with origins tracing back to the sugar-cane colonial cycle display today more inequality in the distribution of land, while municipalities with origins tracing back to the gold cycle display worse governance practices and less access to justice. These colonial rent-seeking episodes are also correlated with lower provision of different dimensions of public goods. Moreover, the evidence suggests that the worse institutional quality determined by this colonial heritage is reflected in lower income per capita today.

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Appendix: Description of the Variables

History	
sugar	index of proximity to the sugar-cane cycle, ranging from 0 (municipalities more than 200 kilometers from those directly affected by the sugar-cane cycle) to 1, according to equation 1 in the text.
sugar x dist to Portugal	interaction between the distance to Portugal and the proximity to the sugar-cane cycle.
gold	index of proximity to the gold cycle, ranging from 0 (municipalities situated more than 200 kilometers from the nearest municipality in gold areas) to 1, according to equation 1 in the text.
gold x dist to Portugal	interaction between the distance to Portugal and the proximity to the gold cycle.
distance to Portugal	Euclidian distance (in degrees) computed from the coordinates of each Brazilian municipality center to Lisbon (lat 38º42' long -9º).
Institutions	
land Gini	Gini coefficient of the land distribution, constructed with data from the 1996 Brazilian Agricultural Census.
political persistence	variable defined between 0 and 2 indicating the number of repetitions of at least one family name across mayors elected in the 1996, 2000 and 2004 elections; constructed with data from the Brazilian Superior Electoral Court.
governance	simple average of four qualitative indicators, normalized from 1 to 6: the year in which the database of the tax on urban property ("IPTU") was updated, the IPTU payment rate in 1999, the number of administrative instruments, and the number of planning instruments; from the Brazilian Census Bureau; calculated using data between 1997 and 2000.
access to justice	average of three binary variables indicating the existence of: (i) Small Claims Courts ("Tribunal de Pequenas Causas"), (ii) Youth Council ("Conselho Tutelar") and (iii) Consumer Commission ("Comissão de Defesa do Consumidor"). constructed using information available in 2001, with data from the Brazilian Census Bureau.
Geography	
distance to equator	absolute value of the latitude coordinate of each municipality center, obtained from the National Institute of Geology (INGEO).
distance to coast	distance (in kilometers) from the municipality center to the Brazilian coast, calculated by the Federal University of Rio de Janeiro (UFRJ).
rainfall	the average quantity of water precipitation in each municipality for the period of 1931-1990, expressed in 100 millimeters per year, obtained from the National Institute of Geology (INGEO).
sunshine	the average amount of sunshine during the day for the period of 1931-1990, expressed in 100 hours per year, obtained from the National Institute of Geology (INGEO).
altitude	the average altitude of each municipality, reported in the "Cadastro de cidades e vilas" published by the Brazilian Census Bureau in 1998.
temperatures (12 monthly averages)	a set of 12 variables indicating the average monthly temperatures (degrees Celsius) in each municipality, obtained from the Brazilian Agricultural Research Institute (EMBRAPA).
soils (12 predominant types)	a set of 12 binary variables indicating the types of soil present in a 0.1 degree ray from the municipality's center, obtained from the Brazilian Agricultural Research Institute (EMBRAPA).
Municipalities Characteristics	
income per capita	the total municipal income divided by the number of people in the municipality; from the 2000 Brazilian Census; all values deflated to August 1st, 2000.
years of schooling	the total sum of the completed years (or grades) of schooling at the elementary, high school, university and college levels divided by the population of each municipality, considering only individuals at age 25 and older; from the 2000 Brazilian Census.
illiteracy rate	proportion of the population aged 25 and older who cannot, with understanding, both read and write a short simple statement on their everyday life; from the 2000 Brazilian Census.
ln(population)	the logarithm of the total population in each municipality according to the 2000 Brazilian Census.
ln(area)	the logarithm of the municipal area, expressed in 1000 kilometers, from the Municipal Information System published by the Brazilian Census Bureau.
age of municipality	created from the year of the municipality foundation reported by the Municipal Information System, considering the year 2000 as reference.
dummies for geographic regions	a set of 5 dummy variables indicating the Brazilian macro-regions: North, Northeast, Central-West, Southeast and South.
Public Goods	
radio station	dummy variable indicating whether the municipality had at least one local radio station; calculated in 2000, from the National System of Urban Indicators (Brazilian Ministry of Cities).
public library	dummy variable indicating whether the municipality had at least one public library; calculated in 2000, from the National System of Urban Indicators (Brazilian Ministry of Cities).
health centers	number of health centers per 10,000 inhabitants; calculated in 2000, from the National System of Urban Indicators (Brazilian Ministry of Cities).
sewage	percentage of households with toilet connected to the public sewage system; calculated in 2000, from the National System of Urban Indicators (Brazilian Ministry of Cities).
education and culture	natural logarithm of per capita municipal spending on education and culture; calculated in 2000, from the National System of Urban Indicators (Brazilian Ministry of Cities).

Table 1: Development, Institutions, and Geography across Brazilian Municipalities - OLS Estimation - 2000

	ln Income per Capita (1)	Governance (2)	Access to Justice (3)	Land Gini (4)	Political Persistence (5)	ln Income per Capita (6)
governance						0.105***
						(0.006)
access to justice						0.147***
						(0.005)
land Gini						-0.332***
						(0.072)
political persistence						-0.022***
						(0.008)
distance to equator	0.064***	0.041***	0.038***	-0.001**	-0.012***	0.052***
	(0.003)	(0.005)	(0.005)	(0.001)	(0.003)	(0.002)
distance to coast	-0.011***	-0.000	-0.013***	-0.000	0.002	-0.010***
	(0.002)	(0.004)	(0.004)	(0.000)	(0.003)	(0.002)
sunshine	-0.018***	-0.002	-0.022***	0.002**	0.002	-0.012***
	(0.002)	(0.005)	(0.006)	(0.001)	(0.003)	(0.002)
rainfall	0.034***	0.027***	0.022***	-0.004***	-0.014***	0.025***
	(0.002)	(0.004)	(0.004)	(0.000)	(0.003)	(0.002)
altitude	0.007***	-0.001	-0.007	-0.000	-0.006	0.007***
	(0.002)	(0.005)	(0.006)	(0.001)	(0.004)	(0.002)
temperatures	yes	yes	yes	yes	yes	yes
(12 monthly averages)	F(12, 4941) = 39.26	F(12, 4940) = 36.23	F(12, 4940) = 2.45	F(12, 4941) = 15.07	F(12, 4870) = 1.24	F(12, 4865) = 49.99
	prob > F = 0.0000	prob > F = 0.0000	prob > F = 0.0035	prob > F = 0.0000	prob > F = 0.2511	Prob > F = 0.0000
soils	yes	yes	yes	yes	yes	yes
(12 types)	F(12, 4941) = 13.46	F(12, 4940) = 3.11	F(12, 4940) = 5.83	F(12, 4941) = 9.08	F(12, 4870) = 1.25	F(12, 4865) = 12.39
	prob > F = 0.0000	prob > F = 0.0002	prob > F = 0.0000	prob > F = 0.0000	prob > F = 0.2419	prob > F = 0.0000
constant	yes	yes	yes	yes	yes	yes
Observations	4971	4970	4971	4971	4900	4899
R-squared	0.65	0.30	0.09	0.20	0.05	0.74

Obs.: Robust standard errors in parentheses. * indicates significance at 10%, ** significance at 5%, and *** significance at 1%. Dependent variables are income per capita (ln), Gini coefficient of the distribution of land, indicator of whether the same family held mayoral office more than once in 1996, 2000 and 2004, index of quality of local administration, and indicator of the local presence of three types of courts. Independent variables are absolute value of the latitude, distance from municipality center to the coast (in km), average water precipitation btwn 1931-1990 (100 millimeters per year), average sunshine during the day btwn 1931-1990 (100 hours per year), average altitude, average montly temperatures in each of the 12 months of the year (degrees Celsius), and 12 dummy variables indicating the types of soil present in a 0.1 degree ray from the municipality's center. Institutional variables also used as independent variables in the last specification. Municipality level observations. Variables measured with data available between 1996 and 2000, unless otherwise noted.

Table 2: Descriptive Statistics - Brazilian Municipalities - 2000

	Inside the Sugar-Cane Cycle Area (39 obs directly affected + 1021 obs indirectly affected)	Outside the Sugar-Cane Cycle Area (4446 obs)
governance	2.885	3.232
	(0.832)	(0.911)
access to justice	0.918	1.192
	(0.914)	(0.934)
land Gini	0.828	0.799
	(0.067)	(0.088)
political persistence	0.861	0.773
	(0.494)	(0.515)
ln(income p.c.)	4.651	5.058
	(0.459)	(0.577)
years of schooling	3.371	4.197
	(1.147)	(1.268)
latitude	-12.318	-17.370
	(5.245)	(8.554)
	Inside the Gold Cycle Area (534 obs directly affected + 976 obs indirectly affected)	Outside the Gold Cycle Area (3996 obs)
governance	3.137	3.176
	(0.795)	(0.945)
access to justice	0.946	1.218
	(0.958)	(0.918)
land Gini	0.814	0.801
	(0.051)	(0.095)
political persistence	0.762	0.800
	(0.524)	(0.508)
ln(income p.c.)	4.992	4.976
	(0.471)	(0.615)
years of schooling	3.948	4.072
	(1.124)	(1.342)
latitude	-17.052	-16.151
	(3.379)	(9.468)

Obs.: Variables are index of quality of local administration, indicator of the local presence of three types of courts, Gini coefficient of the distribution of land, indicator of whether the same family held mayoral office more than once in 1996, 2000 and 2004, income per capita (ln), average years of schooling in the population aged 25 and above, and absolute value of the latitude. Municipality level observations. Variables measured with data available between 1996 and 2000. Areas affected by the sugar-cane and gold cycles defined in section 3.

Table 3: Effects of Colonial Cycles on Institutional Development - OLS Estimation - Brazilian Municipalities - 2000

	Only Cycle Variables				Baseline Specification			
	Land Gini	Political Persist.	Governan.	Access to Justice	Land Gini	Political Persist.	Governan.	Access to Justice
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
sugar	0.059***	0.111***	-0.538***	-0.299***	0.690***	0.427	-0.613	-0.045
	(0.005)	(0.034)	(0.061)	(0.062)	(0.111)	(0.602)	(0.975)	(1.221)
sugar x dist to Portugal					-0.009***	-0.008	0.010	0.005
					(0.002)	(0.009)	(0.014)	(0.017)
gold	0.025***	-0.043*	-0.103**	-0.326***	-0.092	0.156	-3.119***	-6.265***
	(0.003)	(0.026)	(0.040)	(0.045)	(0.058)	(0.533)	(0.783)	(0.804)
gold x dist to Portugal					0.001*	-0.002	0.039***	0.078***
					(0.001)	(0.007)	(0.010)	(0.009)
distance to Portugal					0.001	-0.010*	-0.011	0.031***
					(0.001)	(0.006)	(0.008)	(0.009)
geographical controls	no	no	no	no	yes	yes	yes	yes
constant	yes	yes	yes	yes	yes	yes	yes	yes
Observations	4973	5407	5505	5506	4971	4900	4970	4971
R-squared	0.025	0.003	0.014	0.012	0.21	0.05	0.30	0.12

Obs.: Robust standard errors in parentheses. * indicates significance at 10%, ** significance at 5%, and *** significance at 1%. Dependent variables are Gini coefficient of the distribution of land, indicator of whether the same family held mayoral office more than once in 1996, 2000 and 2004, index of quality of local administration, and indicator of the local presence of three types of courts. Independent variables are sugar-cane cycle influence index, gold cycle influence index, distance to Portugal (in degrees), and interaction between the cycle influence indices and distance to Portugal. All regressions include as additional independent variables (not shown): constant, absolute value of the latitude, distance from municipality center to the coast (in km), avg water precipitation btwn 1931-1990 (100 millimeters per year), avg sunshine during the day btwn 1931-1990 (100 hours per year), avg altitude, avg montly temperatures in each of the 12 months of the year (degrees Celsius), and 12 dummies indicating the types of soil present in a 0.1 degree ray from the municipality's center. Municipality level observations. Colonial cycle variables described in section 3. Variables measured with data available between 1996 and 2000, unless otherwise noted.

Table 4: Robustness of the Effects of Colonial Cycles on Institutional Development - Alternative Definitions of Cycle Influence - Brazilian Municipalities - 2000

	Cycle influence defined on a 300km ray				Cycle influence defined on a 100km ray				Cycle as a dummy with 50km ray			
	Land Gini	Political Persist.	Governan.	Access to Justice	Land Gini	Political Persist.	Governan.	Access to Justice	Land Gini	Political Persist.	Governan.	Access to Justice
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
sugar	0.619***	0.038	-0.508	-0.849	0.702***	0.984	0.343	3.064*	0.481***	0.602	0.122	1.483
	(0.086)	(0.507)	(0.786)	(0.976)	(0.151)	(0.799)	(1.386)	(1.834)	(0.116)	(0.482)	(0.795)	(1.002)
sugar x dist to Portugal	-0.008***	-0.002	0.008	0.014	-0.009***	-0.015	-0.001	-0.041	-0.007***	-0.009	-0.000	-0.020
	(0.001)	(0.007)	(0.011)	(0.013)	(0.002)	(0.011)	(0.020)	(0.027)	(0.002)	(0.007)	(0.012)	(0.015)
gold	-0.105*	0.320	-3.121***	-7.835***	-0.158**	0.289	-2.551***	-4.767***	-0.125**	0.435	-2.128***	-3.958***
	(0.058)	(0.501)	(0.736)	(0.783)	(0.061)	(0.564)	(0.829)	(0.814)	(0.051)	(0.494)	(0.722)	(0.719)
gold x dist to Portugal	0.001**	-0.005	0.039***	0.097***	0.002***	-0.004	0.032***	0.060***	0.002***	-0.006	0.027***	0.049***
	(0.001)	(0.006)	(0.010)	(0.010)	(0.001)	(0.007)	(0.011)	(0.010)	(0.001)	(0.006)	(0.009)	(0.009)
distance to Portugal	0.001	-0.013**	-0.012	0.025**	0.000	-0.007	-0.007	0.039***	-0.000	-0.008	-0.011	0.034***
	(0.001)	(0.006)	(0.009)	(0.010)	(0.001)	(0.005)	(0.008)	(0.009)	(0.001)	(0.005)	(0.008)	(0.009)
geographical controls	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
constant	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	4971	4900	4970	4971	4971	4900	4970	4971	4971	4900	4970	4971
R-squared	0.21	0.05	0.30	0.13	0.21	0.05	0.30	0.12	0.21	0.05	0.30	0.12

Obs.: Robust standard errors in parentheses. * indicates significance at 10%, ** significance at 5%, and *** significance at 1%. Dependent variables are Gini coefficient of the distribution of land, indicator of whether the same family held mayoral office more than once in 1996, 2000 and 2004, and indicator of the local presence of three types of courts. Independent variables are sugar-cane cycle influence index, gold cycle influence index, distance to Portugal (in degrees), and interaction between the cycle influence indices and distance to Portugal. All regressions include as additional independent variables (not shown): constant, absolute value of the latitude, distance from municipality center to the coast (in km), avg water precipitation btwn 1931-1990 (100 millimeters per year), avg sunshine during the day btwn 1931-1990 (100 hours per year), avg altitude, avg montly temperatures in each of the 12 months of the year (degrees Celsius), and 12 dummies indicating the types of soil present in a 0.1 degree ray from the municipality's center. Municipality level observations. Colonial cycle variables described in section 3. Variables measured with data available between 1996 and 2000, unless otherwise noted.

Table 5: Robustness of the Effects of Colonial Cycles on Institutional Development - Municipality Characteristics - Brazilian Municipalities - 2000

	Size of Municipality				Year of Foundation				Geographic Regions			
	Land Gini	Political Persist.	Governan.	Access to Justice	Land Gini	Political Persist.	Governan.	Access to Justice	Land Gini	Political Persist.	Governan.	Access to Justice
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
sugar	0.948***	0.181	-0.239	1.196	0.708***	0.441	-0.379	0.573	0.674***	0.305	-0.564	0.07
	(0.110)	(0.606)	(0.846)	(0.922)	(0.113)	(0.604)	(0.918)	(1.127)	(0.110)	(0.613)	(0.978)	(1.179)
sugar x dist to Portugal	-0.013***	-0.004	0.003	-0.021	-0.010***	-0.008	0.004	-0.015	-0.009***	-0.007	0.010	0.001
	(0.002)	(0.009)	(0.012)	(0.013)	(0.002)	(0.009)	(0.013)	(0.016)	(0.002)	(0.009)	(0.014)	(0.017)
gold	-0.191***	0.245	-2.980***	-6.175***	-0.064	0.107	-2.595***	-5.149***	0.018	-0.297	-2.323***	-3.655***
	(0.059)	(0.535)	(0.727)	(0.693)	(0.057)	(0.533)	(0.753)	(0.775)	(0.059)	(0.553)	(0.818)	(0.837)
gold x dist to Portugal	0.003***	-0.004	0.037***	0.077***	0.001	-0.002	0.032***	0.063***	-0.000	0.004	0.029***	0.043***
	(0.001)	(0.007)	(0.009)	(0.009)	(0.001)	(0.007)	(0.010)	(0.009)	(0.001)	(0.007)	(0.011)	(0.010)
distance to Portugal	-0.003***	-0.006	-0.024***	-0.024	0.001	-0.009*	-0.019**	0.013	0.002**	-0.007	0.001	0.052***
	(0.001)	(0.006)	(0.008)	(0.008)	(0.001)	(0.006)	(0.008)	(0.009)	(0.001)	(0.006)	(0.009)	(0.010)
ln (population)	-0.008***	0.006	0.275***	0.543***								
	(0.002)	(0.007)	(0.010)	(0.011)								
ln (area)	0.027***	-0.025***	-0.021*	-0.009								
	(0.002)	(0.009)	(0.012)	(0.012)								
age of municipality					0.000***	-0.000**	0.003***	0.007***				
					(0.000)	0.000	(0.000)	(0.000)				
dummies for geographic regions	no	no	no	no	no	no	no	no	yes	yes	yes	yes
geographical controls	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
constant	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	4968	4897	4967	4968	4965	4894	4964	4965	4971	4900	4970	4971
R-squared	0.28	0.05	0.40	0.49	0.22	0.05	0.34	0.27	0.22	0.05	0.31	0.14

Obs.: Robust standard errors in parentheses. * indicates significance at 10%, ** significance at 5%, and *** significance at 1%. Dependent variables are Gini coefficient of the distribution of land, indicator of whether same family held mayoral office more than once in 1996-2004, index of quality of local administration, and indicator of the local presence of courts. Independent variables: sugar-cane cycle influence index, gold cycle influence index, distance to Portugal (in degrees), interaction btwn cycle influence and distance to Portugal, population (ln), area in square km (ln), age (years since foundation), and dummies for geographic regions (S, SE, N, NE, CW). All regressions include as indep. vars. (not shown): constant, abs value of latitude, dist to the coast (in km), avg water precipitation btwn 1931-1990 (100 millimeters per year), avg sunshine during the day btwn 1931-1990 (100 hours per year), avg altitude, avg montly temperatures in the 12 months (degrees Celsius), and 12 dummies indicating the types of soil present in a 0.1 degree ray from the municipality's center. Municipality level observations. Colonial cycle variables described in section 3. Variables measured with data available between 1996 and 2000, unless otherwise noted.

Table 6: Robustness of the Effects of Colonial Cycles on Institutional Development - Sources of Variation - Brazilian Municipalities - 2000

	Restricting to Sugar-Cane Cycle Influence Area				Restricting to Gold Cycle Influence Area				Including State Dummies			
	Land Gini	Political Persist.	Governan.	Access to Justice	Land Gini	Political Persist.	Governan.	Access to Justice	Land Gini	Political Persist.	Governan.	Access to Justice
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
sugar	0.448***	1.385	0.209	4.096**					0.576***	0.336	1.938	1.424
	(0.164)	(1.069)	(1.767)	(1.950)					(0.117)	(0.806)	(1.191)	(1.445)
sugar x dist to Portugal	-0.006***	-0.021	-0.0004	-0.059**					-0.007***	-0.007	-0.024	-0.017
	(0.002)	(0.015)	(0.025)	(0.273)					(0.002)	(0.012)	(0.017)	(0.020)
gold					0.014	-0.462	-2.817***	1.976*	0.005	-0.087	-1.860*	1.203
					(0.075)	(0.754)	(1.082)	(1.113)	(0.069)	(0.649)	(0.960)	(0.949)
gold x dist to Portugal					-0.00009	0.006	0.035**	-0.026*	0.000	0.001	0.023*	-0.014
					(0.001)	(0.010)	(0.014)	(0.014)	(0.001)	(0.008)	(0.012)	(0.012)
distance to Portugal	0.011	-0.051	-0.082	-0.313***	0.011	0.030	0.003	-0.019	0.003*	-0.005	0.013	0.057***
	(0.007)	(0.053)	(0.083)	(0.093)	(0.007)	(0.024)	(0.037)	(0.041)	(0.001)	(0.010)	(0.015)	(0.017)
geographical controls	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
state dummies	no	no	no	no	no	no	no	no	yes	yes	yes	yes
constant	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	978	977	978	978	1391	1391	1391	1391	4971	4900	4970	4971
R-squared	0.21	0.05	0.18	0.20	0.16	0.04	0.13	0.17	0.24	0.06	0.34	0.21

Obs.: Robust standard errors in parentheses. * indicates significance at 10%, ** significance at 5%, and *** significance at 1%. Dependent variables are Gini coefficient of the distribution of land, indicator of whether the same family held mayoral office more than once in 1996, 2000 and 2004, index of quality of local administration, and indicator of the local presence of three types of courts. Independent variables are sugar-cane cycle influence index, gold cycle influence index, distance to Portugal (in degrees), interaction between the cycle influence indices and distance to Portugal, and state dummies. All regressions include as indep. vars (not shown): constant, absolute value of the latitude, dist. from municipality center to coast (in km), avg water precipitation btwn 1931-1990 (100 millimeters per year), avg sunshine during the day btwn 1931-1990 (100 hours per year), avg altitude, avg montly temperatures in each of the 12 months of the year (degrees Celsius), and 12 dummies for types of soil present in a 0.1 degree ray from the municipality's center. Municipality level observations. Colonial cycle variables described in section 3. Vars measured with data available between 1996 and 2000, unless otherwise noted.

Table 7: Reduced Form Equation: Effects of Colonial Cycles on Income per Capita - OLS Estimation - Brazilian Municipalities - 2000

	ln Income per Capita	
	(1)	(2)
sugar	-0.681***	0.599
	(0.037)	(0.519)
sugar x dist to Portugal		-0.01
		(0.007)
gold	-0.044*	-3.001***
	(0.027)	(0.345)
gold x dist to Portugal		0.037***
		-0.004
distance to Portugal		-0.005
		(0.004)
geographical controls	no	yes
constant	yes	yes
Observations	4971	4971
R-squared	0.56	0.66

Obs.: Robust standard errors in parentheses. * indicates significance at 10%, ** significance at 5%, and *** significance at 1%. Dependent variable is income p.c. (ln). Independent variables are sugar-cane cycle influence index, gold cycle influence index, distance to Portugal (in degrees), and interaction between the cycle influence indices and distance to Portugal. All regressions include as additional independent variables (not shown): constant, absolute value of the latitude, distance from municipality center to the coast (in km), avg water precipitation btwn 1931-1990 (100 millimeters per year), avg sunshine during the day btwn 1931-1990 (100 hours per year), avg altitude, avg montly temperatures in each of the 12 months of the year (degrees Celsius), and 12 dummies indicating the types of soil present in a 0.1 degree ray from the municipality's center. Municipality level observations. Colonial cycle variables described in section 3. Variables measured with data available between 1996 and 2000, unless otherwise noted.

Table 8: Effects of Local Institutions on Development - IV Estimation - Brazilian Municipalities - 2000

	ln Income per Capita					
	(1)	(2)	(3)	(4)	(5)	(6)
governance	0.719***				0.291	0.363**
	(0.131)				(0.292)	(0.133)
access to justice		0.425***			0.361**	0.302***
		(0.046)			(0.148)	(0.072)
land Gini			0.653		0.369	
			(0.565)		(1.153)	
political persistence				0.926*	1.328**	
				(0.476)	(0.610)	
first stage F-test	F(5, 4935) = 5.39	F(5, 4936) = 16.94	F(5, 4936) = 18.99	F(5, 4865) = 1.39		
(Instruments)	prob > F = 0.0000	prob > F = 0.0000	prob > F = 0.0000	prob > F = 0.2255		
geographical controls	yes	yes	yes	yes	yes	yes
constant	yes	yes	yes	yes	yes	yes
Observations	4970	4971	4971	4900	4899	4970

Obs.: Robust standard errors in parentheses. * indicates significance at 10%, ** significance at 5%, and *** significance at 1%. Dependent variables is income p.c. (ln). Independent variables are Gini coefficient of the distribution of land, indicator of whether the same family held mayoral office more than once in 1996, 2000 and 2004, index of quality of local administration, and indicator of the local presence of courts. All regressions include as additional independent variables (not shown): const, abs value of lat, dist tocoast (in km), avg water precipitation btwn 1931-1990 (100 millimeters per year), avg sunshine during the day btwn 1931-1990 (100 hours per year), avg altitude, avg montly temperatures in the 12 months of the year (degrees Celsius), and 12 dummies indicating types of soil present in a 0.1 degree ray from the municipality's center. Instr. are sugar-cane cycle influence index, gold cycle influence index, distance to Portugal (in degrees), and interaction between the cycle indices and dist. to Portugal (1st stage results presented in Table 3). Municipality level observations. Variables measured with data available between 1996 and 2000, unless otherwise noted.

Table 9: Robustness of the Effects of Local Institutions on Development - Dist. To Portugal as Control Variables- IV Estimation - Brazilian Municipalities - 2000

	ln Income per Capita					
	(1)	(2)	(3)	(4)	(5)	(6)
governance	0.851***				0.228	-1.143
	(0.171)				(5.100)	(1.057)
access to justice		0.509***			0.392	1.066**
		(0.054)			(2.499)	(0.534)
land Gini			0.548		0.347	
			(0.584)		(2.060)	
political persistence				1.022	1.274	
				(0.548)	(4.397)	
first stage F-test	F(4, 4935) = 5.35	F(4, 4936) = 19.72	F(4, 4936) = 19.62	F(4, 4865) = 1.40		
(Instruments)	prob > F = 0.0003	prob > F = 0.0000	prob > F = 0.0000	prob > F = 0.2303		
geographical controls	yes	yes	yes	yes	yes	yes
constant	yes	yes	yes	yes	yes	yes
Observations	4970	4971	4971	4900	4899	4970

Obs.: Robust standard errors in parentheses. * indicates significance at 10%, ** significance at 5%, and *** significance at 1%. Dependent variables is income p.c. (ln). Independent variables are Gini coefficient of the distribution of land, indicator of whether the same family held mayoral office more than once in 1996, 2000 and 2004, index of quality of local administration, and indicator of the local presence of three types of courts. All regressions include as additional independent variables (not shown): constant, abs value of lat, dist to the coast (in km), avg water precipitation btwn 1931-1990 (100 millimeters per year), avg sunshine during the day btwn 1931-1990 (100 hours per year), avg altitude, avg montly temperatures in the 12 months of the year (degrees Celsius), 12 dummies indicating types of soil present in a 0.1 degree ray from the municipality's center, and distance to Portugal (in degrees). Instr. are sugar-cane cycle influence index, gold cycle influence index, and interaction between the cycle indices and dist. to Portugal (1st stage results presented in Table 3). Municipality level observations. Variables measured with data available between 1996 and 2000, unless otherwise noted.

Table 10: Robustness of the Effects of De Facto Institutions on Long-term Development - Human Capital Hypothesis - Brazilian Municipalities - 2000

	ln Income per Capita			
	years of schooling		illiteracy rate	
	HK exogenous	HK instrumented	HK exogenous	HK instrumented
governance	0.306**	0.313**	0.538***	0.208
	(0.110)	(0.107)	(0.132)	(0.175)
access to justice	0.200**	0.161*	0.251**	0.386***
	(0.074)	(0.083)	(0.089)	(0.094)
illiteracy rate			-0.007***	-0.009
			(0.003)	(0.007)
years of schooling	0.113**	0.179**		
	(0.039)	(0.076)		
geographical controls	yes	yes	yes	yes
constant	yes	yes	yes	yes
Observations	4970	4970	4970	4970

Obs.: Robust standard errors in parentheses. * indicates significance at 10%, ** significance at 5%, and *** significance at 1%. Dependent variables is income p.c. (ln). Independent variables are index of quality of local administration, indicator of the local presence of three types of courts, illiteracy rate and average schooling (pop 25 and above). All regressions include as additional independent variables (not shown): constant, abs value of lat, dist to coast (in km), avg water precipitation btwn 1931-1990 (100 millimeters per year), avg sunshine during the day btwn 1931-1990 (100 hours per year), avg altitude, avg montly temperatures in the 12 months (degrees Celsius), and 12 dummies indicating types of soil present in a 0.1 degree ray from the municipality's center. Instr. are sugar-cane cycle influence index, gold cycle influence index, distance to Portugal (in degrees), and interaction between the cycle indices and dist. to Portugal (1st stage results presented in Table 3). Municipality level observations. Variables measured with data available between 1996 and 2000, unless otherwise noted.

Table 11: Unbundling the Governance Index - Effect of Local Institutions on Development - OLS and IV Estimation - Brazilian Municipalities - 2000

	Income per Capita					
	OLS	IV				
tax on urban property database update	0.013***	0.247***				0.209**
	(0.003)	(0.087)				(0.088)
tax on urban property payment rate	0.039***		0.264**			0.117
	(0.004)		(0.106)			(0.133)
administrative instruments	0.082***			0.118		
	(0.004)			(0.152)		
planning instruments	0.001				0.057	
	(0.004)				(0.111)	
access to justice	0.113***	0.370***	0.254*	0.447***	0.537***	0.277*
	(0.006)	(0.110)	(0.131)	(0.110)	(0.082)	(0.153)
first stage F-test		F(5, 4935) = 3.25	F(5, 4935) = 6.48	F(5, 4935) = 3.35	F(5, 4935) = 4.20	
(Instruments)		prob > F = 0.0062	prob > F = 0.0000	prob > F = 0.0050	prob > F = 0.0008	
geographical controls	yes	yes	yes	yes	yes	yes
constant	yes	yes	yes	yes	yes	yes
Observations	4970	4970	4970	4970	4970	4970

Obs.: Robust standard errors in parentheses. * indicates significance at 10%, ** significance at 5%, and *** significance at 1%. Dependent variables is income p.c. (ln). Independent variables are indicator of the update of the tax on urban property database, tax on urban property payment rate, n of administrative instruments used by administration, n of planning instruments, and indicator of the local presence of three types of courts. All regressions include as additional independent variables (not shown): constant, abs value of lat, dist to the coast (in km), avg water precipitation btwn 1931-1990 (100 millimeters per year), avg sunshine during the day btwn 1931-1990 (100 hours per year), avg altitude, avg montly temperatures in the 12 months of the year (degrees Celsius), and 12 dummies indicating types of soil present in a 0.1 degree ray from the municipality's center. Instr. are sugar-cane cycle influence index, gold cycle influence index, distance to Portugal (in degrees), and interaction between the cycle indices and dist. to Portugal. Municipality level observations. Variables measured with data available between 1996 and 2000, unless otherwise noted.

Table 12: Unbundling the Access to Justice Index - Effect of Local Institutions on Development - OLS and IV Estimation - Brazilian Municipalities - 2000

	Income per Capita				
	OLS	IV			
small claims courts	0.164***	0.690***			0.845**
	(0.010)	(0.164)			(0.362)
consumer commission	0.176***		0.969**		-1.465
	(0.014)		(0.473)		(1.343)
youth council	0.101***			0.483***	0.515
	(0.010)			(0.165)	(0.450)
governance	0.107***	0.413***	0.530***	0.460***	0.355
	(0.006)	(0.132)	(0.157)	(0.144)	(0.223)
first stage F-test		F(5, 4936) = 10.29	F(5, 4936) = 5.75	F(5, 4936) = 14.03	
(Instruments)		prob > F = 0.0000	prob > F = 0.0000	prob > F = 0.0000	
geographical controls	yes	yes	yes	yes	yes
constant	yes	yes	yes	yes	yes
Observations	4970	4970	4970	4970	4970

Obs.: Robust standard errors in parentheses. * indicates significance at 10%, ** significance at 5%, and *** significance at 1%. Dependent variables is income p.c. (ln). Independent variables are dummies indicating the presence of small claims courts, consumer comissions, and youth councils, and index of quality of administration. All regressions include as additional independent variables (not shown): constant, abs value of lat, dist to the coast (in km), avg water precipitation btwn 1931-1990 (100 millimeters per year), avg sunshine during the day btwn 1931-1990 (100 hours per year), avg altitude, avg montly temperatures in the 12 months of the year (degrees Celsius), and 12 dummies indicating types of soil present in a 0.1 degree ray from the municipality's center. Instr. are sugar-cane cycle influence index, gold cycle influence index, distance to Portugal (in degrees), and interaction between the cycle indices and dist. to Portugal. Municipality level observations. Variables measured with data available between 1996 and 2000, unless otherwise noted.

Table 13: Effects of Colonial Cycles on Public Good Provision - OLS Estimation - Brazilian Municipalities - 2000

	% households connected to the sewage system	# health centers (per 10,000)	ln(public spending on education and culture p.c.)	has public library	has radio station
	(1)	(2)	(3)	(4)	(5)
sugar	-114.967***	-19.209***	0.174	0.152	-0.952
	(30.225)	(4.186)	(0.794)	(0.436)	(0.619)
sugar x dist to Portugal	1.699***	0.251***	-0.005	0.0005	0.014
	(0.439)	(0.061)	(0.011)	(0.006)	(0.009)
gold	-75.878***	-16.934***	0.569	-1.683***	-1.272**
	(22.728)	(3.296)	(0.629)	(0.453)	(0.499)
gold x dist to Portugal	0.779***	0.218***	-0.009	0.021***	0.016**
	(0.292)	(0.043)	(0.008)	(0.006)	(0.006)
distance to Portugal	-0.424*	-0.199***	-0.021***	-0.014***	0.005
	(0.243)	(0.042)	(0.007)	(0.004)	(0.006)
geographical controls	yes	yes	yes	yes	yes
constant	yes	yes	yes	yes	yes
Observations	4970	4971	4698	4970	4971
R-squared	0.44	0.10	0.08	0.04	0.03

Obs.: Robust standard errors in parentheses. * indicates significance at 10%, ** significance at 5%, and *** significance at 1%. Dependent variables are: dummy vars for presence of radio station and public library, number of health centers per 10,000 inhabitants, % of households connected to public sewage system, and ln of municipal spending on education and culture per capita. Indep vars are sugar-cane cycle influence index, gold cycle influence index, distance to Portugal (in degrees), and interaction between the cycle influence indices and distance to Portugal. All regressions include as additional indep variables (not shown): constant, abs value of lat, dist from municipality center to coast (in km), avg water precipitation btwn 1931-1990 (100 millimeters per year), avg sunshine during the day btwn 1931-1990 (100 hours per year), avg altitude, avg montly temperatures in each of the 12 months of the year (degrees Celsius), and 12 dummies indicating the types of soil present in a 0.1 degree ray from the municipality's center. Municipality level observations. Colonial cycle variables described in section 3. Vars measured with data available between 1996 and 2000, unless otherwise noted.

Table 14: Effects of Public Good Provision on Development - IV Estimation - Brazilian Municipalities - 2000

	Panel A - Each Endogenous Variable Alone Dependent Varibale: ln Income per Capita					
	(1)	(2)	(3)	(4)		
% hh connected to public sewage system	0.008*** (0.001)					
# health centers (per 10,000)		0.051*** (0.014)				
has public library			1.253*** (0.256)			
has radio station				1.417*** (0.412)		
first stage F-test (Instruments)	F(5, 4936) = 27.95 prob > F = 0.0000	F(5, 4933) = 15.96 prob > F = 0.0000	F(5, 4936) = 5.55 prob > F = 0.0000	F(5, 4936) = 2.34 prob > F = 0.0397		
geographical controls	yes	yes	yes	yes		
constant	yes	yes	yes	yes		
Observations	4971	4968	4971	4971		
	Panel B - Two Endogenous Variables at a Time Dependent Varibale: ln Income per Capita					
	(5)	(6)	(7)	(8)	(9)	(10)
% hh connected to public sewage system	0.007*** (0.001)	0.006*** (0.001)	0.004 (0.003)			
# health centers (per 10,000)	0.043*** (0.013)			-0.091* (0.052)	0.028 (0.022)	
has public library		1.098*** (0.237)		2.275*** (0.750)		1.020*** (0.318)
has radio station			0.974** (0.434)		1.253*** (0.393)	0.969*** (0.415)
geographical controls	yes	yes	yes	yes	yes	yes
constant	yes	yes	yes	yes	yes	yes
Observations	4968	4971	4971	4971	4968	4971
	Panel C - Three and Four Endogenous Variables at a Time Dependent Variable: ln Income per Capita					
	(11)	(12)	(13)	(14)	(15)	
% hh connected to public sewage system	.005* (0.003)	0.005** (0.002)	0.004 (0.003)		0.002 (0.005)	
# health centers (per 10,000)	-0.078* (0.047)	0.034** (0.015)		-0.100* (0.060)	-0.094 (0.059)	
has public library	1.996*** (0.675)		1.030*** (0.262)	2.124** (0.839)	2.062*** (0.793)	
has radio station		0.676* (0.388)	0.488 (0.480)	1.064 (0.695)	0.86 (0.966)	
geographical controls	yes	yes	yes	yes	yes	
constant	yes	yes	yes	yes	yes	
Observations	4968	4968	4971	4968	4968	

Obs.: Robust standard errors in parentheses. * indicates significance at 10%, ** significance at 5%, and *** significance at 1%. Dependent variable is income p.c. (ln). Independent variables are: dummy vars for presence of radio station and public library, number of health centers per 10,000 inhabitants, % of households connected to public sewage system, and ln of municipal spending on education and culture per capita. All regressions include as additional independent variables (not shown): constant, abs value of lat, dist to the coast (in km), avg water precipitation btwn 1931-1990 (100 millimeters per year), avg sunshine during the day btwn 1931-1990 (100 hours per year), avg altitude, avg montly temperatures in the 12 months of the year (degrees Celsius), and 14 dummies indicating types of soil present in a 0.1 degree ray from the municipality's center. Instr. are sugar-cane cycle influence index, gold cycle influence index, distance to Portugal (in degrees), and interaction between the cycle indices and dist. to Portugal (1st stage results presented in Table 13). Municipality level observations. Variables measured with data available between 1996 and 2000, unless otherwise noted.

Figure 1: Income per capita and Distance to the Equator across Countries, 2000

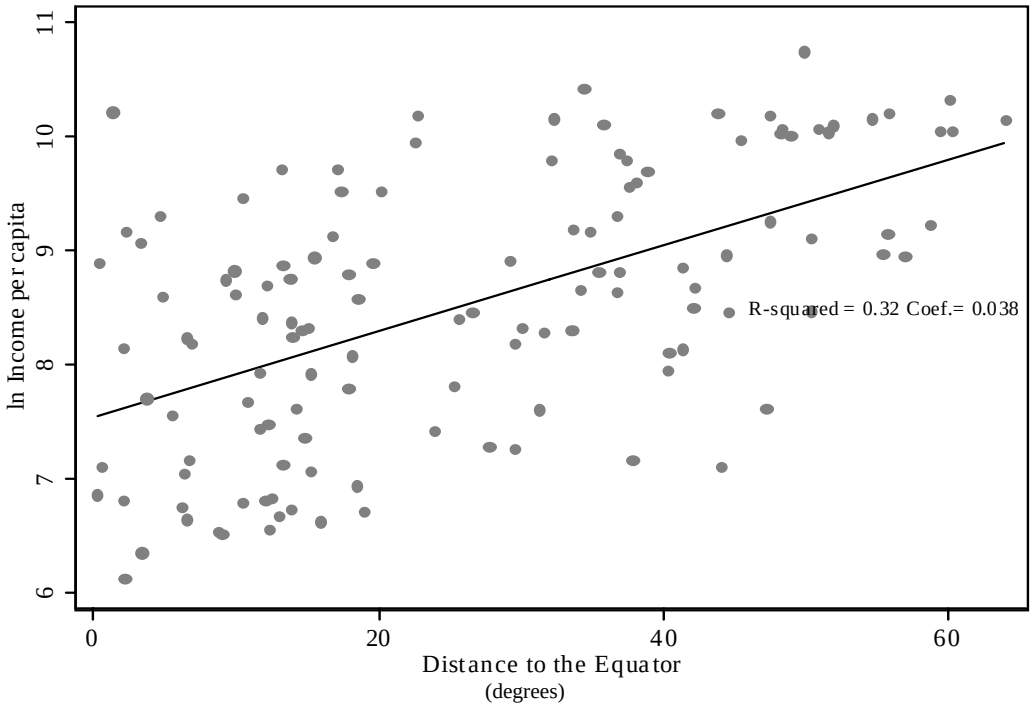

Figure 2: Income per capita and Distance to the Equator across Brazilian Municipalities, 2000

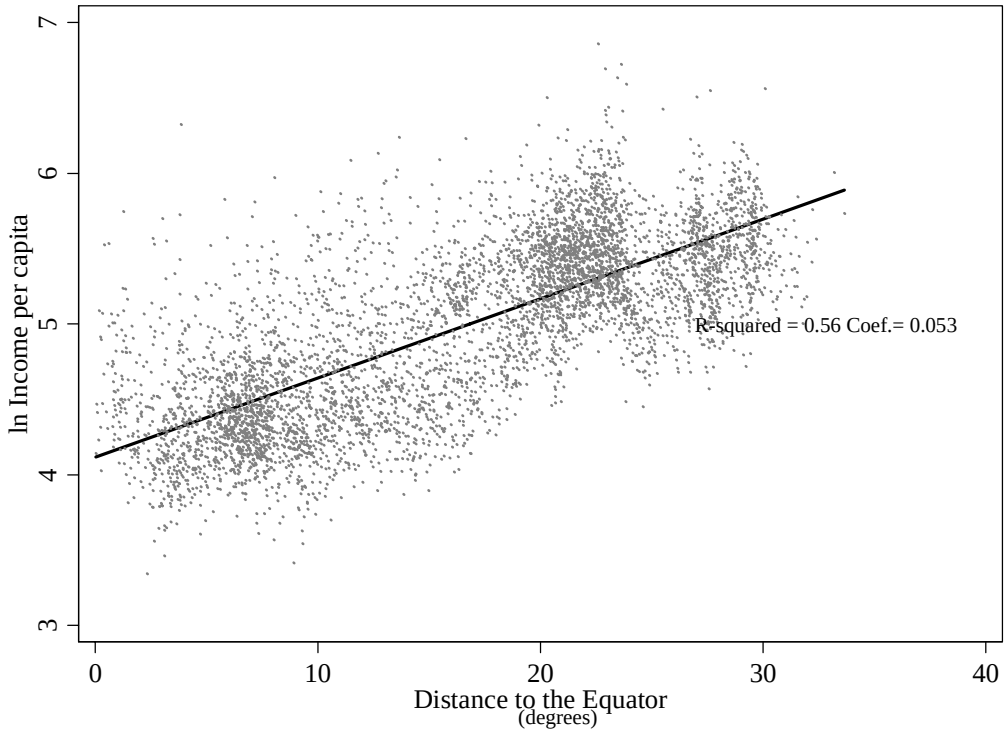

Figure 3: Brazilian States and Position of the Country in Relation to Portugal

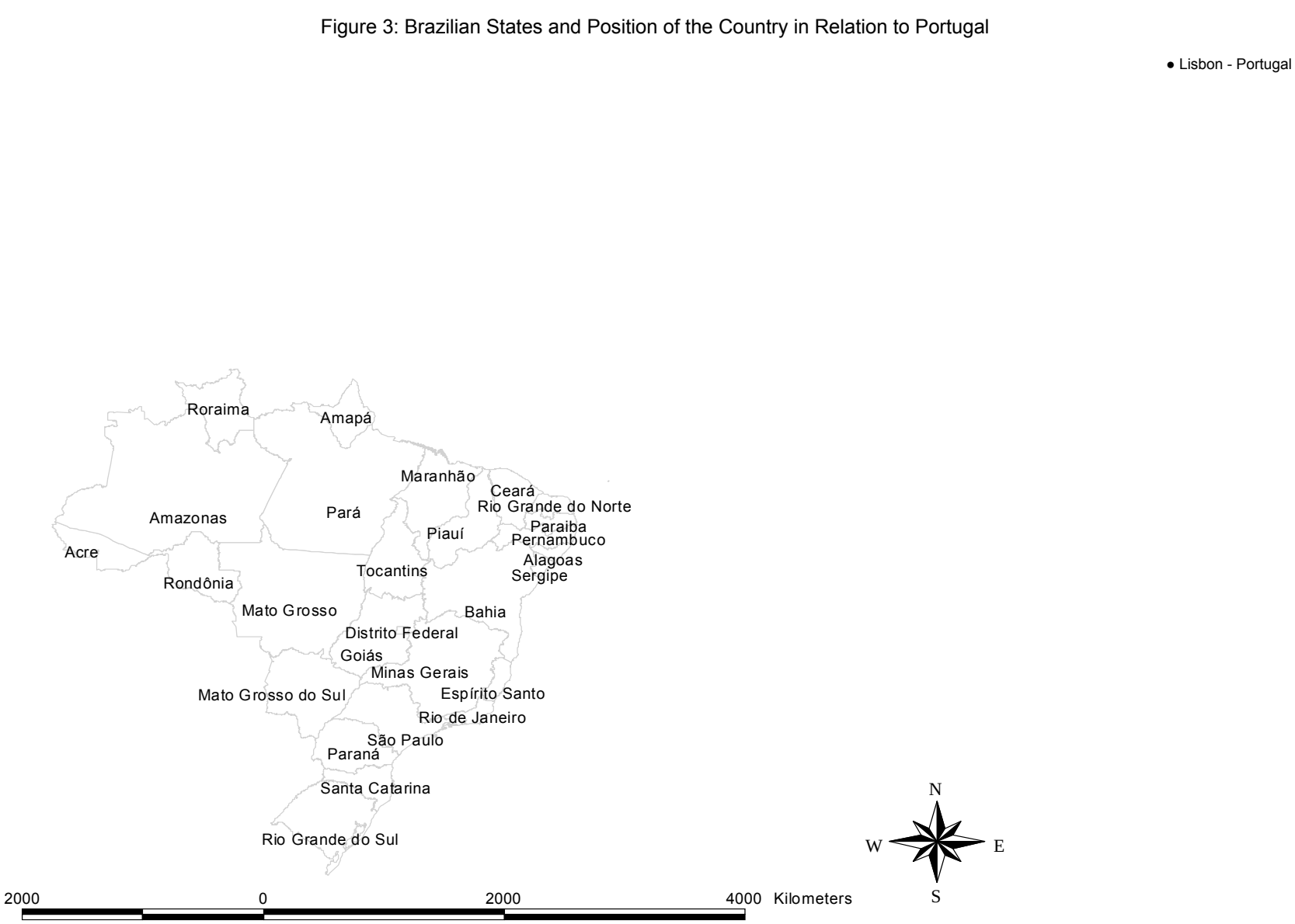

Figure 4: Alternative Definitions of the Influence Functions of the Colonial Cycles

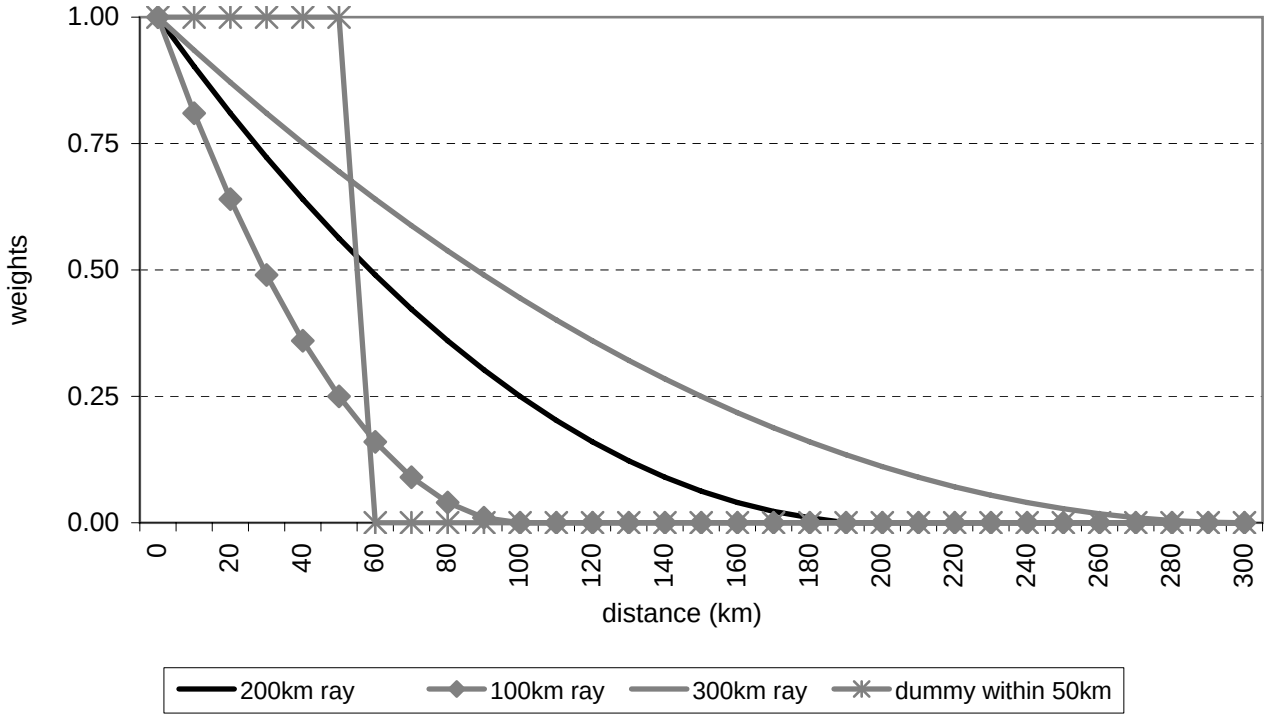

Figure 5: Influence Area of the Sugar-cane Colonial Cycle

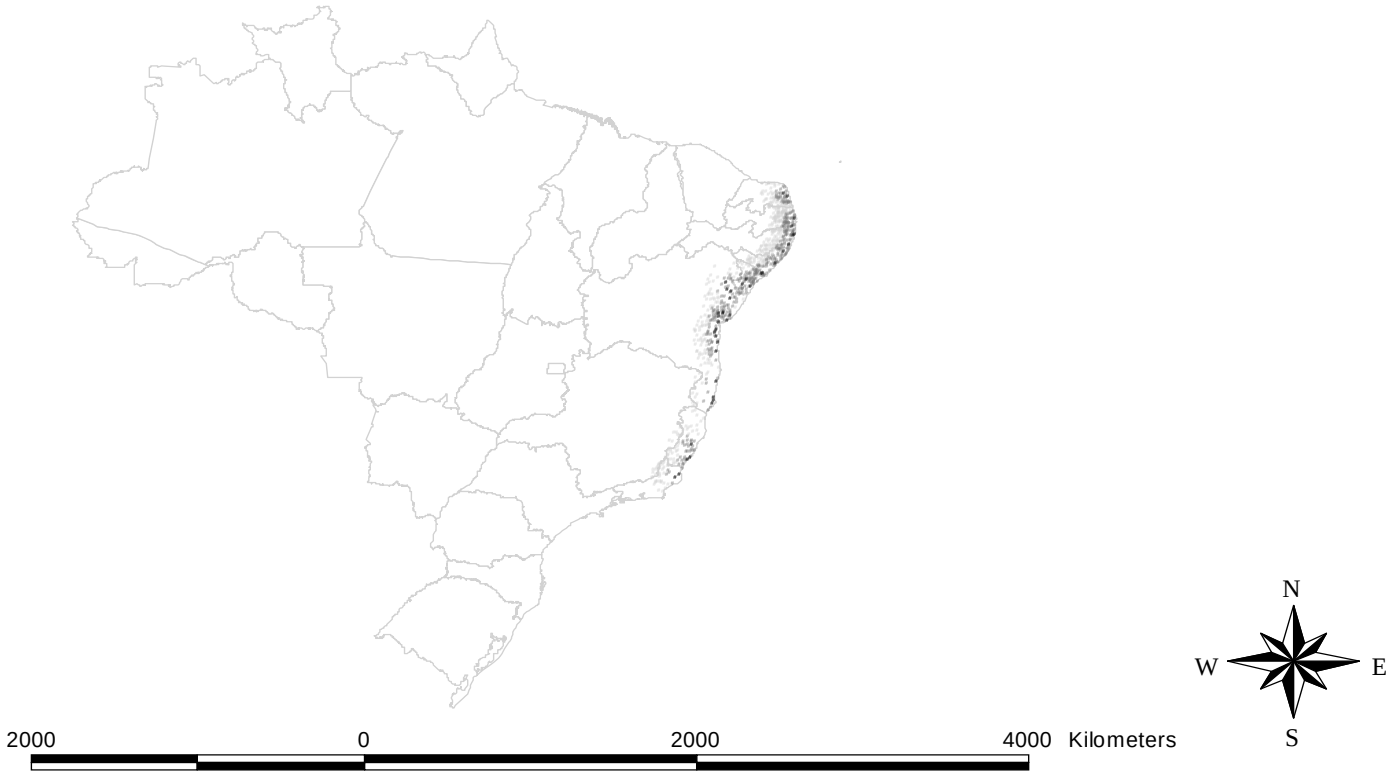

Figure 6: Influence Area of the Gold Colonial Cycle