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Institutions or human capital: which is more important for economic performance? Evidence from Brazil

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Abstract

We investigate the role of institutions and human capital on economic performance of Brazilian municipalities. We use instrumental variables with two-stage least squares estimators for capturing causal relationships. We found evidence that institutional quality has an important and robust effect on the income of municipalities. However, there is no robust evidence for the role of human capital. These results are similar to what Acemoglu, Galleano and Robinson (2014) documented in their research conducted with cross-country data. Human capital is likely to be a consequence of institutions.

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1. Introduction

We empirically evaluate the effects of institutions and human capital on the differences observed in average level of per capita household income among Brazilian municipalities. The intention is to identify which of these two factors is the most important for determining the economic performance of municipalities.

The discussion of institutions versus human capital has been controversial for more than fifteen years in the literature of economic growth. On one hand, there is a series of researches by Daron Acemoglu and co-authors who claim supremacy of the role of institutions in determining the economic performance of regions and countries around the world (see Acemoglu, Johnson and Robinson, 2001; Acemoglu, Johnson and Robinson, 2002; Acemoglu, Johnson and Robinson, 2005; Acemoglu and Robinson, 2012; and Acemoglu, Gallego and Robinson, 2014).

From a theoretical point of view, that supremacy would occur because in an adequate institutional environment (protection of private property, compliance with contracts, freedom in the labor market, etc.) there would also be a favourable business environment able to stimulate investments in physical and human capital, since the private initiative would be able to obtain gains from the success of investments in technological innovation. Thus, institutions would be responsible for the high levels of per capita income observed in the richest countries and regions, as empirically documented for the first time by Acemoglu, Johnson and Robinson (2001).

On the other hand, Glaeser et al. (2004) raised several critical points on the empirical exercises performed in the first studies of Acemoglu (e.g. inadequacy of proxies for the institutions and fragility of assumption of instruments exclusion). Glaeser and co-authors indicates that human capital is the central element behind the differences in economic performance observed in the research of Acemoglu, Johnson and Robinson (2001), and not the institutions. For pro-human capital researchers, the institutional environment is the result of the increase in physical and human capital, and not its cause. This is because, as the population becomes more enlightened and educated, experiencing higher living standards, it demands an improvement in the institutional environment, in order to guarantee its achievements (see Glaeser et al., 2004).

Considering the controversies in the literature presented above, our aim here is to contribute with one more empirical evidence for the debate. In particular, we will contribute studying empirically the role of institutions and human capital in explaining economic inequalities within a large country as Brazil, which still has an moderate level of development, plentiful poverty and income inequality (see Medeiros, Souza and Castro, 2015)

We will address the classic problem of endogeneity of educational and institutions variables in economic performance equations in a similar way as that was done by Acemoglu, Gallego and Robinson (2014): instrumental variables for both institutional quality and human capital. We will perform estimates using the two-stage least squares method (2SLE).

There are already some interesting studies on institutions and development for Brazil. Naritomi, Soares and Assunção (2012) evaluated the historical factors and episodes of Brazil that were determinants to shape current institutions and the performance of some economic indicators of local economies around the country, such as the provision of public goods. Nakabashi, Pereira and Sachsida (2013) attempted to estimate the role of institutions in the economic growth of municipalities by instrumentalizing institutions with local geographical characteristics. However, Nakabashi and co-authors did not accommodate properly the possibility that human capital is also an endogenous variable in the equations relating economic performance and institutions. In some econometric specifications they used geographical variables (latitude, rain and temperature) as instruments for human capital, what does not seem

to be reasonable, because there is no theory that support this procedure. A central criticism of Acemoglu, Gallego and Robinson (2014) to the empirical exercise performed by Glaeser et al. (2004) is that human capital needs a good exogenous variation. Another interesting study for municipalities in Brazil is Carvalho Filho and Monasterio (2012). They evaluate the long-term consequences of the European immigration programs that existed in the period prior to World War I. They found evidence that cities which participated of that program has currently lower poverty rates.

About our results, evidence obtained from the application of the instrumental variables method in two-stage estimation shows that human capital, measured by the average schooling of people aged 25 or over, becomes insignificant when controlled by the effect of the institutions. However, the effect of institutions, conditional to the level of human capital, is largely significant, indicating the supremacy of institutions in promoting economic performance. This result is very close to what had been observed by Acemoglu, Gallego and Robinson (2014) in their country estimates.

2. Empirical Strategy and Data

The main equation to be estimated is the following:

$$y_m = \alpha_0 + \alpha_1 IQ_m + \alpha_2 H_m + \phi' X_m + \varepsilon_m \quad (1)$$

where y_m is the economic performance variable in the municipality m, IQ_m is the institutional quality of the municipality m, H_m is the human capital of the municipality m, X_m is the set of geographic control variables and ε_m is the random error term.

As we know from literature, probably $Cov(IQ_m, \varepsilon_m) \neq 0$ and $Cov(H_m, \varepsilon_m) \neq 0$, which does not allow the use of Ordinary Least Squares estimators to identify causality. To overcome this issue, the chosen empirical strategy consists in the use of instrumental variables with estimation via the two-stage least square method (2SLE). In the first stage, the endogenous variables (institutional quality and human capital) are estimated from the instruments and the exogenous variables. The equations for the first stage are the following:

$$IQ_m = \beta_0 + \beta_1 Z_{1m} + \beta_2 Z_{2m} + \delta' X_m + \nu_m \quad (2)$$

$$H_m = \gamma_0 + \gamma_1 Z_{1m} + \gamma_2 Z_{2m} + \rho' X_m + \upsilon_m \quad (3)$$

where Z_{1m} is the instrument for institutional quality, Z_{2m} is the instrument for human capital, X_m is the set of exogenous covariates and ν_m and υ_m are the idiosyncratic errors terms.

The second stage consists of replacing the endogenous variable of the equation (1) for their predicted values, $\widehat{IQ}_m$ and $\widehat{H}_m$, obtained in the first stage estimations. This generates the following equation:

$$y_m = \alpha_0 + \alpha_1 \widehat{IQ}_m + \alpha_2 \widehat{H}_m + \phi' X_m + \varepsilon_m \quad (4)$$

The set of parameters to be estimated are $(\alpha_0, \alpha_1, \alpha_2, \phi')$, so that α_1 and α_2 are the coefficient of interests, since they represent the impact of the institutional quality and the human capital on the average household income per capita of municipalities, respectively.

The dependent variable y_m, is the logarithm of average household income per capita in 2010, obtained through the Demographic Census of that year (Brazilian Institute of Geography and Statistics – IBGE). The variables that represent institutions (IQ_m) and human capital (H_m) are, respectively, the Municipal Institutional Quality Index of 2000, calculated by the Brazilian Ministry of Planning, and the average schooling of people aged 25 or over in 2010, from the Demographic Census (IBGE).

Regarding the institutions variable, the index varies from 1 to 6 (with values closer to 6 representing higher quality of institutions) and is composed of the following sets of indicators, that receive equal weights: (i) degree of participation of the population in political decisions; (ii) municipal financial capacity; and (iii) municipal management capacity. The first

set seeks to measure the involvement of the population in the municipalities' administration, which is done by quantifying the existing municipal councils and their characteristics. The second is the financial capacity of the municipalities, which is measured by accounting for the number of inter-municipal consortia, the ratio of current revenue to municipal debt, and the actual savings per capita. The third and final set aims at evaluating the municipalities' management capacity, which is based on the updating of the venal value of properties, used to calculate the amount to be paid as Urban Land and Territorial Tax (IPTU), on the degree of compliance with this tax and on management and planning indicators.

The elements of the Institutional Quality Index summarize the quality of public administration and the political participation of individuals. Those elements are probably highly correlated with the quality of the business environment in the municipalities level. The literature that points out the role of institutions in determining economic performance supports the thesis that the one of the main mechanism that links institutions and development is the role of institutions in shaping the business environment. A good "bundle" of institutions may improve the possibilities of doing business which is a fundamental condition for an active entrepreneurial behaviour. Entrepreneurship causes investment in technology (new markets, products, arrangements of production, etc.), and, as we have already known for economic growth research, the advance in technology is in the heart of prosperity. This mechanism has exhaustive been discussed in a country level analysis, but we believe that "the bridge" that connects institutions and economic performance in a municipalities level is the same: business environment.

Also, it is worth to mention that it is not a simple task measuring institutions. As Glaeser et al. (2004) pointed out, institutions are a very broad concept and its usual measures may fail in accomplish the task to evaluation impacts because they do not capture adequately all the extension of what the concept of institutions means. According to Glaeser and colleagues own words "most indicators of institutional quality used to establish the proposition that institutions cause growth are constructed to be conceptually unsuitable for that purpose". Acemoglu et al. (2001) themselves had already recognized that error measurement in institutions variables were important issues for the identification of impact evaluation.

Taking this question into account, one must have some caution about any evidence obtained with the frequent institutions variable. However, in the Brazilian municipalities case, the best proxy available for institutions is the one we have chosen in this paper and its components mentioned above. The Institutional Quality Index was already explored in others papers about institutions and development for Brazilian municipalities (see Nakabashi, Pereira and Sachsida (2013) and Naritomi, Soares and Assunção (2012)).

About the instruments for institutions and human capital, the following two variables are used: the proportion of blacks and *pardos* (term used for mixed race but specifically from black descendants, related specifically to skin color) population in Brazilian municipalities in 1872 (the year of the first Brazilian Demographic Census), and the ratio of the number of elementary school teachers and the number of children aged 6 to 15 in 1996.

The idea of using the proportion of blacks and *pardos* in each municipality in 1872 as an instrument for institutions is that: i) this proportion at the end of the nineteenth century would be a proxy to identify how deep the colonial heritage was and how non-inclusive the institutions were at that time (possibly regions with higher incidence of slave labor developed weak institutions), and ii) conditional on a set of covariates that encompass geographic aspects related to economy (productivity), one imagines that the instrument is not correlated with the current economic performance, but certainly, due to the path dependence of institutions, has influenced the current levels of institutions. The methodology of Comparable Minimum Areas was used to reconcile municipalities over time (see Monastério, 2009).

For the human capital instrument, the central assumption is that, conditional to a set of geographic covariates, the supply of education in 1996 (ratio of teachers and school-age children and adolescents) affects the schooling of the population, but is not correlated with the future economic performance (in 2010) of the municipalities directly, only via human capital accumulation. A time lag was used between the instrument of education and average schooling because part of the people in the labor market in 2010 were in school in the past. The year 1996 was chosen specifically for being the first with municipal variation of the education's offer for Brazil.

Table I: Descriptive Statistics

		Obs.	Average	SD	Min	Max
VARIABLES OF THE MODEL						
Variables of interest	Log of average household income per capita in 2010	4200	6.12	0.49	4.81	7.62
Explanatory variables	Average school years in 2010	4200	6.50	1.04	4.31	11.42
	Institutional Quality in 2000	4200	3.06	0.55	1.00	4.90
Instrumental variables	Log Teachers/Population in 1996	4200	2.94	0.85	-2.21	4.87
	Log Proportion blacks and *pardos* in 1872	4200	3.88	0.40	1.17	4.53
CONTROL VARIABLES						
Geographical position	Latitude	4200	-16.63	8.23	-33.52	3.88
	Longitude	4200	46.11	6.29	34.81	72.58
Dummies for quality of the soil	Acrisol	4200	0.32	0.47	0.00	1.00
	Cambisol	4200	0.12	0.32	0.00	1.00
	Chernozem	4200	0.01	0.09	0.00	1.00
	Spodosol	4200	0.01	0.07	0.00	1.00
	Gleysol	4200	0.01	0.09	0.00	1.00
	Latosol	4200	0.34	0.47	0.00	1.00
	Luvisol	4200	0.04	0.19	0.00	1.00
	Neosol	4200	0.12	0.33	0.00	1.00
	Nitisol	4200	0.02	0.15	0.00	1.00
	Planosol	4200	0.04	0.20	0.00	1.00
	Plinthosol	4200	0.03	0.18	0.00	1.00
	Vertisol	4200	0.00	0.02	0.00	1.00
Average temperature	Summer	4200	24.60	1.97	16.83	28.77
	Winter	4200	20.35	4.17	10.37	27.42
	Fall	4200	22.89	2.88	14.37	27.53
	Spring	4200	23.16	3.33	13.93	29.32
Average precipitation	Summer	4200	173.61	75.74	22.83	378.63
	Winter	4200	61.34	57.54	0.81	393.64
	Fall	4200	131.91	64.47	33.27	496.10
	Spring	4200	101.29	51.48	1.30	313.37
Dummies for natural regions	North	4200	0.09	0.28	0.00	1.00
	Northeast	4200	0.31	0.46	0.00	1.00
	Southeast	4200	0.32	0.46	0.00	1.00
	South	4200	0.20	0.40	0.00	1.00
	Central-West	4200	0.09	0.29	0.00	1.00

Source: Elaborated by the authors.

The covariates used are the geographical position (latitude and longitude), dummies for soil quality, average temperature in each season of the year, average precipitation in each season of the year and dummies for identifying the natural regions to which the municipalities belong. The information was obtained from the Brazilian Institute of Geography and Statistics, the Climate Research Unit (University of East Anglia) and the Brazilian Agricultural Research Corporation (EMBRAPA).

Due to the fact that several databases were added, the resulting sample was of 4,200[1] observations. The descriptive statistics of the variables are in Table I.

Although Acemoglu, Gallego and Robinson (2014) have used a cross-country data set in their main econometric analysis, while in this paper we used a cross-municipalities data set, it is worth to say that our *ceteris paribus* analysis is very similar to the refereed authors. In both studies there are covariates to the purpose of control geographical idiosyncrasies (as latitude), and fixed effects for regions that group the observations. Acemoglu and co-author have included into the covariate matrix continent (dummies) fixed effects, and we used Brazilian natural regions. Beyond that, in both papers, since there is no temporal dimension (because data sets are not panel data), it was not possible to control for units (countries or Brazilian municipalities) fixed effects.

3. Results

The results are presented in Table II. Five different specifications were estimated whose differences reside in the covariates groups. Panel B shows the first stage estimates, while panel A holds the second stage estimates.

Table II: Effects of human capital and institutions on per capita income

	(1)	(2)	(3)	(4)	(5)
PANEL A: SECOND STAGE REGRESSIONS					
Dependent Variable: Log of average household income per capita in 2010					
Average school years in 2010	0.314***	0.308***	0.133	0.166*	0.142
	(0.0281)	(0.0298)	(0.111)	(0.0816)	(0.101)
Institutional Quality in 2000	0.347***	0.316***	1.045**	0.949***	1.002**
	(0.0787)	(0.0866)	(0.340)	(0.223)	(0.335)
PANEL B: FIRST STAGE REGRESSIONS					
Dependent Variable: Average school years in 2010					
Log Teachers/Population in 1996	0.203***	0.207***	0.184***	0.169***	0.167***
	(0.0167)	(0.0165)	(0.0169)	(0.0168)	(0.0174)
Log Prop.blacks and *pardos* in 1872	-0.0696	-0.138**	-0.366***	-0.306***	-0.404***
	(0.0497)	(0.0505)	(0.0581)	(0.0597)	(0.0624)
Dependent Variable: Institutional Quality in 2000					
Log Teachers/Population in 1996	0.0366***	0.0413***	0.0425***	0.0355***	0.0307***
	(0.00858)	(0.00867)	(0.00870)	(0.00868)	(0.00884)
Log Prop.blacks and *pardos* in 1872	-0.211***	-0.208***	-0.182***	-0.204***	-0.184***
	(0.0213)	(0.0227)	(0.0251)	(0.0255)	(0.0267)
Observations	4200	4200	4200	4200	4200
R-squared	0.74	0.767	0.2	0.318	0.269
STATISTIC F FOR EXCLUDED INSTRUMENTS					
Human Capital	76.22	82.11	85.25	65.76	67.86
Institutions	57.87	52.03	38.3	40.23	30.15
CONTROL VARIABLES INCLUDED IN THE FIRST AND SECOND STAGES					
Latitude/Longitude	Yes	Yes	Yes	Yes	Yes
Quality of the soils	No	Yes	Yes	Yes	Yes
Temperature	No	No	Yes	Yes	Yes
Precipitation	No	No	No	Yes	Yes
Regions	No	No	No	No	Yes

Standard deviation in brackets. Significance levels: * p < 0.05, ** p < 0.01, *** p < 0.001.
Source: Elaborated by the authors.

[1] In 2010, there was 5.565 municipalities in Brazil. The main losses in municipal information occurred when using statistics from the Climate Research Unit regarding precipitation (there were no data for 591 municipalities). Important losses occurred also when using the 1996 National School Census (there were no data for 694 municipalities). Other databases used also presented losses, but not as significant.

From the observations of the first stage results, it can be seen that the instruments do affect the endogenous variables as expected. In the case of human capital, the higher the ratio of teachers to children and adolescents, the higher the average schooling. In turn, the higher the proxy index for slavery in the colonial period, the worse the institutional quality indicator in 2000 (confirming the hypothesis of path dependence of institutions). The F test of excluded instruments ratifies the statistical validity of the chosen instruments.

Panel A shows that human capital returns are not significant in all specifications. In the most complete specification (column (5)), with more covariates, possibly the one that generates the best counterfactuals, the estimated coefficient is 14.2%, but not significant. In turn, the estimated coefficients for the institutions variable are all statistically significant. The inclusion of a larger set of covariates also increases the estimated coefficients of the institutions. This result corroborates with those observed by Acemoglu, Gallego and Robinson (2014): institutions are the key element for development, and, as the results of this study point out, this applies not only between countries but also within them.

The estimated human capital coefficients, especially in the more complete specifications, shows a return of 13% to 14%, which are closer to the private returns that the literature on the estimation of the equation by Mincer documents for Brazil (see Moura, 2008). In addition, the absence of statistically significant effects corroborates with what is known in the literature on the externality of education, which does not find consensus regarding evidence of positive externalities of education (Lange and Topel, 2006). Therefore, the coefficients in aggregate analysis should not be higher than Mincer's, which is what we observe in this research.

It is worth to emphasizing that Acemoglu, Galleano and Robinson (2014) also found a similar evidence about the effects of human capital on economic performance. In the same way that our estimates, their estimated coefficients was very proximate to the estimate private returns for the most countries (range from 6% to 8%). They also found in some specification absence of statistical significance.

With the coefficients estimated in hands, one should ask himself what is the relevance of the magnitude of the impact of institutional quality on economic performance? To answer this question, first we have to look at the descriptive statistics of both the dependent variable and Institutional Quality index (Table I). For the Log of average household income per capita in 2010, one standard deviation is 0.49, and for the institutions variable one standard deviation is 0.55. Then, with the coefficient estimated in the specification presented in column (5) Table II, we calculate that the estimated impact of an additional standard deviation on institutional quality over the Log of average household income per capita is 1.12 standard deviation ($\frac{1.002*0.55}{0.49}$).

Now, let's shift our attention to human capital since we would like to compare institutions and human capital relevance on economic performance. Disregarding the absence of statistical significance, as the standard deviation for the human capital variable is near to one (1.04), an increase in one standard deviation in human capital increases the dependent variable in 0.3 standard deviation ($\frac{0.142*1.04}{0.49}$). Clearly, human capital impact on economic performance is considerably lower than the effect estimated for the role of institutions.

4. Final Remarks

Our aim in this study was to investigate institutions and human capital impact on the observed differences in average household income per capita among Brazilian municipalities, in order to understand the causes of regional inequalities observed throughout Brazil. The empirical strategy used was inspired by recent advances on the topic discussed in the literature.

The estimates presented here are in line with the most recent literature findings, especially with Acemoglu, Galleano and Robinson (2014). Institutions are at the heart of the development process. It is the political and business environment that gives incentives for innovation. The evidence gathered from this research shows that the theoretical framework of institutions can be used to explain economic performance inequalities within countries, not just between countries as documented in Acemoglu's papers.

Given that there is a correlation between wealth and human capital, it is possible that human capital is a consequence of institutions. Future studies should involve estimating how (in developing countries) the process of accumulation of human capital relates to institutions.

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