Institutions and Growth: A Developing Country Case Study

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Abstract: The Brazilian municipalities show an enormous inequality on its development level. Even within the states considered relatively prosperous, there are huge internal disparities on income levels. The richest Brazilian municipality's GDP *per capita* is about 190 times greater than the poorest municipality's, according to IBGE (2000) database. A possible explanation for this phenomenon relies on institutional theory. Many theoretical and empirical studies, mainly based on cross-country data, emphasize the role played by institutions on the determination of long run development. Nevertheless, there still is little research concerning the income differences within the national territory and its connection to institutional quality. The literature points out that institutions matter for the level of economic development because of their effects on political power distribution, generation of economic opportunities, innovation, human capital accumulation, and so on. Based on this assumption, the present study main goal is to analyze the effects of Brazilian municipalities' institutional quality on their GDP *per capita* levels. The results indicate that institutions are relevant and its importance is greater for large municipalities. On the other hand, human capital human capital is more important to small municipalities. To address the endogeneity problem inherent to the relationship between institutions and development, we employ the 2SLS method.

Key words: institutions; income level; Brazilian municipalities.
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Institutions and development in the Brazilian Municipalities

I. Introduction

Given the large disparities observed in the income level across countries, several studies attempt to explain the determinants of economic growth. What factors are responsible for raising the standard of living in a society? Why are some countries rich while others have remained stagnant with a lower level of income? The difference in the level of income per capita is noticeable not only among countries, but also in different regions within the same terriroty. In the Brazilian case, for example, the per capita income divergence between the richest and poorest municipalities is over 190 times.

One possible explanation for these disparities in income levels refers to the difference in institutional quality between regions. Several empirical studies found a high correlation between the degree of institutional development and GDP per capita. The theory suggests that institutions affect the level of income through the distribution of political power, the security of property rights, by generating economic opportunities, stimulating innovation, fostering human and physical capital accumulation, and other ways. Although the cross-country analysis has thrown light on various aspects of the relationship between institutions and economic development, today there is much debate about the effects of institutional quality on income level of different regions within a country [Pande and Udry, 2006].

Given the existence of several candidates to explain income differential between regions, a relevant question would be: in what extent does the current political and economic institutions affect economic performance in a region? At this point we have an important econometric problem: the institutions endogeneity issue. After all, one can argue that the degree of development of a particular region has an important role on its institutions development. To address this problem, several empirical studies instrument institutional quality proxies through geographical and historical variables that are correlated with the formers because of the institutional legacy coming from initial factor endowments and colonization mode [Acemoglu, Johnson and Robinson (2001, 2002, 2004), Engerman and Sokoloff (2002), Hall and Jones (1999), Easterly and Levine (2002)].

To measure the municipalities' institutional framework relevance on their income levels is critical as support for public policies that aim both economic growth and regional income distribution improvement. With this background, the main goal of the present study is to measure the relationship between institutional quality and GDP per capita of Brazilian municipalities. As a proxy for institutional quality, we adopted the Municipal Institutional Quality Indicator (MIQI) elaborated by the Brazilian Planning Ministry. Furthermore, as is customary in this literature, we adopted the following instruments to measure institutional quality of the municipalities: 1) latitude; 2) average annual temperature; and 3) average annual rainfall. According to the best of our knowledge, we are not aware of other study that has taken the same approach for the Brazilian municipalities. The great advantage of our set of instruments is that they are available for most municipalities, thus increasing the degrees of freedom and the results reliability compared to past studies in the same subject.

The econometric results illustrate that differences in municipal institutions are crucial to understanding the diversity of per capita income among Brazilian municipalities. They are consistent with other empirical studies employing Brazilian's datasets, such as those of Naritomi (2007) for the Brazilian municipalities and of Menezes-Filho et al. (2006) for the Brazilian states. Our results are also in conformity with those obtained in the international literature comparing different countries [Acemoglu, Johnson and Robinson (2001, 2002, 2004), Engerman and Sokoloff (2002) and Hall and Jones (1999)].

Besides this introduction, the present paper has four additional sections. The second one introduces a review of theoretical and empirical studies that deal with the concept of institutions and their relationship with long run economic growth, emphasizing institutional differences as a possible cause of income levels discrepancies in different regions within the national territory. The following section provides a description of the variables, the data source, the specification and the estimation method applied. Section 4 empirically tests our hypothesis, including the robustness of the results and the tests to the validity of the instruments, and the last section concludes.

II. The Role of Institutions in Economic Growth

North (1991, p. 97) defines institutions as rules formulated by mankind to shape political, economic and social interactions. They consist of informal constraints (customs, traditions, codes of conduct) and formal rules (constitutions, laws, property rights). According to this author, because the institutional framework evolution over the history of the countries drove their economic changes, it can be seen as a decisive ingredient into their different trajectories of growth, stagnation or decline.

Institutions operate as the rules of the game in a society. Therefore, they ensure ownership rights, providing better or worse distribution of wealth, political power and human capital, foster or discourage innovation, diffusion of technology and investment in physical capital, and then influence resource allocation.

Although there is disagreement about the various ways in which institutions can be related to economic activity, the basic idea emphasized in the literature is that institutions have a key role in economic development process. A considerable number of studies have empirically measured the relationship between institutions and economic growth.

II.1 Cross country analisys

To measure the role of institutions on economic performance requires carefulness, since most economically developed regions are more likely to invest in and sustain good institutional frameworks. That is, there may be a reverse causality between institutions and economic development. The endogeneity of institutions makes it necessary to search for exogenous sources of institutional variation before proceeding with the empirical analysis. Most of the literature that performs cross-country empirical investigation searches in history and geography such exogenous sources of variation. These two sources are interrelated, because geographical variables determine to a large extent the economies evolution. As examples, there are studies that take into account the former European colonies as object of analysis (Acemoglu, Johnson, Robinson, 2001, 2002, Engerman, Sokoloff, 2002).

The premise behind the use of variables representing earlier institutions - clearly exogenous relative to current countries' income - as an instrument for current institutions is the idea of institutional inertia, in which the institutions that develop, whether positive or negative for economic growth, tend to persist over the centuries. Most of the literature on this topic suggests that the differences in initial endowments or geography would be decisive in shaping a country's institutional framework, and via institutional inertia, it would influence the process of economic development and per capita income level [Naritomi (2007)]. Therefore, the geographical characteristics have an indirect effect on economic performance via institutions, but not a direct influence.

Engerman and Sokoloff (2002) studied, for instance, former European colonies in America - the New World - and they sought to explain the origins of economic differences among these countries. Through the investigation of policies and institutions related to the suffrage, land ownership, schooling, immigration, and finance, the authors found out that nations showing a great deal of inequality nowadays are those that had developed institutions with the purpose of benefiting an elite at the expense of the majority of population, and that concentrated political power and access to economic opportunities. Moreover, the colonies that were more uniform in wealth, human capital and political power distribution, were the ones that at the outset established institutions more likely to generate opportunities to a wider segment of the population. Thus, they promoted economic growth more effectively. These different dynamics provide an explanation for the persistence of high inequality among the New World economies.

The factor endowments or initial conditions - such as soil, climate, population size and density of natives - were, as stated by Engerman and Sokoloff (2002), the source of inequality and they have shaped institutions development. Some colonies, like those that became the Caribbean and Brazil, had climate and soil conditions extremely favorable for the production of sugar, coffee, tobacco, and other highly valued goods in the world market. Additionally, they were produced more efficiently on large slavery plantations. For that reason, there was made extensive use of native and african slaves in those colonies, making it possible to achieve considerable economies of scale in the production of the above cited commodities. The widespread slavery contributed to the unequal distribution of wealth, human capital and political power in those regions.

The Spanish America was also characterized by extreme inequality, which began with native labor exploitation for minerals extraction. There was a large contingent of natives and mestizos previously established in these colonies, and Spain adopted a policy of European migration restriction to them. Thus, natives and mestizos predominated in society. In contrast, in the North America colonies, the colonization process, from the outset, was mostly based on the establishment of small family farms that produced mainly grains, employing none or a small number of slaves. These settlements, which became the United States and Canada, had no favorable climate and soil to grow crops like sugar - produced with large-scale slave labor - and they did not have a large native population. The society consisted mainly of European descent workers with a relatively homogeneous human capital level, which contributed to the solidification of institutions that led to widespread participation in politics and economic processes.

Engermann and Sokoloff (2002) highlight the institutions related to education as an important link between the distribution of political power and economic growth. More egalitarian societies tend to invest more in education, and the rising levels of schooling can trigger social and economic changes that lead to growth, such as increased labor productivity, faster technological innovation, and greater popular participation in political and economic activities.

Acemoglu, Johnson and Robinson (2002) also depart from European colonization to investigate institutions development and their relationship with economic growth. They display some evidences that European intervention altered the colonies institutions, and these changes led to a reversal on their income evolution: those colonies that were relatively richer in 1500 are relatively poorer today. Due to the difficulty of measuring economic prosperity around 1500, the authors made use of the degree of urbanization and population density as proxies. Employing both proxies, they observe a negative relationship between economic prosperity in 1500 and today, in many former European colonized countries, even when controlling for a number of variables such as distance from the equator, temperature, humidity, and natural resources.

For the authors, the most plausible explanation for the reversal of fortune is the institutional hypothesis. European colonization brought about an institutional reversal by changing the organization of societies. Less prosperous regions - which were initially the least populated - were those in which European immigrants settled in relatively greater numbers and developed institutions that encouraged investment. The authors classify them as private property institutions that guarantee to a broader range of population access to private property, ensuring greater opportunity for investment, industrialization, and stimulating economic development. In contrast, on the most densely populated and prosperous regions at the time of colonization, it was more profitable for the colonizers to set extractive institutions, which tended, however, to concentrate power in the hands of a small elite, reducing investment, opportunities for industrialization and economic growth.

Acemoglu, Johnson and Robinson (2001) instrumented current institutions quality by means of the settlers' potential mortality rate, on the assumption that it was the major determinant for European settlers' establishment. They believe the number of settlements was crucial for the formation of initial institutions and, finally, that there is a strong correlation between past and present institutions.

In line with Acemoglu, Johnson and Robinson (2001, 2002) and Engerman and Sokoloff (2002) reasoning, Easterly and Levine (2002) also come to cross-country results unfavorable to the geographic hypothesis, presenting evidences that the environmental conditions effects on economic performance occurs only via economic institutions. Their results give support to the interpretation that factor endowments and government policies have no direct influence on economic performance when controlling for institutions, while the later are statistically significant for determining economic development level.

Hall and Jones (1999) also attribute economic performance to institutional quality. By means of a 127 countries sample, they argue that countries reach higher GDP per capita levels when they have higher rates of investment in physical and human capitals, and when they use these inputs more productively. Nonetheless, social infrastructure is essential to accumulate factors of production. That is, the long run economic growth would be determined mainly by the social infrastructure - defined as the set of institutions and government policies that shape economic environment. The authors also acknowledge the reverse causality problem. It is likely that countries with lower income level have fewer resources to develop an effective social infrastructure. To circumvent this problem, they make use of geographic and linguistic variables as institutional instruments (exogenous in relation to current production) because they consider that these aspects reflect the degree in which each country has been influenced by Western Europe - the first region of the world to implement more effectively social infrastructure favorable to production.

II.2. Institutional differences and income level within-country

According to Pande and Udry (2006), the focus of empirical studies that investigate the links between institutional quality and economic development process should focus on micro data analysis. As stated by the authors, studies on institutional and economic development using intra-country databases could improve the understanding of the issues already discussed in the international cross-country analysis literature. Some authors have pointed out some empirical advantages of limiting the analysis to the national level: the sources of institutional variations can be more easily identified and compared in relation to cross-country analysis because the omitted variable bias tends to be lower in within-country analysis than in cross-country analysis. Additionally, some institutions may be directly comparable among regions or municipalities of the same country, but may not be across countries [Iyer (2003); Benerjee and Iyer (2004) and Jimeno (2005) cited by Naritomi (2007)].

Berkowitz and Clay (2004) study the North-America economic performance, using as a source of institutional exogenous variation differences resulting from the adoption of the Civil Law (from French and Spanish colonists) and the Common Law (from British colonists). The analysis results indicate that the Common Law associated institutions tend to perform better, in terms of promoting growth. Thus, the initial conditions (the formation of the North American legal system) would have a significant role in driving their states' legal system evolution, and hence in determining the current economic development level.

Turning to the Brazilian literature on the subject, Menezes-Filho et al. (2006) perform an empirical analysis to test if the hypotheses put forward to explain the differences in income across countries - such as those presented by Hall and Jones (1999), Acemoglu, Johnson and Robinson (2001, 2002), Engerman and Sokoloff (2002) and Easterly and Levine (2002) - are valid to explain differences in income per capita level among the Brazilian states. Their results support the view that institutions do play an important role in explaining Brazilian states income per capita disparities. Additionally, their results points to a strong positive correlation between institutional quality and GDP per capita, even when one takes into consideration the reverse causality between both variables. The authors utilize a range of past period variables that have strong correlation with current institutional quality as the proportion of illiterates (negative correlation), the proportion of voters, and the proportion of immigrants (positive correlation). The Brazilian southern states had lower proportion of illiterates, larger number of electoral votes and a higher proportion of foreign immigrants. There was a positive correlation between latitude and current institutions and, therefore, between latitude and GDP per capita. Using the latitude - strongly correlated with institutional proxies of the past - rather than the quality of current institutions to explain the GDP, they avoided the institutional endogeneity problem: the existing institutions can be influenced by current GDP, but past institutions and latitude are certainly exogenous.

Following the proposition that studies that focus on the relationship between institutions and income level tend to produce more reliable results when employing intra-country database , Naritomi (2007) carries out an investigation for the Brazilian municipalities attaining qualitative results similar to the ones obtained in the analysis of Menezes Filho et al. (2006). The author emphasizes that restricting the empirical analysis to the Brazilian territory may bring about new perspectives. Municipalities have the same political system, a single idiom, i.e., there is uniformity on macro institutions - indexes of democratization, restrictions on executive power, judicial system, among others. Since these macro institutions - which are widely used as sources of institutional variations in cross-country empirical studies - do not differ significantly within the Brazilian territory, we must identify other sources of disparities in economic performance of municipalities.

Despite this macro institutions homogeneity, it is important to highlight that law enforcement varies from region to region in the same country. For example, there are different security levels for land ownership across Brazilian municipalities. This shows that institutional quality that actually prevail in each region varies, and so its impact on the level of economic development. In other words, *de jure* political institutions, - as conceptualized by Acemoglu, Johnson and Robinson (2004) - are fairly constant throughout the national territory, while *de facto* institutions differ4.

Naritomi (2007) utilizes *proxies* as land distribution, political concentration, management capability, and access to justice, to measure the quality of institutions in the empirical analysis. She instruments the institutional *proxies* via two historical episodes: the Brazilian sugarcane and gold cycles. The Two-Stage Least Squares method results points to a relevant effect of institutions - instrumented by historical and geographical variables - in determining the per capita income of the Brazilian municipalities. One drawback of this instrumental variable approach concerns the cities located far from where those cycles took place, especially because it is assumed that their institutions are the same. The direct use of geographic instruments such as latitude, average temperature, and average rainfall may provide a clearer idea of each municipality initial institutions.

III.Methodology and Data

Given the above mentioned advantages in using intra-country databases to investigate the relationship between institutions and income level, we focus our analysis on the 5,507 Brazilian municipalities in 2000. This large sample is employed to investigate whether local institutions can affect the level of economic development (proxied by GDP per capita) under the same macro-institutions like the political and legal systems, the degree of democracy, and so on.

Our empirical analysis is similar to the Menezes-Filho *et al*. (2006) approach, but the proxy to institutional quality used here is more comprehensive, embracing different dimensions of institutional framework. Furthermore, aggregate data by state can hide internal disparities. Even inside the states from South and Southeast regions, considered relatively prosperous when compared to other Brazilian regions, there is a huge inequality in the degree of their development. Thus, using a smaller territorial unit – the municipality – seems more appropriate.

Our explained variable is the GDP *per capita*. GDP and population data were obtained from Census 2000 from the Brazilian Institute of Geography and Statistics (IBGE).

In order to test our hypothesis, we use the Municipality's institutional quality indicator (Iqim) calculated by the Planning, Budget and Management Ministry5 as a proxy to institutional quality. The indicator consists of the average of three measures of institutional development: i) Degree of Participation; ii) Financial Capacity; and iii) Management Capacity.

The first one indicates the extent of populational engagement in public administration. To compute this sub-indicator, the Ministry takes into account the number of municipal councils and its characteristics. The second one considers: the number of inter-municipal consortia, i.e., the association between two or more municipalities to provide some public services more efficiently; the ratio between municipal government debts and net revenue (excluding payroll expenses), in order to capture the municipality's

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4 *De facto* political power is composed of political power from resource distribution, since groups that have financial resources have greater ease in solving their collective problems and imposing their will on society.

5 *Ministério do Planejamento, Orçamento e Gestão* (MPOG).

capability of paying its debt over the time; and real savings *per capita*. Finally, the last one indicates: how recent is the database that supports the IPTU (the Brazilian urban property tax collected by municipal administration)6; the percentage of IPTU default; the number of management tools, and planning tools employed by the municipal government7.

Many variables used as proxies to physical and human capital in other empirical studies are not available for municipalities, but only for states or even countries. Then, as a proxy to physical capital we adopted the urban residential capital stock, from the Applied Economic Research Institute (IPEA). Human capital is represented by two distinct proxies: the human capital stock proposed by IPEA and the average years of schooling of the over-25-years-old population. Physical and human capital stocks *per capita* were included in the regressions as controls.8

Considering that institutions can be endogenous in the sense that richer municipalities can be more capable of and more interested in promoting better institutions, the Ordinary Least Squares (OLS) method used to estimate the impact of institutions over the income is not appropriate because the OLS estimators are biased and inconsistent. In this case, the Two Stage Least Squares (2SLS) is more suitable. Many empirical studies have recently emphasized that initial factor endowments are the main determinant of early (and long-lasting) institutions. For this reason, geographical variables can be used as instruments for quality of currently institutions (Hall e Jones, 1999; Engerman e Sokoloff, 2002; Easterly e Levine, 2002; Menezes-Filho *et al*., 2006).

In Brazil, we can observe a clear geographical pattern concerning institutions, income level and education: states and municipalities situated near the equator exhibit a lower level of the above mentioned variables when compared to the ones located further south. However, it does not mean that geography has a direct effect on the level of development. We stress here that the only channel through which endowment can affect income is through its impact on the quality of early institutions, which according to the inertial hypothesis, tend to persist over years.

It is possible that, even under the same set of macro-institutions, geographical conditions led to the consolidation of different *de facto* institutions among municipalities. In regions close to equator, with hot and humid climate, the activity that has developed more effectively was the agriculture based on large land properties (plantations), leading to the establishment of institutions less favorable to industrialization and development, i.e., *extractive institutions* that ensure economic opportunities only to a small fraction of society, as defined by Engerman and Sokoloff (2002). On the other hand, in the regions where climate was not appropriate for this kind of activity, namely the regions farther from the equator, the environment was more promising to the establishment of *private property* institutions that ensure economic opportunities for a broad section of the society, providing incentives to investment, industrialization and long-run development.

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6 This database supplies necessary information for the IPTU calculus, namely which areas are subject to this kind of taxation and the estimated value of the properties that will be taxed. The municipal administration must constantly update the database in order to establish fair taxation.

7 Management tolls: existence of district administration and administrative regions, Subprefecture, master plan, land subdivision law, zoning law or equivalent, building codes and posture code. Planning instruments: existence of government plan, strategic plan and ‘organic law’.

8 In some specifications, human capital stock was treated as endogenous and thus was instrumented in first stage regressions. By doing this we address the Glaeser critique.

To address the endogeneity problem, the geographical variables included in the first stage regressions as instruments for the institutional quality indicator were: i) the absolute value of latitude, representing the distance from the equator; ii) the average annual rainfall in mm; and iii) the average annual temperature in degrees. The data were taken from IPEA. Appendix 1 summarizes the database employed and its source description. The instrumental variable that presented higher correlation with Iqim was latitude (-0.53). The negative sign indicates that the closer the municipality is to the equator, the worse is its institutional quality.

The described data were employed to estimate the impact of institutions over GDP *per capita* in a cross section of Brazilian municipalities in 2000. The 2SLS regressions specifications were the following:

First stage: $$Iqim_i = \propto_0 + \propto_1 Z_i + \propto_2 K_i + \propto_3 H_i + \varepsilon_i$$

Second stage: $$GDP_i = \beta_0 + \beta_1 \widehat{Iqim}_i + \beta_2 K_i + \beta_3 H_i + \mu_i$$

where $Iqim_i$is the institutional quality indicator for the municipality i, Z_i is a set of instrumental variables, K_i is the proxy for capital stock *per capita* and H_i is either the proxy for human capital stock *per capita* or average years of schooling. On the second stage, GDP_i is *per capita* GDP and $\widehat{Iqim}_i$ is the predicted value of Iqim in the first stage. The error terms in first and second stage regressions are ε_i and μ_i respectively.

IV. Empirical results

Table 1 introduces the descriptive statistics of the variables. Complete descriptions of all variables (and their respective sources) are in the appendix. It is worth noting the enormous disparities between Brazilian localities. The GDP per capita difference between the richest and the poorest municipalities is about 190 times. Similar disparities are also present in both the human capital stock per capita and the physical capital stock per capita across municipalities.

Table 1: Descriptive Statistics

Variable	Average	Standard-deviation	Number of observations	Minimum	Maximum
h	24.312	(5.816)	5507	11.153	59.520
k	3.050	(2.339)	5506	0.045	19.210
GDP per capita	4.136	(4.772)	5507	0.641	123.701
latitude	16.417	(8.226)	5507	0.038	33.691
rain	116.108	(36.603)	4974	28.870	282.433
temp	22.730	(2.987)	4974	14	28.041
pop	30,833.3	(186,750.6)	5507	795	1.04e+07
iqim	3.026	(0.552)	5506	1	4.9

Table 2 presents the OLS regressions. In all regressions h per capita and k per capita are important determinants of the GDP per capita. However, the inclusion of the *proxy* for the institution's quality (iqim) decreases the magnitude of the effect of h over GDP per capita. It is important to stress that the effect of iqim over GDP per capita is always positive and statistically significant. According to Table 2, an increase by 1 point in iqim raises the GDP per capita of the municipality between R$ 1,031 and R$ 1,269. Since the average GDP per capita is equal to R$ 4,136 an increase by 1 point in iqim's average is able to increase the GDP per capita average by an value between 24.9 and 30.7 percent.
In the literature about institutions a common claim refers to the endogeneity problem. That is, the processes through which institutions are formed are not exogenous. The quality of institutions would be dependent on income per capita, so it would be endogenous. Our approach to overcome this problem is to instrument IQIM by clearly exogenous variables as latitude, average temperature (temp) and a pluviometric index (rain). In the last column of Table 2, it is possible to verify that all instruments are positively and significantly correlated to GDP per capita.

Table 2: OLS Regressions. Dependent variable: GDP per capita*

Dependent variable is GDP per capita in 2000 (thousands)					
Variable	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
h	0.2559 (0 .0187)***	0.3179 (0.0115)***	0.1841 (0.0197)***	0.1567 (0.0203)***	0.1018 (0.0217)***
k (2000)	0.3733 (0.0465)***		0.3853 (0.0461)***	0.38405 (0.0460)***	0.4969 (0.0479)***
latitude				0.0483 (0.0092)***	0.1123 (0.0171)***
rain					0.0079 (0.0016)***
temp					0.2001 (0.0410)***
pop					-5.67e-07 (3.07e-07)**
iqim		1.2698 (0.1221)***	1.2947 (0.1215)***	1.0313 (0.1313)***	1.0560 (0.1368)***
const.	-3.2262 (0.3465)***	-7.4374 (0.3233)***	-5.4347 (0.4011)***	-4.7601 (0.4205)***	-10.4578 (1.1810)***
observ.	5,506	5504	5503	5503	4971
adj. R^2	0.2281	0.2341	0.2436	0.2471	0.2635

*** significant at 1%; ** significant at 5%; * significant at 10%. h is municipality human capital per capita in 2000, k (2000) is municipality physical capital per capita in 2000, latitude is municipality distance from equator in module, rain is a pluviometric index, temp is a index for municipality mean temperature, pop is municipality population in 2000, iqim is the municipality institutional proxy, const is the regression intercept, observ. is the observations number, and adj. R^2 is the adjusted coefficient of determination.

To address this issue Table 3 presents the results by instrumental variables regressions. Iqim is instrumented by the three above mentioned exogenous variables and test diagnostics are presented at the end of Table 3.
The Durbin-Wu-Hausman test (DWH) verifies the endogeneity of the iqim. A rejection of the null hypothesis indicates that iqim must be treated as endogenous. The Sargan test (Sargan) verifies the quality of the instruments, wherein a rejection of the null casts doubt on their validity. The Anderson canonical correlation test (ACC LR) verifies whether the equation is identified, that is, whether the

excluded instruments are relevant (correlated with the endogenous regressors). A rejection of the null indicates that the model is identified. To test for the presence of weak instruments we present Stock and Yogo (2005) critical values (SY) for the Cragg-Donald F statistic. A rejection of the null indicates that the instruments are not weakly identified.

In the first column, the only instrumented variable is iqim. The 2SLS regression results suggest that human capital has a smaller impact than OLS results while the opposite holds for iqim. Nevertheless, Sargan's test indicates that fitted iqim in the second stage is still correlated to the regression residuals. Because all variables that are not considered endogenous in the 2SLS regression are employed as instruments in the first stage, one possible explanation is that human capital is also an endogenous variable, explaining the correlations between fitted iqim and the regression residuals. If this is the case, it is appropriate to instrument human capital, as well.

In the next six specifications of Table 3, both human capital and iqim are instrumented by latitude, rain and temperature. In columns (2) to (7), the results indicate that human capital has a significant positive effect on GDP per capita and its magnitude is more important than we could conclude when it was not instrumented, and its coefficient is fairly stable, except in column (6). Physical capital has a negative effect and is significant in almost all regression results. The difference between columns (2) and (3) results is that the physical capital proxy is lagged in the latter (1991 values) to control for reverse causality. The results remain quite stable with this change.

The 2SLS regressions suggest a slightly lower effect of iqim over GDP per capita, except in the results presented in columns (4) and (6), but its coefficient is not significant in the latter. Relying in which set of regressors is considered more appropriate, the effect of iqim ranges from R$ 804 to R$ 2,215, excluding the results of columns (1) and (6). These values imply that an increase in the average iqim by 1 point is able to enhance the average GDP per capita between 19.4 and 53.5 percent. Because the iqim effects in GDP per capita are closer to the former one in most specifications (19.4%), the instrumented variables results indicate, as expected, that institutions have a smaller impact on GDP per capita when one controls for the reverse causality problem.

The regressions results illustrated in columns (4) to (6) indicate that the instruments have no direct impacts on GDP per capita because their coefficients are not statistically different from zero when their influence on institutions are taken into account. In addition, Durbin-Wu-Hausman tests (DWH) point to the endogeneity of institutions and human capital, Anderson canonical correlation tests (ACC LR) are evidence for relevant excluded instruments, Stock and Yogo critical values (SY) indicates that instruments are not weak, and Sargan tests point that fitted values of the endogenous variables are not correlated to the regressions residuals.

Table 3: IV Regressions. Dependent variable: GDP per capita* (iqim=latitude)

Dependent variable is GDP per capita in 2000 (thousands)							
Variable	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
h	0.0871 (0.0258)***	0.5189 (0.0741)***	0.4687 (0.0729)***	0.5164 (0.0752)***	0.4969 (0.0754)***	0.0516 (0.3531)	0.5138 (0.0739)***
k (2000)	0.4321 (0.0475)***	-0.2641 (0.1218)**		-0.3201 (0.1293)**	-0.2133 (0.1261)*	0.3190 (0.4489)	-0.2243 (0.1206)*
k (1991)			-0.2664 (0.1465)*				
latitude				-0.0438 (0.0301)			
rain					0.0027 (0.0018)		
temp						0.2619 (0.1927)	
pop							-8.89e-07 (3.15e07)***
iqim	2.8702 (0.3285)***	0.8966 (0.4605)**	1.0089 (0.5607)*	2.2157 (1.020)**	0.8046 (0.4628)*	5.9521 (3.7533)	0.81488 (0.4623)*
const.	-8.074 (0.6820)***	-10.505 (0.7952)***	-10.051 (0.7529)***	-13.546 (2.2420)***	-10.161 (0.8255)***	-22.173 (8.6286)***	-10.228 (0.7886)***
Obser.	4971	4971	4489	4971	4971	4971	4971
Adj. R^2	0.2308	0.2066	0.2199	0.1850	0.2131	0.0690	0.2095
DWH [a] (p-value)	26.7735 (0.0000)	67.9219 (0.0000)	65.1513 (0.0000)	43.6170 (0.0000)	48.33325 (0.0000)	67.14461 (0.0000)	62.8632 (0.0000)
Sargan [b] (p-value)	42.195 (0.0000)	2.169 (0.1408)	1.652 (0.1986)	0.000 EEI[e]	0.000 EEI[e]	0.000 EEI[e]	3.053 (0.0806)
ACC LR [c] (p-value)	825.984 (0.0000)	298.029 (0.0000)	230.921 (0.0000)	97.678 (0.0000)	297.567 (0.0000)	7.204 (0.0073)	296.724 (0.0000)
S Y [d] Ho at 10 %	299.162 13.43	102.278 13.43	78.900 13.43	49.272 7.03	153.172 7.03	3.601 7.03	101.797 13.43

*** significant at 1%; ** significant at 5%; * significant at 10%. In column (1) iqim is instrumented by latitude, rain, temp, h and k in 2000. In column (2) iqim and h are instrumented by latitude, rain, temp and k in 2000. In column (3) iqim and h are instrumented by latitude, rain, temperature, and k in 1991. In columns (4), (5) and (6) iqim and h are instrumented by latitude, rain, temperature, and k in 2000. In columns (7) iqim and h are instrumented by latitude, rain, temperature, pop., and k in 2000. a: the Durbin-Wu-Hausman test for endogeneity. A rejection of the null indicates that iqim must be treated as endogenous. b: the Sargan test that verifies the quality of the instruments. A rejection of the null casts doubt on the validity of the instruments. c: the Anderson canonical correlation test that verifies whether the equation is identified. Rejection of the null indicates that the model is identified. d: the Stock and Yogo critical values for the Cragg-Donald F statistic. A rejection of the null indicates that the instruments are not weakly identified. Values in brackets are standard deviations. e: EEI means Equation Exactly Identified.

Table 4 presents the IV regressions in the logarithm of the variables. The specifications are the same as in Table 3, but the variables are in natural logarithm, so the coefficients can be interpreted as elasticities. In column (1), iqim is the only instrumented variable, and the Sargan test points toward a correlation between fitted iqim values and the regression residuals. In the next specifications, both human capital and institutions are instrumented, and this seems to solve the endogeneity problem. After this change, there is no correlation between fitted iqim and h with regression residuals.

The regressions results are evidence of the relevance of human capital in the determination of Brazilian municipalities' income per capita. A 1 percent increment in h increases GDP per capita between 3.76 and 4.12 percent, excluding column (6) results. A similar increase in k has an effect of reducing GDP per capita from 0.57 to raising it to 0.45 percent, in the last column. However, the Sargan test indicates that the inclusion of pop as a regressor in the second stage (results in the last column) and as an instrument in the first stage turns the instrumented variables from exogenous to endogenous, biasing the estimated coefficients.

Table 4 gives a better idea of the importance of the quality of the institutions to improve income. Excluding results from columns (1) and (6), a 10 percent increase in institutions *proxy* generates an improvement in GDP per capita between 11.8 and 15.0 percent. The effects of institutions are relatively stable over the distinct specifications, which indicate the results robustness. Once more, the regressions results illustrated in columns (4) to (6) point out that each instrument has no direct effects o GDP per capita because its coefficient is not statistically different from zero when its influence on institutions are taken into account.

Table 4: IV Regressions in Log. Dependent variable: LGDP per capita* (Liqim=latitude Leduc)

Dependent variable is GDP per capita in 2000 (thousands)							
Variable	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Log h	0.6165 (0.0908)***	4.1297 (0.3095)***	3.7651 (0.2977)***	4.1277 (0.3109)***	4.0499 (0.4310)***	5.0369 (3.6476)	3.9069 (0.2845)
Log k (2000)	0.1274 (0.0205)***	-0.5712 (0.0623)***		-0.5726 (0.06265)	-0.5531 (0.0923)***	-0.6931 (0.4924)	0.4494 (0.0553)***
Log k (1991)			-0.3611 (0.0628)***				
Log latitude				-0.0059 (0.0230)			
Log rain					0.0104 (0.0396)		
Log temp						-0.4416 (1.7687)	
Log pop							-0.0807 (0.0076)
Log iqim	3.0706 (0.1531)***	1.4664 (0.2043)***	1.1825 (0.2342)***	1.5094 (0.2635)***	1.476 (0.2062)***	0.2582 (4.8433)	1.1823 (0.1978)***
Const.	-4.293 (0.2046)***	-13.085 (0.7682)***	-12.054 (0.7333)***	-13.108 (0.7768)	-12.907 (1.0165)***	-13.1616 (-13.161)***	-11.411 (0.6794)***
Obser.	4971	4971	4489	4971	4971	4971	4971
Adj. R^2	0.3498	0.3479	0.4366	0.3425	0.3592	0.2865	0.4274
DWH [a] (p-value)	411.426 (0.0000)	642.811 (0.0000)	541.446 (0.0000)	400.131 (0.0000)	322.455 (0.0000)	467.607 (0.0000)	521.934 (0.0000)
Sargan [b] (p-value)	141.594 (0.0000)	0.068 (0.7939)	0.887 (0.3463)	0.000 EEI[e]	0.000 EEI[e]	0.000 EEI[e]	8.279 (0.0040)
ACC LR [c] (p-value)	609.094 (0.0000)	214.283 (0.0000)	163.513 (0.0000)	181.424 (0.0000)	136.101 (0.0000)	0.630 (0.4274)	211.376 (0.0000)
S.Y. [d]	215.733	72.916	55.447	92.295	68.921	0.315	71.891
Ho at 10 %	9.08	13.43	13.43	7.03	7.03	7.03	13.43

*** significant at 1%; ** significant at 5%; * significant at 10%. In column (1) lniqim is instrumented by lnlatitude, lnrain, lntemp, lnh and lnk in 2000. In column (2) lniqim and lnh are instrumented by lnlatitude, lnrain, lntemp and lnk in 2000. In column (3) lniqim and lnh are instrumented by lnlatitude, lnrain, lntemperature, and lnk in 1991. In columns (4), (5) and (6) lniqim and lnh are instrumented by lnlatitude, lnrain, lntemperature, and lnk in 2000. In columns (7) lniqim and lnh are instrumented by lnlatitude, lnrain, lntemperature, lnpop, and and lnk in 2000. a: iDurbin-Wu-Hausman test for endogeneity. A rejection of the null indicates that iqim must be treated as endogenous. b: the Sargan test that verifies the quality of the instruments. A rejection of the null casts doubt on the validity of the instruments. c: the Anderson canonical correlation test that verifies whether the equation is identified. A rejection of the null indicates that the model is identified. d: the Stock and Yogo critical values for the Cragg-Donald F statistic. A rejection of the null indicates that the instruments are not weakly identified. Values in brackets are standard deviations. e: EEI means Equation Exactly Identified.

Table 5 sort the sample by population size. One important finding is that human capital is more important to small municipalities. Its effect on GDP per capita rises when municipalities' inhabitants range from 5,000 to 20,000; and declines greatly for municipalities over 50,000. However, Stock and Yogo critical values indicate that the instruments are not weakly identified when it is considered just the municipalities over 50,000 inhabitants – columns (4) and (5). Because only human capital coefficients turn out to be not statistically different from zero, the instruments are weakly identified only with human capital in those municipalities. Iqim's coefficients remain statistically different from zero and its influence on income per capita rises with municipalities' size.

In fact, the quality of the municipality institutions is always an important determinant of the GDP per capita. However, this importance is greater for large municipalities. When they have less than 20,000 inhabitants, an increment of 1 percentage point in iqim has a less than proportional positive impact on GDP per capita. For municipalities over 50,000 inhabitants, the same percentage increase in iqim has a positive impact of about 3.5 percent.

Sargan tests reveal that physical capital in 1991 is a better instrument than physical capital in 2000, as expected, mainly for small municipalities. In addition, Durbin-Wu-Hausman tests (DWH) point to the endogeneity of institutions and human capital, and Anderson canonical correlation tests (ACC LR) are evidence for relevant excluded instruments.

Table 5: IV Regressions. Dependent variable: GDP per capita* (iqim= educ pop)

Dependent variable is GDP per capita in 2000 (thousands)												
Variable	**< 5,000 (1)**		**< 10,000 (2)**		**< 20,000 (3)**		**> 50,000 (4)**		**> 70,000 (5)**		**Whole Sample (6)**	
Log h	3.42 (0.4606)***	3.19 (0.4536)***	3.77 (0.3788)***	3.323 (0.3523)***	4.211 (0.2972)***	3.676 (0.2759)***	1.24 (1.2981)	1.03 (1.1395)	- (2.1015)	0.32 (1.2455)	4.129 (0.3095)***	3.76 (0.2977)***
Log k (2000)	- (0.0745)***		- (0.0619)		- (0.0517)***		- (0.3354)		0.56 (0.5294)		- (0.0623)***	
Log k (1991)		- (0.0646)		- (0.0457)***		- (0.0380)***		- (0.2678)		0.21 (0.3154)		- (0.0468)***
Log iqim	0.84 (0.2680)***	0.92 (0.3149)***	0.93 (0.2448)***	0.882 (0.2657)***	0.881 (0.2042)***	0.763 (0.2212)***	3.50 (0.9256)***	3.86 (0.9160)***	3.48 (1.3824)***	3.54 (1.2549)***	1.466 (0.2043)***	1.18 (0.2342)***
Const.	- (1.1897)***	- (1.2018)***	- (0.9348)***	- (0.8790)***	- (0.7280)***	- (0.6776)	- (3.5247)*	- (3.2380)**	- (6.2325)	- (4.0601)	- (0.7682)***	- (0.7333)***
Obse	1034	766	2188	1795	3498	3040	519	513	352	347	4971	4489
Adj.	0.29	0.36	0.34	0.432	0.372	0.460	0.18	0.10	0.19	0.21	0.347	0.43
DWH (p-value)	94.2 (0.0000)	76.9 (0.0000)	253. (0.0000)	179.9 (0.0000)	458.5 (0.0000)	346.2 (0.0000)	25.4 (0.0000)	32.0 (0.0000)	6.29 (0.04288)	7.10 (0.02860)	642.8 (0.0000)	541. (0.0000)
Sarga (p-value)	5.25 (0.0218)	1.50 (0.2194)	6.65 (0.0099)	1.726 (0.1890)	10.90 (0.0010)	10.40 (0.0013)	0.33 (0.5658)	0.43 (0.5092)	1.38 (0.2391)	1.96 (0.1609)	0.068 (0.7939)	0.88 (0.3463)
ACC	79.4	67.8	117.	98.93	196.5	160.5	15.4	23.3	4.31	9.94	214.2	163.

(p-value)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0004)	(0.0000)	(0.1156)	(0.0069)	(0.0000)	(0.0000)
S.Y. [d]	27.3	23.4	40.1	33.81	67.29	54.86	5.17	7.88	1.42	3.31	72.91	55.4
Ho 10	13.4	13.4	13.4	13.43	13.43	13.43	13.4	13.4	13.4	13.4	13.43	13.4

*** significant at 1%; ** significant at 5%; * significant at 10%. In all columns lniqim is instrumented by lnlatitude, lnrain, lntemp, lnh and lnk in 2000, in the left and lniqim is instrumented by lnlatitude, lnrain, lntemp, lnh and lnk in 1991, in the right. a: Durbin-Wu-Hausman test for endogeneity. A rejection of the null indicates that iqim must be treated as endogenous. b: the Sargan test that verifies the quality of the instruments. A rejection of the null casts doubt on the validity of the instruments. c: the Anderson canonical correlation test that verifies whether the equation is identified. Rejection of the null indicates that the model is identified. d: the Stock and Yogo critical values for the Cragg-Donald F statistic. A rejection of the null indicates that the instruments are not weakly identified. Values in brackets are standard deviations.

V. Concluding remarks

The idea that a country's institutional framework is an important element to promote its development has gained attention recently. The empirical literature do test this hypothesis has growth rapidly (Hall & Jones, 1999; Acemoglu, Johnson & Robinson, 2001, 2002, Engerman & Sokoloff, 2002; Easterly & Levine, 2002; Menezes-Filho *et al*., 2006; Naritomi, 2007). Although, the research concerning the relationship between these two variables employing intra-country databases is on the onset

Analyzing a sample of the 5507 Brazilian municipalities in 2000, and being aware of the macro-institutions homogeneity along the national territory, the results suggests that local institutions matter to the GDP *per capita* level determination, even when the causality problem is taken into consideration.

It is also important to highlight that the regressions results suggests that each instrument has no direct effects on GDP per capita because its coefficient is not statistically different from zero when its influence on institutions are taken into account. This result favors the institutional approach.

Moreover, institutional quality seems to be more essential in greater municipalities. One potential explanation for this result is that informal institutions matters in small municipalities because people now each other, while in bigger cities formal institutions have a more important role. On the contrary, human capital is more important in small ones. A possibility to explain this phenomenon is that the instruments are weakly identified with human capital only in bigger municipalities.

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APPENDIX 1

Table 6: Data description

Variable	Description	Source
h	Human capital stock, estimated as the expected present value of annual earnings (discounted at 10% per year) associated with education and experience (age) of working-age population (15 to 65 years), *per capita*.	IPEA
k (2000)	Urban residential capital stock *per capita* in 2000	IPEA
k (1991)	Urban residential capital stock *per capita* in 1991	IPEA
GDP per capita	Gross domestic product *per capita*	IBGE
Latitude	Absolute value of latitude representing the distance from equator	IPEA
Rain	Average annual rainfall in mm	IPEA
Temp	Average annual temperature in degrees	IPEA
Iqim	Municipality's institutional quality indicator	MPOG
Pop	Municipality's population according to Censo 2000	IBGE
Educ	Average years of schooling of over-25-years-old population	IPEA

Table 7: Source description

IBGE	Brazilian Institute of Geography and Statistics *(Instituto Brasileiro de Geografia e Estatística)*
IPEA	Applied Economic Research Institute *(Instituto de Pesquisa Econômica Aplicada)*
MPOG	Planning, Budget and Management Ministry *(Ministério do Planejamento, Orçamento Gestão)*