GETÚLIO VARGAS FOUNDATION
SÃO PAULO SCHOOL OF ECONOMICS

RAFAEL TERRA DE MENEZES

THREE ESSAYS ON LOCAL DEMAND FOR PUBLIC SERVICES

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Dissertation presented to the Graduate Program of the São Paulo School of Economics of Getulio Vargas Foundation, in fulfillment of the requirements for the degree of Doctor of Philosophy in Economics.
Field of Knowledge:
Economics of Public Sector

Advisor: Prof. Enlinson Henrique Carvalho de Mattos

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Committee:

_____
Professor. Enlinson Henrique Carvalho de Mattos (Advisor) (EESP-FGV)

_____
Professor Maria da Conceição Sampaio Sousa (UFPB)

_____
Professor Ciro Biderman (EAESP-FGV)

_____
Professor Vladimir Pinheiro Ponczek (EESP-FGV)

_____
Professor Fabiana Fontes Rocha (FEA-USP)

TO MY WIFE CAROL

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Abstract

Local provision of public services has the positive effect of increasing the efficiency because each locality has its idiosyncrasies that determine a particular demand for public services. This dissertation addresses different aspects of the local demand for public goods and services and their relationship with political incentives.

The text is divided in three essays. The first essay aims to test the existence of yardstick competition in education spending using panel data from Brazilian municipalities. The essay estimates two-regime spatial Durbin models with time and spatial fixed effects using maximum likelihood, where the regimes represent different electoral and educational accountability institutional settings. First, it is investigated whether the lame duck incumbents tend to engage in less strategic interaction as a result of the impossibility of reelection, which lowers the incentives for them to signal their type (good or bad) to the voters by mimicking their neighbors' expenditures. Additionally, it is evaluated whether the lack of electorate support faced by the minority governments causes the incumbents to mimic the neighbors' spending to a greater extent to increase their odds of reelection. Next, the essay estimates the effects of the institutional change introduced by the disclosure on April 2007 of the Basic Education Development Index (known as IDEB) and its goals on the strategic interaction at the municipality level. This institutional change potentially increased the incentives for incumbents to follow the national best practices in an attempt to signal their type to voters, thus reducing the importance of local information spillover. The same model is also tested using school inputs that are believed to improve students' performance in place of education spending. The results show evidence for yardstick competition in education spending. Spatial auto-correlation is lower among the lame ducks and higher among the incumbents with minority support (a smaller vote margin). In addition, the institutional change introduced by the IDEB reduced the spatial interaction in education spending and input-setting, thus diminishing the importance of local information spillover.

The second essay investigates the role played by the geographic distance between the poor and non-poor in the local demand for income redistribution. In particular, the study provides an empirical test of the geographically limited altruism model proposed in Pauly (1973), incorporating the possibility of participation costs associated with the provision of transfers (Van de Wale, 1998). First, the discussion is motivated by allowing for an "iceberg cost" of participation in the programs for the poor individuals in Pauly's original model. Next, using data from the 2000 Brazilian Census and a panel of municipalities based on the

National Household Sample Survey (PNAD) from 2001 to 2007, all the distance-related explanatory variables indicate that an increased proximity between poor and non-poor is associated with better targeting of the programs (demand for redistribution). For instance, a 1-hour increase in the time spent commuting by the poor reduces the targeting by 3.158 percentage points. This result is similar to that of Ashworth, Heyndels and Smolders (2002) but is definitely not due to the program leakages. To empirically disentangle participation costs and spatially restricted altruism effects, an additional test is conducted using unique panel data based on the 2004 and 2006 PNAD, which assess the number of benefits and the average benefit value received by beneficiaries. The estimates suggest that both cost and altruism play important roles in targeting determination in Brazil, and thus, in the determination of the demand for redistribution. Lastly, the results indicate that 'size matters'; i.e., the budget for redistribution has a positive impact on targeting.

The third essay aims to empirically test the validity of the median voter model for the Brazilian case. Information on municipalities are obtained from the Population Census and the Brazilian Supreme Electoral Court for the year 2000. First, the median voter demand for local public services is estimated. The bundles of services offered by reelection candidates are identified as the expenditures realized during incumbents' first term in office. The assumption of perfect information of candidates concerning the median demand is relaxed and a weaker hypothesis, of rational expectation, is imposed. Thus, incumbents make mistakes about the median demand that are referred to as misperception errors. Thus, at a given point in time, incumbents can provide a bundle (given by the amount of expenditures per capita) that differs from median voter's demand for public services by a multiplicative error term, which is included in the residuals of the demand equation. Next, it is estimated the impact of the module of this misperception error on the electoral performance of incumbents using a selection models. The result suggests that the median voter model is valid for the case of Brazilian municipalities.

Resumo

A provisão local de serviços públicos tem o efeito positivo de aumentar a eficiência, pois cada localidade tem as suas idiossincrasias que determinam uma demanda distinta por serviços públicos. Esta dissertação aborda diferentes aspectos da demanda local por bens e serviços públicos e sua relação com incentivos políticos

O texto está dividido em três ensaios. O primeiro ensaio visa testar a existência de *yardstick competition* nos gastos em educação utilizando um painel de municípios brasileiros. O ensaio estima modelos espaciais de Durbin com dois regimes e efeitos fixos espaciais e temporais por meio de máxima verossimilhança, onde os regimes representam diferentes cenários institucionais de *accountability* eleitoral e educacional. Primeiro, é investigado se os prefeitos de segundo mandato tendem a interagir menos com os vizinhos como resultado da impossibilidade de reeleição, que reduz os incentivos para sinalizarem seus tipos (bons ou ruins) para os eleitores por meio da reprodução dos gastos de seus vizinhos. Além disso, é avaliado se prefeitos sem apoio político da maioria da câmara dos vereadores (que pode indicar uma falta de apoio dos eleitores) buscam reproduzir os gastos dos vizinhos em maior medida, a fim de aumentarem suas chances de reeleição. Em seguida, o ensaio calcula os efeitos da mudança institucional introduzida pela divulgação do Índice de Desenvolvimento da Educação Básica (IDEB) e de suas metas em abril de 2007 sobre a interação estratégica entre governos locais. Esta mudança institucional possivelmente aumentou os incentivos para os prefeitos seguirem as melhores práticas nacionais, na tentativa de sinalizarem aos eleitores que são competentes, reduzindo assim a importância de transbordamentos de informação local. O mesmo modelo é também testado usando insumos escolares que se acreditam aumentarem o desempenho dos alunos no lugar de gastos com educação. Os resultados mostram evidências de *yardstick competition* nos gastos em educação. A autocorrelação espacial é menor entre os prefeitos em segundo mandato e maior entre os prefeitos com o apoio da minoria (i.e., com uma margem menor de votos). Além disso, a mudança institucional introduzida pelo IDEB reduziu a interação espacial nos gastos educação e na definição dos insumos escolares, diminuindo assim a importância de transbordamentos de informação local.

O segundo ensaio investiga o papel desempenhado pela distância geográfica entre os pobres e não pobres na determinação da demanda local por redistribuição de renda. Em particular, o estudo fornece um teste empírico do modelo de altruísmo delimitado geograficamente proposto em Pauly (1973), incorporando ainda a possibilidade de custos de

participação associados à provisão de transferências (Van de Wale, 1998). Primeiramente, a discussão é motivada permitindo que o modelo original Pauly incorpore um "custo iceberg" de participação nos programas para as pessoas pobres. Foram utilizados dados seccionais do Censo Demográfico de 2000 e um painel de municípios com base na Pesquisa Nacional por Amostra de Domicílios (PNAD) de 2001 a 2007. Todas as variáveis explicativas que constituem medidas de distância indicam que uma maior proximidade entre pobres e não pobres está associada a uma melhor cobertura dos programas (demanda por redistribuição). Por exemplo, um aumento de 1 hora no tempo gasto em deslocamento casa-trabalho pelos pobres reduz a cobertura em 3,158 pontos percentuais. Este resultado é semelhante ao de Ashworth, Heyndels e Smolders (2002), mas definitivamente não se deve à existência de vazamentos nos programas. Para diferenciar empiricamente os efeitos resultantes de custos de participação daqueles devido ao altruísmo geograficamente delimitado, um teste adicional é realizado com dados em painel obtidos junto as PNAD de 2004 e de 2006, que avaliam o número de benefícios e o valor do benefício médio recebido pelos beneficiários. As estimativas sugerem que tanto o custo quanto o altruísmo desempenham papéis importantes na determinação da cobertura/focalização de programas sociais no Brasil e, portanto, na determinação da demanda por transferências. Os resultados indicam também que o tamanho do orçamento para a redistribuição tem um impacto positivo na cobertura dos programas.

O terceiro ensaio tem como objetivo testar empiricamente a validade do modelo do eleitor mediano para o caso brasileiro. As informações municipais são provenientes do Censo Demográfico e do Tribunal Supremo Eleitoral para o ano de 2000. Primeiramente, a demanda do eleitor mediano para os serviços públicos locais é estimada. As cestas ofertadas pelos candidatos à reeleição são identificadas como os gastos realizados durante o primeiro mandato. A suposição de informação perfeita dos candidatos sobre a demanda mediana é relaxada e uma hipótese mais fraca, de expectativas racionais, é imposta. Assim, os representantes podem se enganar quanto à demanda mediana ao que se denominou “erros de percepção”. Assim, em um determinado ponto no tempo, os representantes podem fornecer uma cesta (dada pelas despesas per capita), que difere por um termo de erro multiplicativo da demanda do eleitor mediano por serviços públicos, o qual está incluído nos resíduos da equação de demanda. Em seguida, calcula-se o impacto do módulo deste “erro de percepção” sobre o desempenho eleitoral dos prefeitos utilizando modelos de seleção. O resultado sugere que o modelo do eleitor mediano é válido para o caso dos municípios brasileiros.

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1 Yardstick Competition in Education Spending: a Spatial Analysis based on Different Educational and Electoral Accountability Regimes

Information asymmetry between the voters and the politicians is known to be a building block for the well-established models of political agency.[1] Nevertheless, a new outlook on these models is provided by Salmon (1987) in the context of tax and expenditure-setting. The author argues that to determine the quality of the incumbents (agents), the voters (principals) evaluate the incumbents' performance in terms of tax levels and the amount (and the quality) of public services provided by comparing them to those of the neighboring jurisdictions, where information is easily accessible. Having perfect information, the incumbents would then engage in a sort of yardstick competition to signal their performance to voters.

This discussion resulted in a number of empirical studies that were interested in testing the nature of strategic interaction between jurisdictions, both in the case of expenditure[2] and tax setting.[3] In an attempt to complement the literature, the present study aims to test the presence of yardstick competition in the specific case of education expenditures using panel data from Brazilian municipalities from 2002 to 2008. For this purpose, we first exploit the distinct electoral accountability regimes, which are expected to change the incumbents' incentives for signaling their quality to voters. This change of incentives is measured by the shift induced by each of the regimes on the jurisdiction's spending reaction function, i.e., the change in the amount of spatial auto-correlation between the neighboring jurisdictions.

Next, we rely on an institutional change that was provided by the local level disclosure in 2007 of an educational index known as the Basic Education Development Index (also known by its acronym in Portuguese IDEB), which was based on the results of a new national standardized test (termed *Prova Brasil*). Along with the yearly goals that provide guidance to the municipalities, this index possibly reduced the information asymmetries regarding the quality of education, thus diminishing the spatial interaction between jurisdictions. Nonetheless, in theory, the effects of disclosing the standardized tests results on the spending interaction patterns are unclear. Revelli (2006) argues that the disclosure of performance ratings at the national level leads the voters and the officeholders to adopt the national level

[1] See Ferejohn (1986), Alesina and Cukierman (1990), and Persson et al. (1997).
[2] Regarding strategic spending-setting see Revelli (2006), Elhorst and Fréret (2009), Case et al. (1993) and Bivand and Szynanski (2000).
[3] Regarding strategic tax-setting, see Besley and Case (1995), Bordignon et al. (2003), Revelli (2008), Allers and Elhorst (2005), Sollé Ollé (2003), Revelli (2002), Ladd (1992) and Revelli (2001).

best practices instead of the practices that have been verified among their neighbors, thereby reducing yardstick competition. However, the author analyzes welfare spending, which is fundamentally different from education expenditures.

The problem in this case is that the relationship between education spending and students' achievement still remains largely unknown to the public officials and academics. As noted by Hanushek (1986, 1996, 2006), the lack of information about the educational production function causes officials to employ financial resources on inputs that have little or no role in determining the educational output. Contrary to the profit and efficiency maximizing behavior of a firm in a competitive market, the officials' objective is not necessarily to be efficient in educational matters. Efficiency will be pursued only if it helps the officials to reach their political goals. Not surprisingly, the effect of educational spending on students' performance presents mixed results.[4] Consequently, the effect of student's performance disclosure on yardstick competition is far from obvious, making it an empirical matter.

It is likely that prior to the disclosure of the students' achievement, the incumbents did not pay much attention to this aspect of the educational quality because it was unfeasible to measure it in a proper manner. This behavior of the officeholders may have changed after the average students' performances were made public at the local level. In fact, Firpo et al. (2011) find evidence for the Brazilian municipalities that higher average achievement increases the odds of the incumbents' reelection. Thus, once the schools' and the municipalities' performances were made public, the question is whether the incumbents tried to change the patterns of education spending as though there was a deterministic relationship between achievement and expenditures, or if they resorted to other means such as changing the allocation of school inputs and the management practices, or even if they chose to do nothing knowing they lack the knowledge on what is effective for increasing students' achievement.

[4] Menezes-Filho and Pazello (2007) use data on the 1998 Brazilian Fundamental Education reform to identify the effect of teachers' wages on students' achievement and find evidence that higher salaries translate into higher student performances. Similarly, Card and Payne (2002) use data on funding reform across richer and poorer US districts and find evidence that the narrowing of the spending gap between the low- and the high-income districts has led to a decrease in the SAT performance gap between the poor and the rich districts. However, Leuven et al. (2007) find that subsidies aimed at personnel and computer or software acquisition have a negative effect on Dutch students' achievement. Revelli (2009), in turn, analyzes the effects of general expenditure in England - in excess of centrally set spending standards - on performance ratings (with higher weights to education and other services areas such as child care, health and safety) and finds evidence of a negative association between expenditures and performance.

To the best of our knowledge, no empirical study has explicitly associated education expenditures with yardstick competition[5] or verified how the introduction of an educational index (with results disclosed at the school and municipality levels) changes the strategic interaction between jurisdictions through education expenditures or through other means. Besides, the fact that Brazil is a country with a huge educational gap[6] that is still struggling to identify which priority educational inputs deserve investment provides an interesting case that is worth analyzing.

A final motivation for the present work is provided by Bordignon et al. (2003), who argue that if yardstick competition is a real phenomenon, and depending whether this behavior is beneficial or detrimental, then it could be possible to reassign the tax and spending responsibilities to the local governments in such a manner as to encourage or discourage this behavior.

The empirical exercises in the present work are based on maximum likelihood two-regime spatial Durbin models with time and spatial fixed effects, where the regimes represent different electoral and educational accountability institutional settings. The results show evidence for yardstick competition in education spending. Spatial auto-correlation is lower among the lame duck incumbents and higher among the incumbents with minority support (a smaller vote margin) at the city council. In addition, the institutional change introduced by the IDEB reduced the spatial interaction both in the case of education spending as in the case of educational input-setting, thus diminishing the importance of local information spillovers.

This paper is organized as follows. Section 2 provides an overview of the features of yardstick competition. Section 3 describes the basic institutional settings of the Brazilian political system and Brazil's public finance and education funding. It also describes the recent educational accountability experience in Brazil, focusing on IDEB and its dissemination process. Section 4 presents the estimation strategy, which includes the decision on the nature of the spatial process of the spatial econometric model. Section 5 describes the dataset and justifies the inclusion of the variables in the model. Section 6 presents the results of the two-regime spatial Durbin model for education spending in an attempt to evaluate strategic interaction under different regimes of electoral and educational accountability. This section

[5]In fact, Rincke (2009) finds evidence for yardstick competition in the provision of public education, but through the adoption of educational innovations instead of through education spending.

[6] For example, Brazil ranked 53rd (out of 65 countries) in PISA 2009 reading and science exams and 57th in the math exam. As of 2010 only 50.2% of 19-year-old individuals finished high school, and the illiteracy rate among individuals older than 15 years is 9.6% (Brazilian Institute of Geography and Statistics).

also provides robustness tests that assess the effects of the IDEB disclosure on jurisdictions' strategic interaction when setting school inputs. Finally, section 7 presents the concluding remarks.

1.1 Yardstick Competition: General Features

Yardstick competition theory was first introduced by Salmon (1987) and further developed by Besley and Case (1995).[7] The theory consists of a relatively new research branch within Fiscal Federalism theory, but on the contrary it considers that voters are non-mobile and that their tastes are similar across geographical units. Thus, the voters do not behave like the Tiebout (1956) "voting with their feet" mechanism, but instead use voting as a tool for disciplining politicians, removing them from office when dissatisfied.

The usual framework in this literature is the political agency model, where voters (principals) are not aware of the true costs of providing public services and are imperfectly informed about the quality of incumbents (agents). Besley and Case (1995) argue that because of this information asymmetry, the voters can mistake the incumbents' attempt at rent appropriation for negative economic shocks, thus being unable to distinguish the "good" and the "bad"-type incumbents, i.e., those that will or will not try to charge rent on top of the provision cost of the public services. Thus, the incumbents that are considered to be the "bad" type, if they are willing to try for reelection, should not set taxes to a point where it becomes evident to the voters that they are trying to charge rent. To evaluate the incumbent's performance (or the incumbents' type), the voters then compare own levels (or quality) of public services and/or taxes with those of the neighboring jurisdictions, where information is more easily accessible from the media or through other means.[8][9] To signal their performance

[7] The idea was inspired by the literature about multi-agent incentive schemes, wherein agents take the performance of similar others as a benchmark to make their decisions about their own desired performance (Schlaefer, 1985).

[8] See Strömberg (2004) and Revelli (2008) about the role of the media in providing the voters with information.

[9] Salmon (1987) and Case et al. (1993) stress that voters and incumbents do not necessarily need to compare their jurisdiction's performance to the neighboring jurisdictions. In turn, the comparison can occur between similar jurisdictions, where similarity is defined in terms of a wide range of characteristics such as population, income and ethnic composition, to name a few.

to their voters, the perfectly informed incumbents then engage in competition with the neighboring jurisdictions by mimicking each other's fiscal behavior.[10]

Conversely, Bordignon et al. (2004) warn that yardstick competition might not necessarily lead to greater interaction between jurisdictions, making it an empirical issue. The existence of yardstick competition could dampen the incentives for the "bad" incumbents to pool with good ones, i.e., to choose a level of rent that is not so high as to allow the voters to perfectly identify them. Bad incumbents could prefer to extract the most rent that they can in the first term and then be voted out of office rather than mimic the good incumbents' behavior to increase the odds of an uncertain reelection (and only then divert the most rent that they can). Thus, yardstick competition can in fact decrease the amount of strategic interaction between local governments. Besley and Smart (2007) also observe that yardstick competition can be welfare diminishing when compared to a situation where the voters ignore the fiscal performance of their neighbors. When the voters know both the reputation of the neighbors' incumbents and their fiscal situation, it becomes harder for the bad incumbents to hide their type, thus inducing them to extract the most rent that they can while in office.

In this type of political agency model, anything that changes the incumbents' incentive to seek reelection will affect the way that the jurisdictions interact. The literature points to several political, economic and institutional features that can alter these incentives. One of these features is the existence of term limits. In case the officials are not running for reelection by force of law, i.e., they are "lame ducks," voting will no longer enforce discipline, and some will set the level of taxes and expenditures that maximizes rent extraction. Thus, the lame duck incumbents, in principle, should not have incentives to use their neighbors' performance as a benchmark (Besley and Case, 1995). The same reasoning could be applied to the incumbents on the edge of retirement and those not running for reelection because of the determination of the party. As argued by Alesina and Spear (1988), it could be the case that the lame ducks have some partisan interest that prevents them from attempting the maximum rent extraction, but the expected amount of spatial interaction should still be smaller.

Considering that holding the majority of seats at the city council implies having the support of the majority of voters, the size of the majority can also change the pattern of

[10] The same conclusions can be reached using other frameworks. Revelli and Tovmo (2007), for example, rely on a "bureaucratic agency" model with welfare-maximizing politicians (principals) and self-interested bureaucrats (agents). The information about the true cost of providing public services is asymmetric, and to attain efficiency, the principals compare their own public service production with that observed in neighboring jurisdictions.

interaction among the jurisdictions. Allers and Elhorst (2005) and Elhorst and Fréret (2009) argue that the localities that are governed by a local official with a small political majority tend to mimic the neighboring expenditures because reelection is uncertain. Conversely, in those jurisdictions that are governed by large majorities, the incumbents are pretty confident about their reelection and do not feel the need to signal their quality to the voters by mimicking the neighbors.

Another related measure of majority support is noted by Besley and Case (1995) and Sollé Ollé (2003) and consists of the total votes received by the incumbent in the last election. In this case, the incumbents that are backed by a large number of voters in the previous suffrage could feel less compelled to set taxes and expenditures strategically, while those backed by a small share of voters must interact strategically to raise their odds of reelection.

Allers and Elhorst (2005) and Sollé Ollé (2003) also highlight the influence of partisan ideology. According to the authors, rightist incumbents should be less willing to mimic the increases in tax rates and, thus, the increases in expenditures. The latter author also argues that the mimicking behavior is expected to be higher in election years because the incentives for the incumbents to signal their quality to the voters become stronger as the election year approaches.

In the same way, the existence of a coalition government can affect yardstick competition. However, Geys (2006) claims that the direction of this influence is ambiguous. In theory, coalition governments should be less willing to mimic the neighboring jurisdictions because it would be harder to assign the blame for being less efficient (or extracting rents) to one or the other party. However, the uncertainty regarding the role that each coalition party would play in the government could increase the importance of coalition negotiations and stimulate the need for mimicking.

Institutional settings that change information asymmetry can also affect yardstick competition. Regarding this aspect, Revelli (2006) claims that by making information about the quality of local public services nationally available, the local citizens would not have to rely on the neighbors' information to know if their officials are competent. Thus, the officials would have an incentive to set the expenditure at such a level as to produce a public service quality that could place their jurisdiction among the highest rated jurisdictions, attenuating the role of local information spillover and, perhaps, eliminating yardstick competition.

Similar effects can be produced by changing the rules for the concession to operate a public service. Bivand and Szynanski (2000) rely on a bureaucracy agency model to conclude that monopoly privileges in the provision of local public services such as garbage collection can induce the local authorities to compare their costs with those of the neighboring jurisdictions, a form of yardstick competition. The authors then find evidence that allowing compulsory competitive tendering for the provision of a specific service (even with the public departments as contenders) changes the quality-cost standards from the local to the national best practices, thus eliminating strategic interaction in the provision of that service.

These aforementioned political and institutional features are necessary to identify yardstick competition because the presence of fiscal spatial interaction in itself may reflect competing phenomena, such as tax or welfare competition. Brueckner (2003) classifies models of strategic interaction in two categories: resource-flow models and spillover. Resource-flow models assume the mobility of capital and labor among jurisdictions, following the reasoning of Oates (1972) and Tiebout (1956). Tax and welfare competition models fall in this category.[11] The second category comprises the models wherein the strategic interaction results from the spillovers between jurisdictions. Models of yardstick competition can also be considered spillover models because the uninformed voters use the readily available information that spills over from the neighboring jurisdiction to make their decision.

Despite the differences between the two categories, sometimes it can be difficult to determine if the problem is one of spillovers or resource-flow, e.g., governments can set expenditure levels strategically because of yardstick competition or because of welfare competition and the reaction function will be the same in both cases. The difference lies in the hypothesis regarding the mobility of factors. Thus, a simple empirical test, such as including a spatial lag or a spatial error in the regression model, is not enough to differentiate the underlying reason that produces spatial autocorrelation. The key for an empirical test is to explore the heterogeneity of the spatial parameter induced by political factors or informational asymmetries, in the case of yardstick competition models, or migration or firm location decisions, in the case of tax or welfare competition models.

[11] A tax levied on capital, for example, diminishes the net-of-tax return on capital. As a mobile factor, the capital will move to the other jurisdictions to equalize the net-of-tax return. Similarly, an increase in the value of welfare benefits distributed to the poor (occupied in low-skilled jobs) in one jurisdiction will attract unskilled labor from elsewhere to equalize the gross income across jurisdictions.

Finally, note that the previously mentioned studies usually conduct empirical exercises that evaluate yardstick competition through the tax or expenditure levels. However, other dimensions of public policy can be of interest to voters. Geys (2006) and Revelli and Tovmo (2007) note that voters may care about the efficiency in the production of local public services, i.e. about the level of public services given the taxes they face. Rincke (2009), on the other hand, observe that voters may also value the adoption of new technologies for public services provision, thus evaluating the incumbents' relative performance also in terms of their innovative ability.[12]

1.2 Institutional Setting

This section presents brief characterizations of the local public finance, the political system and the budget elaboration process in Brazil. It also describes the recent educational accountability experience in the country, focusing on the educational index known as IDEB and on the standardized test known as *Prova Brasil*. This contextualization helps to understand the estimation strategy and the results to be presented.

1.2.1 Local Public Finance and Education Funding

Brazil is a federal state that is characterized by the union of 27 states (including the Federal District) and 5565 municipalities. There is substantial decentralization in the provision of public services. The municipalities are primarily in charge of the provision of urban sanitation, roads conservation, traffic control, health services, regulation of land use, early childhood and fundamental education (the last being equivalent to the first 9 years of K-12 education). The states' provision of public services focuses on high school (although in some municipalities, the states also maintain fundamental education schools), higher education, public safety, water provision and sewage collection and treatment. The National Government focuses on the provision of services of broad interest such as social security, energy, defense, higher education and the public policies aimed at economic development.

[12] The author considers the introduction of charter schools in California's school districts as the innovation variable and uses the differences in electoral competition as a means to identify yardstick competition. The intuition is that in highly competitive districts, the incumbents should mimic more the neighbors' innovative behavior to signal their quality to voters.

Conversely, the power to tax is only weakly decentralized. As of 2008, the majority of municipalities raised very little revenue through own instruments, amounting to only 6.06% of total revenues. The municipalities' main instruments of taxation are the property tax (1.11% of revenues), tax on services (2.51% of revenues), payroll tax on own employees (1.10% of revenues), fees regarding services such as garbage collection, street lighting, among others (0.63% of revenues), taxes on the transmission of property ownership (0.60% of revenues), and other sources of revenue (0.10%).[13]

The municipalities' main sources of revenues are intergovernmental transfers, such as the block grant known as the Municipalities' Participation Fund or FPM (42.51% of revenues); the categorical grant for the financing of health services also known as the Unified Health System or SUS (7.19% of revenues); the categorical grant for education known as the Fund for the Maintenance and Development of Fundamental Education and Valuation of Teaching or FUNDEF (18.22% of revenues); and 1/4 of all of the state indirect tax on the circulation of goods and services (also known as ICMS) collected within the municipality's borders (18.03% of revenues).

Local education spending is financed by FUNDEF (a categorical grant) and by sources over which the municipalities have discretion; therefore, it can vary according to the local demand for education. The discretionary sources come from FPM – which is funded by 22.5% of the total federal income tax and the same percentage of the total federal indirect tax on industrialized products known as IPI –, the municipalities' share of the ICMS, and the revenues collected through own instruments.

FUNDEF funding scheme is quite complicated in that a different fund is formed by each state and several sources make up the funds. It gathers 15% of its revenues from both the FPM and the States' Participation Fund (also known as FPE), 15% of the IPI owed to states, and the same share of the ICMS owed to both the states and the municipalities. This latter source provides the most important contribution to the fund, at approximately 60% of the total.

After each state receives all of the resources that make up FUNDEF, they divide the amount by the number of students enrolled at the fundamental education level to proportionally distribute the money to the municipalities. If the amount per student is inferior to a minimum value that is defined each year by executive act, the Federal Government

[13] Data are obtained from the National Treasury Office.

complements the state fund to reach this minimum. As of 2002, the minimum value to be transferred to students from 1st to 5th grade of fundamental education was 418 reais (or 118.30 USD), whereas in 2008, this figure was equal 1132.34 reais (or 639.27 USD). The minimum values differ (though not by much) according to the educational stage that the students are enrolled in and whether they attend urban or rural schools. Nevertheless, from 2007 on, FUNDEF was reformulated to encompass also preschool, kindergarten and high school students, being renamed as the Fund for the Maintenance and Development of the Basic Education and Valuation of Education Workers (also known as FUNDEB).[14]

Despite the importance of the categorical grants for educational financing, the large majority of the municipalities spend considerably more than the amount that they receive in the form of transfers.[15] In 2008, the total educational categorical grants amounted (on average) to 63.84% of the total educational expenditure of the municipalities. This spending in excess of the categorical grants indicates that the demand for education is higher than the grant would allow. To finance this difference, the municipalities rely on revenues that are raised primarily through the FPM (the main source) and the share of ICMS that belongs to the municipality.

Finally, this overview shows the importance of the national and state indirect taxes for financing not only education but also all goods and services that are provided by the local governments. Contrary to many countries, where property tax is crucial for the determination of the local tax price and the demand for public services, in Brazilian municipalities this tax is of minor importance. Tax price must be mainly a function of the state and the national indirect taxes.

1.2.2 The Political System and Budget Approval

The municipalities in Brazil are governed by a mayor incumbent who is elected for a 4-year term. Since the 2000 election, the incumbents have been allowed to run for a second and final term. The jurisdictions have elections decided by majority rule, with only 1 round where there are less than 200,000 voters and 2 rounds otherwise.

[14] The reformulation process involved an increase in the amount of resources devoted to constituting the fund. The per pupil amount, however, may have increased, decreased or stayed the same depending on the number of students in each stage of education, if they study in rural or urban areas, or if they study in full-time schools.
[15] In 2008, only 1.58% of the municipalities spent less than the amount received as educational categorical grant.

Aldermen are elected for 4-year terms by an open-list proportional system and face no term limits. The same system applies to the state and federal legislatures, ultimately favoring the proliferation of parties. There are 29 parties that are currently active in Brazil, and even though some of them are identified with some ideology by the occasion of their foundation, once in office, they often must form coalitions with parties of different ideologies to build majorities in the legislature. This process ends up producing inconsistency between the public policies of the party in office and their ideology. In addition, Desposato (2006) shows that the party switching rate in the Brazilian chamber of deputies is higher than 40% (on average). Much of the switching can be attributed to the deputies' desire to broaden their access to public funds to finance pork barrel projects and to increase their odds of reelection. Thus, even though ideology is the driving force for a few parties, it is of secondary importance in general. At the local level, the inconsistence between party ideology and public policies is even more explicit because the local governments have a limited capacity to raise revenues, and their power to produce deficits is restricted by the Fiscal Responsibility Act of 2000, which somewhat eliminates the debates on topics such as more versus less state intervention.

The aldermen are responsible for creating and changing the municipality's Organic Law, legislating on local subjects, and judging the budget that is submitted by the executive. The budget process is enforced by the Fiscal Responsibility Law, which requires the local executives to elaborate a 4-year plan of action (multi-annual plan) with objectives, units in charge of the execution of the projects, amount to be spent, total period of execution and revenue sources. The budget process also requires the elaboration and approval of a Budgetary Guidelines Law with the goals and priorities for the subsequent fiscal year (beginning in January). The final step consists of the local executive submitting the Annual Budget Law with the detailed revenues and expenditures that are expected for the next fiscal year to be voted and approved by the city council until the end of the fiscal year (in December). Thus, the new expenditures usually take a certain amount of time before being executed.

1.2.3 The Recent Education Accountability Experience in Brazil

Prova Brasil (or Brazil's Exam) is a standardized test created in 2005 by the Ministry of Education with the objective of providing political representatives, policy makers, education

workers and society with information about the quality of education. Every two years, the exam assesses the math and the reading skills of 5th and 9th graders (in fundamental education) of public schools with over 20 students, allowing the evaluation of the average performance of the schools and the local education systems. The first results were not disclosed until September 2006, when the Ministry of Education sent the summary reports with the average performance of the students to the local and state Education Offices and to each of the schools. The period immediately after the disclosure of the results was marked by the Ministry of Education's attempt to explain to the media, the local officials and the teachers, how the results should be interpreted and how they could be used to improve students' performances. However, the subnational governments presented difficulties when interpreting *Prova Brasil's* new information and implementing appropriate educational policies.

By April 24th, 2007, the recently reelected President Lula signed decree n. 6094, known as the "Plan of Goals All Committed to Education" (hereinafter referred to as Plan of Goals). This decree established a set of priority goals whose intent was to improve the students' achievement.[16] The plan was centered on the index known as the Basic Education Development Index (IDEB) whose purpose was to measure the overall quality of education in schools and municipalities in a more intelligible and direct manner. The index is defined as $IDEB_{ijt} = P_{ijt}A_{ijt}$, where P_{ijt} stands for the average performance in the math and reading exams of *Prova Brasil* in unit i in stage of education j in period t. The index has been standardized to lie in the interval between 0 and 10, wherein 6 corresponds to the average achievement of the OECD students (based on the results of the 2003 edition of PISA). The term A_{it} reflects the school passing rate and varies between 0 and 100%.[17]

The Plan of Goals envisaged subnational governments voluntarily signing an agreement wherein they commit themselves to achieve gradually increasing annual goals for IDEB that are specific to each school and jurisdiction according to their initial situation. The Federal Government, in exchange, provides the municipalities with the technical and financial support

[16] This plan of goals is part of a broader set of measures called the Education Development Plan (or PDE in its Portuguese acronym), which also includes 29 other actions, goals and policies that are aimed not only at Fundamental Education but also at other stages. However, as Saviani (2007) notes, most of these additional measures were already part of the federal programs, and thus, we can consider the "Plan of Goals All Committed to Education" as the main novelty of the PDE.

[17] Note that there is a trade-off between the performance and the passing rate. Artificially increasing the pass rates to obtain a higher IDEB will cause the less prepared students to be promoted to the next grade, thus reducing the component of the IDEB that measures the performance on the standardized exams. This methodology used to build the index (combining achievement and passing rate) intends exactly that, i.e., to improve the students' achievement and lower grade retention simultaneously.

and orientation about the best practices that could increase students' achievement. The idea is to make society monitor the accomplishment of the goals, reinforcing the sense of accountability towards local educational quality and diminishing the information asymmetry regarding the incumbent's quality. The final purpose of the Federal Government is that, by 2021, the average IDEB in Brazil be equal to 6.0, i.e., the average performance of the OECD students.

In principle, because of the broad disclosure of the students' achievement, the voters would tend to consider all of the other jurisdictions as the benchmark, instead of only their neighbors. Such a disclosure would force the incumbents to adopt the national best practices to improve academic performance so that they could signal their quality to their voters. Another possibility is that the voters are aware of the difficulties of increasing educational quality and that they demand that the incumbents at least participate in the Plan of Goals, making the necessary efforts to achieve their yearly goals and prove that they are competent. Either way, the jurisdictions would tend to interact less with their neighbors in terms of education provision.

The crucial aspect of the Plan of Goals is that the participation is not enforced by law; it is completely voluntary. Thus, if the incumbents change their spending interaction pattern in response to the plan, it would only be to signal their quality to the voters. This spontaneous participation fits perfectly with the objectives of the present work. If this institutional change was legally enforced, the jurisdictions could still reduce the interactions in the provision of public education, but less because of the incumbents' need to signal their type to the voters and more because non-compliance with the law could bring them legal consequences.

Brazil has experienced one such legally enforced institutional change early in the 2000 decade. The National Education Plan (also known as PNE) was enacted by law number 10.172 on January 9th, 2001. The plan affected the municipalities, especially in what concerns preschool and fundamental education, the stages of education that are predominantly under the responsibility of this level of government. The PNE set 26 goals for preschool and 30 goals for fundamental education.

The first and primary goal for each of these stages of education envisioned increasing the supply of school places. To accomplish this increase in school places, the municipalities would have to buy the appropriate pedagogical equipment, build, expand or improve the buildings and all of this while respecting the minimum standards established by the Federal

Government. From the beginning of 2002, any new building designed to house preschool or fundamental education students should meet the minimum requirements, and, no later than 2006, all schools should meet the code's standards. These goals exerted great pressure on the finances of the municipalities, which had to cope with the requirements using their own resources.

Another goal that required great financial effort from the municipalities referred to the qualification of Preschool professionals. Since 2001, only professionals with at least a high school education and specialization in early childhood education could be hired, with preference to those with higher education. By the end of 2005, all municipalities should also ensure qualification and updating of the professionals of preschools already under contract.

Aguiar (2010) emphasizes that, at first (prior to 2003), part of the municipalities did try to accomplish the goals, but the others were challenged to even start trying because of the budget constraints they faced. Saviani (2007) notes that the vetoes that the PNE suffered before it was enacted were particularly prejudicial to the points involving the financial support necessary for the fulfillment of the goals. In addition, because the Worker's Party members participated actively in the elaboration of the original proposal of the PNE, the vetoes caused them to disregard the plan as feasible. After winning the 2003 presidential election, the government of the Workers' Party did not try to overturn the vetoes and did not monitor or enforce the achievement of the goals by the subnational governments. The Workers' Party focused its efforts on the improvement of the educational quality that ultimately led to the approval of the "Plan of Goals All Committed to Education" in 2007.

Table 1.1 presents the evolution of selected variables that clearly show the stronger impact that the PNE had in 2002 and the loosening in the enforcement of the plan observed after 2003. Interestingly, because of the PNE qualification requirements, the number of enrollments in higher education courses aimed at preschool teachers' training exploded in 2002. With the advent of the new government and the signal that the requirements would not be enforced, enrollment fell sharply in 2003. The percentage of teachers with a higher education degree in the field increased from 80.5% in 2001 to 83.2% in 2002, stabilizing at approximately 85% thereafter. Other evidence that the PNE had its greatest impact in 2002 is that the percentage of new schools meeting the minimum infrastructure requirements (represented by percentage of schools with a gymnasium, library and science labs) increased significantly that year. However, this percentage was still much lower than that required by

law, meaning that only a few local governments sought to follow the PNE directions. Moreover, this percentage even decreased after 2003, confirming that the law was not enforced by the new government.

All things considered, the PNE and the IDEB disclosure are two institutional changes with the potential to have negatively affected the strategic interaction between jurisdictions but whose natures are completely different. While the PNE in 2002 "tied the hands" of the incumbents who were obliged to comply with the law requirements on a tight budget, the disclosure of the IDEB in mid-2007 changed the incentives of the incumbents, who were compelled to follow the national best educational practices to signal their quality to the voters. These contextual factors have important implications for the analysis of the results, as we shall see further ahead.

Table 1.1 – PNE effects on selected variables

	2000	2001	2002	2003	2004	2005	2006
enrollments at higher education courses for preschool teachers	1103	2308	8033	5518	4539	1364	1508
% teachers with specialized high school or higher education.	79.0	80.5	83.2	84	85.4	85.6	85.3
% new schools with gymnasium	12.6	15.1	21.0	21.1	19.7	19.2	20.8
% new schools with library/study room	22.5	22	28.3	28.2	20.5	22.1	25.9
% new schools with science lab	4.5	3.8	5 .9	5 .8	6.1	5.7	6.3

Source: Inep (2009)

1.3 Estimation Strategy

The strategies for identifying yardstick competition can be classified into two categories, direct or indirect. In the direct strategies, the dependent variables of the econometric models are the direct objectives of politicians, such as the incumbents' electoral performance (vote share or reelection status); and the explanatory variables refers to own and the neighbors' levels of tax and expenditures.[18] The indirect strategies are the most commonly found in the literature and consist of models that have tax and expenditure levels as the dependent variables of spatial econometric models. These indirect strategies explore the heterogeneity in the spatial parameters due to different incentives for incumbents (Bordignon et al., 2003).

[18] See Besley and Case (1995) and Revelli (2002).

To identify yardstick competition using indirect strategies, the variables capturing the differences in the institutional framework (which affect the incumbents' incentive to react to their neighbors' policy) should enter the econometric model, either interacting the spatial term together with the spatial term itself, or interacting the spatial term with each of the different regimes that assign the different institutional frameworks.[19] The model should then be estimated by maximum likelihood (ML) or instrumental variables (IV) approach. If there are only two possible regimes, there will be two interaction terms in the model, one for each regime. A less appealing econometric procedure consists of estimating the same model for different restricted samples, in which different strategic behaviors are expected.

In the present paper, we rely on a two-regime "Spatial Durbin"[20] model to identify the existence of yardstick competition in education spending (See Elhorst and Fréret, 2009). This model can also be viewed as one representing demand for education[21]. Let

$$y_{it} = \alpha + \lambda_1 d_{it} \sum_{j=1}^{N} w_{ij} y_{jt} + \lambda_2 (1 - d_{it}) \sum_{j=1}^{N} w_{ij} y_{jt} + X_{it}\beta + \sum_{j=1}^{N} w_{ij} X_{jt}\,\theta + \mu_i + \tau_t + u_{it} \quad (1.1)$$

where y_{it} denotes education spending per pupil. Element d_{it} represents the regime dummy equal to 1 in 2008 and 0 otherwise, or assumes the value of 1 from 2007 on, depending whether you consider the IDEB's results and goals or *Prova Brasil*'s scores as the turning point that could have affected how the municipalities interact. The term d_{it} can also represent different electoral accountability regimes, taking on the value of 1 in the case where the incumbents are lame ducks and 0 if they are in their first term in office. Alternatively, if the regimes are defined by the size of the government majority, it assumes the value of 1 for the jurisdictions where the incumbent's government does not have the majority of the seats in the legislative, i.e., holds less than x% of the total seats (with x varying from 45% to 75%), and 0 otherwise. Moreover, to take the possible differences in the mimicking behavior over the political cycle into account, we consider that the regime variable assume the value of 1 in the election years (2004 and 2008) and 0 in the other years. The second regime (or the complement of the first regime) is represented by the element $(1 - d_{it})$.

[19] Remember that the presence of spatial correlation by itself can be evidence for competing theories of strategic interaction (such as yardstick and tax competition), hence the need for empirical applications to take the heterogeneity of the incumbents' incentives into account.
[20] Term coined by Anselin (1988).
[21] See Borcherding and Deacon (1972).

The w_{ij} term is the spatial weight assigned to unit j by the unit i defined by the contiguity criterion.[22] The weights result from the row standardization of the $N \times N$ spatial weights matrix W_N such that $\sum_{j=1}^{N} w_{ij} = 1$. The neighbors' educational expenditure per pupil is represented by $\sum_{j=1}^{N} w_{ij} y_{jt}$. The coefficients λ_1 and λ_2 on the interaction terms are the parameters of interest (as well as their difference $\lambda_1 - \lambda_2$) that inform the spatial correlation under each regime d and $(1-d)$, with $|\lambda_1|, |\lambda_2| < 1$ to ensure spatial stationarity. Vector X is $(1 \times K)$ and represents the demographic and political covariates, while β is a $(K \times 1)$ vector of corresponding parameters. The neighbors' characteristics $\sum_{j=1}^{N} w_{ij} X_{jt}$ and their parameters θ are also included in (1.1). Inserting spatially lagged covariates can help to capture the spillover effects of neighbors as well as to obtain unbiased estimates in case neighbors' characteristics are correlated with the included covariates (Lesage and Pace, 2009).

Element μ_i represents the spatial specific effects and is aimed at capturing the non-observable characteristics that do not vary over time but that are potentially correlated with the variables that are included in the model. A spatial Hausman test is performed to decide if μ_i is fixed or random. Common shocks to all municipalities at a given point in time are represented by τ_t, a set of year dummies. Additionally, by assumption, the error term must be such that $u \sim N(0, \sigma_u^2)$.

We estimate (1.1) using maximum likelihood. Despite being computationally intensive for large samples such as that of Brazilian municipalities, maximum likelihood has advantages. One advantage is that the dependence parameters are restricted to the interval given by the minimum and maximum eigenvalues. Maximum likelihood also produces smaller standard errors than the IV estimators if the disturbances are spherical. Elhorst and Fréret (2009) derive the Log Likelihood function that provides the estimates of the spatial parameters and the other coefficients.

$$
\begin{aligned}
Log\ L = & -\frac{NT}{2} ln(2\pi\sigma^2) + \sum_{t=1}^{T} ln|I_N - \lambda_1 D_t W_N - \lambda_2 (I_N - D_t) W_N| \\
& -\frac{1}{2\sigma^2} \sum_{i=1}^{N} \sum_{t=1}^{T} \Big[y_{it} - \lambda_1 d_{it} \sum_{j=1}^{N} w_{ij}\, y_{jt} - \lambda_2 (1 - d_{it}) \sum_{j=1}^{N} w_{ij}\, y_{jt} \\
& -\alpha - X_{it}\beta - \sum_{j=1}^{N} w_{ij} X_{jt}\, \theta - \mu_i - \tau_t \Big]^2
\end{aligned}
\tag{1.2}
$$

[22] We have also tried distance-based weights and obtained virtually the same results.

where D_t is a $(N \times N)$ diagonal matrix whose diagonal elements are the regime dummies d_{it}. The parameters are then estimated by maximizing the profile likelihood function concentrated with respect to the parameters of the exogenous variables and the variance of the disturbance.[23] Lee (2004) shows that the parameters are asymptotic and normally distributed under weak regularity conditions, e.g., the disturbances need not be normally distributed.

As far as the error term u is concerned, the literature usually admits the possibility that it follows a spatial error structure. In fact, Bordignon et al. (2003) argue that the voters have enough information to not be influenced by differences between jurisdictions' tax and expenditure levels due to observable characteristics. Instead, they are more likely to evaluate neighbors' unexpected changes in public policies.[24] In this case, the appropriate model to identify yardstick competition would be one of the spatial error type. On the other hand, several other authors assume that the voters react to the differences in fiscal policies due to observable characteristics, perhaps because they are not as well informed as one might think.[25] Ultimately, the choice of the model type is an empirical issue that is made based on the robust LM lag and the LM error tests proposed by Anselin et al. (1996).

In standard one-regime specifications, it can be shown that the spatial Durbin model has the spatial error model as a special case (when the common factor restrictions hold), which makes the former a more attractive procedure.[26] However, if the error structure follows a two-regime spatial pattern, this relationship is no longer valid unless all of the spatially lagged independent variables enter the right hand side of (1.1) interacting with each regime dummy. A two-regime spatial error term can be represented as follows:

$$u_{it} = \rho_1 d_{it} \sum_{j=1}^{N} w_{ij} u_{jt} + \rho_2 (1 - d_{it}) \sum_{j=1}^{N} w_{ij} u_{jt} + \varepsilon_{it} \qquad (1.3)$$

where u_{it} is a spatially correlated error term, d_{it} represents the same regime dummy variables, ρ_1 and ρ_2 are the spatial parameters of interest, with $|\rho_1|, |\rho_2| < 1$, and the iid disturbance is represented by $\varepsilon_{it} \sim N(0, \sigma_\varepsilon^2)$.

[23] The models' estimates are obtained using Matlab routines for spatial panel problems developed by Paul Elhorst, kindly made available at http://www.regroningen.nl/elhorst/software.shtml.
[24] See Besley and Case (1995) and Revelli and Tovmo (2007).
[25] See Revelli (2006), Elhorst and Fréret (2009), Allers and Elhorst (2005), Sollé Ollé (2003), and Revelli (2002).
[26] See LeSage and Pace (2009, pp.28).

If the disturbance u_{it} is not spherical, i.e., whether there is spatial correlation in the error term, autocorrelation or heteroskedasticity, in principle, the Instrumental Variables estimators (IV) would be the natural alternative to obtain robust standard errors and consistent estimates of the coefficients of the main equation. Keleijan and Prucha (1998) show that the first and higher order neighbors' characteristics, i. e., $(I_T \otimes W_N)X, (I_T \otimes W_N^2)X, ..., \left(I_T \otimes W_N^q\right)X$, consist of ideal instruments for the spatially lagged dependent variable, but advise that using up to the second order neighbor characteristics should be enough.

However, the IV estimators have a major limitation as regards the linear relationship between the dependent variable and the spatial lag, which can produce estimates of the coefficients out of its parameter space, e.g., correlations greater than 1. An additional problem, specific to the spatial Durbin model, is that the ideal instruments given by the neighbors' characteristics already enter the model as explanatory variables. In this case, Elhorst (2010) suggests using the characteristics of the higher order neighbors (given by ${W_N}^q$ with $q \geq 2$) as the instruments. However, as noted by Pace et al. (2011), weak instruments will often be a concern in the spatial Durbin model because of the smaller explanatory power of the set of excluded instruments.

The estimation strategy in the present work follows a specific to general approach to select the best estimation strategy, and it is carried out as follows. First, we estimate a baseline model with spatial parameters $\theta, \lambda_1, \lambda_2, \rho_1, \rho_2$ set to zero using pooled ordinary least squares and fixed effects within estimators, and evaluate the spatial dependence in the error term before and after controlling for fixed effects. We then perform the robust versions of the LM lag and LM error tests for each case to decide the nature of the spatial interaction process. Spatial Hausman tests are also calculated to decide whether fixed or random effects are more appropriate. Subsequently, we estimate a standard spatial Durbin model with time and spatial fixed effects using maximum likelihood and show its advantages compared with the IV estimators. Finally, we estimate the two-regime models for the various types of regimes and conduct a robustness test that uses school inputs in place of education spending to assess the mechanisms by which IDEB disclosure affects strategic interaction in education provision.

1.4 Data and Variables

Data on the Brazilian municipalities range from 2002 to 2008. Before 2002, spending on education and cultural activities are jointly reported and after 2008 some of the control variables are not available, ultimately restricting the analysis to the referred period. Of the 5565 municipalities, there are complete data for 3604 of them. The dependent and independent variables that we use to estimate (1.1) are described in Table 1.2, and the descriptive statistics are presented in Table 1.3. The continuous variables (and indexes) enter the econometric model in (1.1) in their logarithmic form, whereas the proportions and the dummy variables enter the model unchanged.

The educational spending per pupil is made available by the National Treasury Office (STN) through a database of self-reported records known as Finance of Brazil (FINBRA). Figure 1 shows the remarkable evolution of education spending over the period. Several factors contributed to this increase. The economic growth and the increasing efficiency of tax collection ultimately increased the available revenue. Additionally, over the last decade, there has been growing concern regarding investment in basic education.

On the left panel of figure 1, for the year 2002, the spatial patterns are less clear due to the scale convention. The right panel, on the other hand, shows clearer spatial patterns and a striking difference in the levels of per pupil spending between the municipalities to the north and to the south.

Table 1.3 shows descriptive statistics. There, it is possible to see that the mean spending per pupil is 2,612.13 reais (1,500.19 US dollars).[27] Note also that the standard deviation is expressive (1,782.79 reais or 1,023.89 US dollars), evidencing the large difference in education spending between the Brazilian local governments.

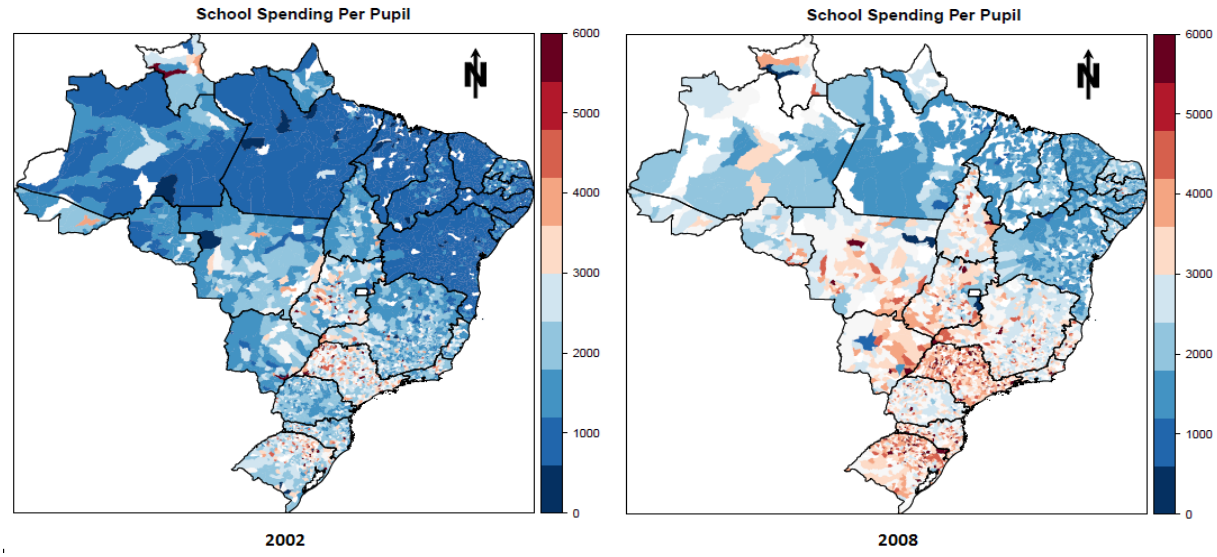
Table 1.2 – Description of the variables

variable	Description	source
education spending	Education spending per pupil enrolled at the local public school system	FINBRA-STN
gdp	Gross domestic product per capita (net of public sector activity). It is a proxy for total income (unavailable for the period) and for own revenue raising capacity.	IBGE
wage	Average wage of formal sector workers. It is a proxy for total income (unavailable for the period).	RAIS-MTE
occupation	Is given by the following expression $occupation = \left(Occupied_j / Total\ Pop_j\right) \times 100$, where $Occupied_j$ is the number of individuals between 25 and 65 years old occupied in	RAIS-MTE

[27] Prices are adjusted by the Amplified Consumer's Price Index (IPCA) to prices of December 2009.

(Continued)

variable	Description	source
	the formal sector of municipality j, and $Total\ Pop_j$ is total individuals of the same age living in the municipality j. It intends to control for the bias resulting from considering only the wage in the formal sector when that is used as a proxy for total income.	
categorical grant	Total grant per pupil received by the municipality with the specific purpose of education financing. Includes FUNDEF (and later on FUNDEB) grants as well as any categorical grant targeted at education, such as the ones from intergovernmental agreements and voluntary (non-mandatory) transfers.	FINBRA-STN
block grant	Total grants per capita received through FPM. These general purposes block grants consist of the main source of municipal revenue.	FINBRA-STN
perceived cost	$perceived\ cost = 100 \cdot (Collected_j / Municipal\ Revenue_j)$, where $Collected_j$ consists of taxes collected in the municipality j by all levels of government through mostly indirect taxes on final goods and services, and $Municipal\ Revenue_j$ is the total revenue of the jurisdiction. It consists of a proxy for the "tax price".	FINBRA-STN and IBGE
schooling	Average years of schooling.	RAIS-MTE
men	Percentage of male individuals.	DATASUS-MS
population	Total population.	IBGE
elderly	Percentage of individuals over 65 years old.	DATASUS-MS
young	Percentage of individuals under 18 years old.	DATASUS-MS
rural	Percentage of the local public schools' students attending schools in the rural area.	Education Census-MEC
second cicle	Percentage of local public schools' students attending the second cycle of fundamental education.	Education Census-MEC
competition	Number of candidates running for office.	Canelew - TSE
incumbent's age	Age of the incumbent.	Canelew - TSE
incumbent's education	Dummy variable assuming value of 1 if the incumbent finished higher education and 0 otherwise.	Canelew - TSE
left	Dummy variable assuming value of 1 if the incumbent belongs to a left wing party and 0 otherwise. The following parties were considered to be left wing (in acronyms): PC do B, PT, PDT, PSTU, PCB, PSB, PCO,PPS, PSOL.	Canelew - TSE
incumbent women	Dummy variable assuming value of 1 if the incumbent is a woman and 0 otherwise.	Canelew - TSE
majority of seats	Dummy variable equal to 1 if the incumbent coalition holds more than 50% of the city council's seats.	Canelew - TSE
percentage of seats	Percentage of seats held by the incumbent coalition at the city council.	Canelew - TSE
president's party	Dummy variable equal to 1 if the incumbent's party is the same as the president's and 0 otherwise.	Canelew - TSE
governor's party	Dummy variable equal to 1 if the incumbent's party is the same as the governor's and 0 otherwise.	Canelew - TSE
lame duck	Dummy variable equal to 1 if the incumbent is in his or her second and final term and 0 otherwise.	Canelew - TSE
aldermen's education	Percentage of aldermen with higher education.	Canelew - TSE
aldermen's age	Average age of the aldermen.	Canelew - TSE
women in council	Percentage of women in city council.	Canelew - TSE
competition for seats	Ratio of the number of candidates to the number of seats available at the city council.	Canelew - TSE
fragmentation	It is calculated by the following formula: $Fragmentation = 100 \cdot (1 - \sum_{i=1}^{N} p_i^2)$, where p_i is the share of seats held by each party i at the city council.	Canelew - TSE



Source: Elaborated by the authors using FINBRA data for the years of 2002 and 2008.
Figure 1. 1 – An overview of the geographical distribution of the education spending per pupil

Table 1.3 – Descriptive Statistics

variable	Obs	mean	sd	min	max
education spending (reais per pupil)	25228	2612.13	1782.79	440.55	33465.82
gdp (reais per capita)	25228	9091.28	9314.83	1301.01	218000.00
wage (reais per worker)	25228	736.67	252.09	101.58	5745.16
occupation (index)	25228	19.99	14.67	0.03	386.52
categorical grant (reais per pupil)	25228	1188.35	460.24	167.78	7228.74
block grant (reais per capita)	25228	521.43	384.41	0.54	5395.86
perceived cost (index)	25228	61.48	119.95	1.58	9574.09
schooling (years)	25228	9.34	1.29	1.46	15.59
men (%)	25228	50.68	1.49	44.88	67.03
population (in 1000 inhab.)	25228	37.22	231.98	0.75	11104.71
elderly (%)	25228	7.01	2.15	0.58	20.92
young (%)	25228	37.98	6.22	17.43	61.79
rural (%)	25228	33.76	31.12	0.00	100.00
second cicle (%)	25228	23.78	19.30	0.00	100.00
competition (number of candidates)	25228	2.78	1.12	1.00	16.00
incumbent's age (years)	25228	49.81	9.73	21.21	86.80
incumbent's education (dummy)	25228	0.41	0.49	0.00	1.00
left (dummy)	25228	0.19	0.39	0.00	1.00
incumbent women (dummy)	25228	0.06	0.24	0.00	1.00
majority of seats (dummy)	25228	0.59	0.49	0.00	1.00
proportion of seats (%)	25228	53.10	17.90	0.00	100.00
president's party (dummy)	25228	0.08	0.27	0.00	1.00
governor's party (dummy)	25228	0.23	0.42	0.00	1.00
lame duck (dummy)	25228	0.27	0.45	0.00	1.00
aldermen's education (%)	25228	15.62	16.24	0.00	90.00
aldermen's age (years)	25228	44.38	3.96	28.62	60.00
women in council (%)	25228	12.04	10.85	0.00	77.78
competition for seats (candidates/seats)	25228	6.08	3.81	1.00	30.33
fragmentation (index)	25228	73.83	10.15	0.00	93.36

Categorical and block grants are also obtained from FINBRA. These variables are expected to have a positive impact on the level of education spending. For a number of municipalities that have a low revenue generating capacity, the educational categorical grants are supposed to have a more pronounced impact because they cannot serve as substitutes for own revenue in the financing of other activities. Block grants, in turn, need not necessarily be employed for education; the amount destined for this area depends on the marginal propensity to spend on education, regardless of the fiscal capacity. Table 1.3 shows that the mean value of the categorical grants is 1188.35 reais per pupil (or 682.49 US dollars), while the block grant that is received by the municipalities amounts to 521.43 reais per capita (or 299.47 US dollars) on average. The variation in the value of grants between localities is also very expressive, as the standard deviations make clear.

Another variable calculated with FINBRA data is the "perceived cost." The literature on public finance usually relies on the share of local property taxes paid by the representative voter as a measure of the tax price. However, as already discussed, property tax in Brazil is a minor source of revenue. The most significant portion of revenues comes from block and categorical grants, – which are funded mainly through the ICMS and the IPI taxes – as well as from the local participation in the ICMS. The "perceived cost" takes these specificities into account by considering the ratio between the sum of the local services tax and the taxes on production collected within the municipality's borders – whose main components are the state and federal indirect taxes ICMS and IPI – and the total revenue of the jurisdiction (then multiplied by 100). This variable reflects the cost perceived by the local citizens of providing one monetary unit of public services. As observed from Table 1.3, the mean perceived cost is equal to 61.48, which means that most of the municipalities are net receivers of public funds. The higher this ratio is, the less expenditure on education the citizens are expected to demand, as well as any other public service.

Demand for public services is also a function of income. Borcherding and Deacon (1972) and Bergstrom, Rubinfeld and Shapiro (1982) show that public education is a normal good, i.e., it is increasing in income. However, for the period under analysis, there is no information on the total income by municipalities. Fortunately though, some proxy variables are available, such as the GDP net of the public sector activities from the Brazilian Institute of Geography and Statistics (IBGE), the average wage of formal sector workers from the Annual Relation of Social Information (RAIS) gathered by the Ministry of Labor and Employment, and an occupation index from the same source, which consists of the ratio between the

number of formal sector workers between 25 and 65 years and the total number of individuals of the same age living in the municipality (multiplied by 100). Note that the index can be greater than 100 because the numerator refers to the total workers, while the denominator is restricted to the citizens living in the municipality. Altogether, these three variables should capture the income effect on the demand for education.

Other variables are included as controls in (1.1) to capture the differences in taste for public education. For example, demographic variables such as the percentage of male, young and elderly individuals are related to tastes for public education. All of these variables are gathered from DATASUS, a database from the Ministry of Health. The proportion of men in the population is included to account for the fact that men leave school for the labor market earlier than women.[28] Elderly people, in turn, usually demand less education and more health expenditures. The predominance of young people, however, can have an ambiguous effect because it can either lead to a higher demand for education, as the localities will be populated by families with a strong preference for education expenditures, or to a lower demand because bigger cohorts of young people can decrease the amount of resources per pupil.[29] In addition, the average years of schooling (obtained from RAIS) is included to capture the preference of more educated individuals for more public education.

The population of the municipality (from IBGE) is included as a control to account for economies of scale in the provision of education. Thus, in principle, the greater the population, the lower the per pupil expenditure should be. However, big cities usually have higher costs of living that can affect the level of expenditures. This phenomenon is difficult to be addressed because there are no indexes that capture such peculiarities for all municipalities.

The percentage of students enrolled in rural public schools and the percentage of students enrolled in the second cycle of fundamental education (from 6^{th} to 9^{th} grade) of the local public schools are included in (1.1) to take into account the differences in the amount of the categorical transfers that these students receive (from FUNDEF) in excess of those enrolled in the first cycle (from 1^{st} to 5^{th} grade) or in the Preschool attending urban schools.

[28] A report by the Organization for Economic Cooperation and Development (2009) shows that the difference in the upper secondary graduation rates of boys and girls is especially remarkable in Brazil, at 71,9% among girls and 53,2% among boys.
[29] See Arvate and Zoghbi (2010) and Poterba (1997).

The electoral variables included in equation (1.1) are all gathered from the Canelew database, which is organized by the Electoral Supreme Court. The political features of the local governments are important determinants of the level of expenditure on education. Left-wing governments, for example, prefer a larger public sector, i.e., higher expenditures.[30] In Brazil, however, partisan ideology is not as well defined as in other countries.[31] Nevertheless, a dummy variable named "left" is included in the model to capture the possible differences in tastes for public expenditure in education. In addition, two dummy variables assigning whether the incumbent's party is the same as the presidents' or the governors' are included in (1.1) to account for the fact that the partisanship of incumbents is supposed to increase the amount of resources that they have access to.

Another frequently explored variable refers to party fragmentation (see the description in Table 1.2). A more fragmented political system supposedly reflects the existence of various interest groups. According to Weingast, Shepsle, and Johnsen (1981), because the resources come from a common pool of taxation, any expenditure that is targeted at specific groups will have its costs equally divided among all groups, making the benefited groups not fully internalize the costs of the program, thus increasing the demand for public spending. Additionally, the incumbents can engage in pork barrel politics to overcome the difficulties imposed by a fragmented city council, increasing the spending level.

The existence of term limits can also influence the level of expenditures. Besley and Case (1995) argue that lame duck incumbents have an adverse incentive to maximize rent extraction because they do not need to run for elections again, which would translate into higher taxes and expenditures in the last term in office.

Mukherjee (2003) estimates that the size of the majority can affect the level of public spending in a non-linear fashion. According to the author, weak majorities (greater than 50% and smaller than 56%) would lessen the need to engage in pork barrel politics and thus decrease the level of total expenditures. Conversely, strong majorities (between 56% and 68%) can diminish the risks of adopting loose fiscal policies and transfer the burden to non-majority members. However, when a super majority (greater than 68%) is reached, the burden cannot be passed on to the minority group because it is too small, and increasing expenditures with a budget restriction means that the majority will have to cope with the costs of taxation. Because the purpose here is not to estimate this effect, but just to control it, we only consider

[30] See Alt and Lowry (1994) and Sollé Ollé (2006).
[31] See Lucas and Samuels (2010).

a dummy variable assigning the value of 1 when the party in office holds over 50% of the city council's seats (and 0 otherwise). This dummy variable should be enough to control for the average effect of the political majority on education spending.

A set of incumbents' and aldermen characteristics that are intended to reflect their quality is also included in (1.1). One of these characteristics is the education of the incumbents and aldermen, which can reflect their preferences regarding educational expenditure. Besley and Case (1995) also emphasize the age of the incumbents as an important determinant of electoral outcomes and fiscal policy. Incumbents on the edge of retirement, who may be in office for a last term, have an incentive to extract more rents and thus increase taxes and spending levels. Therefore, both the age of incumbents and the mean age of the aldermen are used as additional controls.

Milyo and Schosberg (2000) demonstrate that because women face barriers to entry into office, if they are chosen, they are of better quality. Therefore, we include two variables in (1.1) to capture this phenomenon: a dummy variable indicating whether the mayor is woman and the percentage of women in the city council.

A last factor that can lead to better quality incumbents is competition. As the number of candidates for the position increases, the voters will be better able to distinguish between the good and bad candidates and vote for the good ones. As a result, the expected rent extraction will be smaller, as will taxes and expenditures. Accordingly, a variable that informs the number of candidates running for office and another that reflects the number of candidates per seat at the council are included in (1.1).

1.5 Results

1.5.1 Standard One-Regime Models

Before presenting the estimates of (1.1), we analyze the results of basic non-spatial and standard one-regime spatial models following a specific to general approach to determine the best estimation strategy.

The first two columns of Table 1.4 present models where the spatial parameters λ, ρ and θ are all set to zero. The first model (POLS) is estimated using ordinary least squares and is

only illustrative of the importance of considering the fixed effects of the municipalities. As observed at the bottom of Table 1.4, the robust LM lag and the LM error test statistics performed with the residuals of the model reject neither a spatial lag nor a spatial error model as the most suited for the problem. The Moran's I calculated on the residuals is equal to 0.237, with a statistic of 54.58, which is significant at less than the minimum conventional level of 1%, showing a strong spatial correlation in the residuals.

As noted by Elhorst (2010), failing to take fixed effects into account can result in spatially auto-correlated residuals. The model FE in the second column clearly confirms that. The Moran's I that is calculated on the residuals of the fixed effects model is equal to 0.117, which is still significant at much less than 1% but considerably smaller than the correlation observed in the residuals of the POLS model. More importantly, the robust LM test of no spatial lag rejects this hypothesis at a 1% significance level, whereas the robust LM test of no spatial error cannot reject the null hypothesis at the conventional levels, thus indicating the spatial lag as the most appropriate model.

Table 1.4- Results of standard one regime models of log education spending in Brazilian municipalities

	OLS	WITHIN	GM	GM	ML	ML
	POLS	FE	SARFEGM	SDFEGM	SARFE	SDFE
$Wy - Spatial\ parameter\ \lambda$			0.513***	0.865***	0.180***	0.177***
			(12.969)	(8.991)	(23.866)	(22.558)
gdp	0.252***	0.104***	0.059***	0.066***	0.092***	0.085***
	(47.494)	(11.806)	(4.800)	(4.341)	(9.746)	(8.139)
wage	0.319***	0.096***	0.063***	0.054***	0.084***	0.075***
	(36.000)	(10.764)	(5.748)	(4.579)	(8.852)	(7.780)
perceived cost	-0.101***	-0.064***	-0.045***	-0.054***	-0.061***	-0.064***
	(-29.996)	(-13.136)	(-6.050)	(-6.304)	(-11.868)	(-11.802)
categorical grants	0.411***	0.288***	0.188***	0.282***	0.280***	0.285***
	(61.682)	(50.071)	(5.038)	(6.294)	(45.702)	(45.452)
block grants	0.069***	0.024***	0.017**	0.015**	0.022***	0.021***
	(16.232)	(8.421)	(2.528)	(2.127)	(7.469)	(6.945)
schooling	0.027**	0.006	-0.011	-0.020	-0.001	-0.016
	(1.981)	(0.364)	(-0.558)	(-0.931)	(-0.033)	(-0.938)
occupation	0.039***	0.017***	0.007	0.004	0.015***	0.010**
	(9.779)	(4.112)	(1.383)	(0.654)	(3.268)	(2.280)
men	-0.008***	-0.003	0.002	-0.003	-0.003	-0.004
	(-5.333)	(-1.033)	(0.360)	(-0.605)	(-0.842)	(-1.216)
population	-0.045***	0.098***	0.039	0.033	0.081***	0.066***
	(-11.941)	(4.921)	(1.593)	(1.116)	(3.797)	(2.894)
elderly	-0.017***	-0.050***	-0.024***	-0.017***	-0.040***	-0.021***
	(-11.525)	(-21.053)	(-7.168)	(-3.752)	(-15.872)	(-5.517)
young	-0.038***	-0.024***	-0.011***	-0.006***	-0.019***	-0.009***
	(-61.244)	(-15.498)	(-5.933)	(-2.635)	(-11.845)	(-4.466)
rural	0.002***	0.001***	0.001***	0.001***	0.001***	0.001***
	(36.617)	(8.724)	(4.744)	(5.958)	(8.086)	(8.266)
second cicle	-0.004***	-0.001***	-0.001***	-0.002***	-0.001***	-0.001***
	(-44.943)	(-5.185)	(-4.329)	(-6.229)	(-5.765)	(-7.045)
competition	0.028***	-0.003	0.003	0.002	-0.001	0.0001
	(4.291)	(-0.461)	(0.490)	(0.266)	(-0.225)	(-0.018)
incumbent's age	-0.022**	0.017**	0.014	0.024**	0.018**	0.018**

(Continued)

	OLS	WITHIN	GM	GM	ML	ML
	POLS	FE	SARFEGM	SDFEGM	SARFE	SDFE
	(-2.358)	(2.032)	(1.340)	(2.154)	(2.081)	(2.036)
incumbent's Education	0.00023	0.009**	0.012***	0.010**	0.008**	0.009**
	(-0.063)	(2.561)	(2.983)	(2.283)	(2.335)	(2.481)
left	0.027***	0.004	0.006	0.002	0.004	0.003
	(5.474)	(1.083)	(1.223)	(0.319)	(0.970)	(0.720)
incumbent women	-0.035***	0.012**	0.010	0.008	0.012*	0.013*
	(-4.826)	(1.979)	(1.364)	(1.012)	(1.767)	(1.912)
aldermen's education	0.001***	0.0001	0.0001	0.00001	0.0001	0.0001
	(7.997)	(0.833)	(0.739)	(0.074)	(0.646)	(0.657)
aldermen's age	-0.155***	-0.002	0.030	0.017	0.007	0.013
	(-6.848)	(-0.097)	(1.068)	(0.572)	(0.295)	(0.529)
women in council	-0.001***	0.0001	0.00004	0.0002	0.00002	0.00003
	(-3.945)	(0.483)	(-0.201)	(-1.082)	(0.104)	(0.211)
competition for seats	0.005	0.010	0.005	0.013	0.008	0.011
	(0.876)	(1.481)	(0.649)	(1.443)	(1.101)	(1.500)
fragmentation	-0.001***	0.001**	0.0002	0.0002	0.0004**	0.0004*
	(-4.295)	(2.514)	(0.931)	(0.671)	(1.983)	(1.740)
majority of seats	-0.001	-0.005*	-0.002	-0.005	-0.005	-0.005*
	(-0.134)	(-1.767)	(-0.578)	(-1.336)	(-1.449)	(-1.696)
president's party	0.022***	0.018***	0.013**	0.012*	0.017***	0.016***
	(3.110)	(3.616)	(1.980)	(1.706)	(3.306)	(3.031)
governor's party	-0.003	-0.003	0.0002	-0.005	-0.003	-0.003
	(-0.813)	(-0.871)	(0.048)	(-1.225)	(-0.828)	(-0.855)
lameduck	0.003	0.001	0.004	0.008**	0.002	0.003
	(0.769)	(0.317)	(1.278)	(2.154)	(0.668)	(0.888)
Spatially Lagged Independent Variables (WX)	No	No	No	Yes	No	Yes
Spatial Fixed Effects	No	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Robust LM no Spatial Lag $\chi2$	22530.3***	47.1***				
Robust LM no Spatial Error $\chi2$	24993.1***	0.6				
Kleibergen-Paap $\chi2$ (Underidentification)			882.3***	196.8***		
Kleibergen-Paap F (Weak Identification)			31.6(a)	8.4(c)		
Hansen J statistics $\chi2$ (Overidentification)			192.9***	24.2		
R-squared	0.389	0.929	0.631	0.601	0.931	0.932
N	25228	25228	25228	25228	25228	25228
log-likelihood			12573.8	11540.7	12725.1	12898.4

Notes: see the full estimates in the Appendix A.1.
t-statistics in parenthesis. *** significant at 1%; ** significant at 5%; and * significant at 10%. a-significant at 5% IV maximal relative bias; c- significant at 20% IV maximal relative bias . Instruments are first and second order neighbors' characteristics for model SARFEGM, and only second order neighbors' characteristics for SDFEGM model.

Next, we estimate the spatial lag and the spatial Durbin models through the generalized method of moments (GM) and contrast them with the maximum likelihood (ML) estimates. The GM procedure is estimated along with the HAC estimator of the variance-covariance matrix to obtain consistent estimates of the standard errors. The GM spatial lag model (SARFEGM) in Table 1.4 shows a spatial parameter of 0.513 that can be interpreted as elasticity i.e., a 1% increase in the neighbors' education spending per pupil induces a jurisdiction reaction of 0.513% in own education spending. Note that this figure is very high compared to the results of other studies such as in Elhorst and Fréret (2009) and Revelli

(2006) (elasticity of 0.083 and 0.216 in welfare spending, respectively), possibly because of the linear relationship between the endogenous regressor and the dependent variable that is peculiar to IV estimators. Additionally, even though we reject the null of under-identification and weak identification (see the statistics at the bottom of Table 1.4), the test for over-identification rejects the null hypothesis of no correlation between the excluded instruments and the residuals of the main equation, indicating that the instruments are not exogenous.

The rejection of the null of exogeneity appears to be caused by omitted variables, as it becomes clearer when we look at the results of the Spatial Durbin model (SDFEGM). By including the characteristics of the contiguous neighbors in the model and instrumenting the spatial lag by the second order neighbors' characteristics, we no longer reject the null of exogeneity of the instruments (χ^2 statistic equal to 24.2). However, the size of the spatial lag parameter of the SDFEGM model is unusually large, especially compared to those found in the previously mentioned studies. A 1% increase in the neighbors spending per pupil makes the jurisdiction react with an astonishing 0.865% increase in own spending. Weak instruments appear to be the most likely explanation for the increase in the magnitude of the spatial parameter, just as Pace et al. (2011) warned in the case of a spatial Durbin model. Looking at the test result at the bottom of Table 1.4, we cannot reject the presence of weak instruments at the more rigorous levels (F statistic equal to 8.4). In view of these disadvantages, the maximum likelihood estimator appears to be the most appropriate choice.

Maximum likelihood estimates of the spatial lag model (named SARFE in Table 1.4) show a spatial parameter that is much more plausible, with a magnitude that is closer to those found in the literature. A 1% increase in the neighbor's spending per pupil makes the jurisdiction react through a 0.18% increase in own expenditures. In addition, as observed at the bottom of the table, the log-likelihood of this model is higher than its IV counterpart (SARFEGM). We also perform a spatial Hausman test and reject the null that the coefficients of the spatial fixed effects (consistent) and the random effects (efficient) estimators are equal (χ^2 statistic is equal to 828.0 and statistically significant at much less than 1%), which indicates that the fixed effects are the most appropriate choice.

Still, SARFE estimates can suffer from omitted variable bias. Thus, we estimate a fixed effects spatial Durbin model, termed SDFE in Table 1.4. Spatial Hausman for such model also indicates that the spatial fixed effects estimator is the most appropriate method (the χ^2 statistic is equal to 117.7 and statistically significant at less than 1%). The spatial parameter

on the SDFE model indicates that a 1% increase in the neighbors' spending per pupil leads to a reaction of a 0.177% increase in own municipality spending. This result is much lower than those found using the GM procedure and much more coherent with the results of other studies.

Note that the maximum likelihood coefficients of the exogenous variables cannot be interpreted as the marginal effects because the latter consist of the sum of the direct and indirect effects.[32] However, in general, the coefficients can inform the direction of these effects. In the SDFE model, the variables gdp, wage and occupation serve as a proxy for income. As expected, all of these variables present positive coefficients, pointing out that education is a normal good. Categorical and block grants also show positive coefficients, with the former having the stronger impact. The perceived cost shows a negative effect on education spending per pupil, meaning that the higher the cost perceived by the citizens of spending an additional monetary unit on public education, the smaller the demand for this good will be. Schooling does not appear to have a significant effect once the fixed effects are controlled for. The same is true for the percentage of men in the municipality. The coefficient of population, on the other hand, shows a positive sign once the fixed effects are considered, which goes against the hypothesis of economies of scale and supports the hypothesis of differences in the cost of living or even congestion effects.

Both the percentages of the elderly and the young present negative coefficients. The first result is direct; elderly citizens demand less education and more health expenditure.[33] However, the second result has a less clear-cut interpretation. One would expect that a larger fraction of young people in a jurisdiction would increase the demand for education. Possibly because municipalities in Brazil where there are a greater share of young individuals have very little revenue generating capacity – due the lower share of economically active individuals –, an increase in the share of young individuals could mean that they will have to share a fixed amount of own revenues among a higher number of people, decreasing the per capita amount available.

The coefficient on the ratio of students enrolled in rural schools of the local public educational system is positive, reflecting the legal determination that the rural school students receive a greater amount of transfers from FUNDEF. Conversely, the coefficient on the

[32] See LeSage and Pace (2009, pp. 69).
[33] See Poterba (1997) and Arvate and Zoghbi (2010).

percentage of public school students enrolled in the 2nd cycle (6th to 9th grade of fundamental education) is negative, despite that they also should receive a higher amount of transfers.

Among the political variables, the incumbent's characteristics appear to play an important role in determining the educational expenditure. As expected, the age of the incumbent positively affects the spending per pupil, suggesting that the willingness to extract rent increases as the incumbents get older. More educated and female incumbents also show stronger preferences for education expenditures, although the coefficient of the latter only shows weak significance at the 10% level. The party fragmentation coefficient suggests (only weakly) that the more party fragmented a municipality is, the higher the expenditure level will be, either because of the need for pork barrel politics to build a majority or because the parties will tend not to internalize the full cost of their projects in a more fragmented system. Incumbents of the same party as the presidents' also seem to spend more on education according to the estimated coefficient, which can be accredited to the greater access they enjoy to federal transfers.

On the other hand, weak evidence suggests that the incumbents holding the majority of seats in the council spend less on education, possibly because of the lesser need to engage in pork barrel politics. In contrast, variables denoting the number of candidates running for office (variable "competition"), the left wing parties, the aldermen's education and age, the percentage of women in the council, the competition for seats in the council, the incumbents of the same party as the governors' and the lame duck incumbents do not show statistically significant coefficients.

1.5.2 Two-Regime Models

In the last section, we followed a specific to general approach to select the best estimation strategy. Ultimately, the test results indicated that the maximum likelihood spatial Durbin model is the best alternative. Next, to identify the yardstick competition, we generalize this conclusion and use a two-regime spatial Durbin model that is estimated through maximum likelihood, where the regimes reflect different electoral and education accountability scenarios.

Table 1.5 summarizes the main results. In model 1, the regime variable d assumes the value of 1 for "lame duck" incumbents and 0 otherwise, while the second regime $(1-d)$

takes the value of 1 for incumbents in their first term and 0 otherwise. The spatial parameter on lame ducks (λ_1) indicates that they increase their own spending per pupil by 0.163% in response to a 1% increase in the neighbors' average spending. The incumbents in their first term react more intensively, raising the education spending by 0.208% in response to the same 1% change in their neighbors' expenditures. The difference between the spatial elasticities of the two groups ($\lambda_1 - \lambda_2$) is equal to -0.045 percentage points, statistically significant at the 5% level. This difference suggests that there is weaker strategic interaction in education spending among the lame duck governments. This result is consistent with those of Besley and Case (1995) and Bordignon et al. (2003), who analyze interactions in the tax setting and predict fewer incentives for incumbents in their last term in office to mimic their neighbors' behavior and signal their quality to the voters. Note also that an incumbent being a "lame duck" does not eliminate spatial interaction completely, supporting the argument of Alesina and Spear (1988), according to which the parties have incentive mechanisms to prevent the lame duck governors from pursuing only their own interests.

Table 1.5- Two regime models for determination of log education spending in Brazilian municipalities

	1	2	3	4	5
	d= dummy of "lame ducks"	*d* = dummy of "less than 50% of seats"	*d*= dummy of Prova Brasil 2007-2008	*d* = dummy of IDEB 2008	*d* = dummy of election years
$\lambda_1 \, on \, dWy$	0.163***	0.197***	0.166***	0.160***	0.154***
	(16.766)	(17.899)	(18.068)	(18.904)	(16.717)
$\lambda_2 \, on \, (1-d)Wy$	0.208***	0.146***	0.203***	0.264***	0.233***
	(12.439)	(10.741)	(14.760)	(14.608)	(17.277)
$\lambda_1 - \lambda_2$	-0.045**	0.051***	-0.037**	-0.104***	-0.079***
	(-2.194)	(2.736)	(-2.331)	(-5.361)	(-4.986)
Controls (X)	Yes	Yes	Yes	Yes	Yes
Spatially Lagged Indep. Vars. (WX)	Yes	Yes	Yes	Yes	Yes
Spatial Fixed Effects	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes
R-squared	0.9324	0.9324	0.9324	0.9324	0.9324
N	25228	25228	25228	25228	25228
log-likelihood	12899.917	12901.504	12899.984	12912.246	12909.956

Notes: see the full estimates in the Appendix A.1.
t-statistics in parenthesis;
*** significant at 1%;
** significant at 5%;
* significant at 10%.

Model 2 of Table 1.5 uses another electoral accountability variable to identify yardstick competition. In this case, the regime variable d takes the value of 1 for incumbents holding less than 50% of the seats at the city council and 0 otherwise, while the second

regime $(1-d)$ takes the value of 1 for those incumbents holding more than this share of seats. The spatial parameter of the first regime (λ_1) indicates that the localities where the incumbents hold less than 50% of the seats raise educational expenditure by 0.197% in response to a 1% increase in their neighbors' average expenditures. This response is less pronounced in the municipalities that are governed by the incumbents with the majority at the council; equal to 0.146% in response to a 1% increase in neighbors' expenditures. The difference $(\lambda_1 - \lambda_2)$ equals 0.051 percentage points and is statistically significant at the 1% level, meaning that the incumbents ruling with majority support are more confident about their reelection (or the election of the candidates they support), and thus feel less compelled to mimic their neighbors' policies.

Table 1.6- Two regime models: varying the cut-offs of voting margin held by the incumbent at the city council

	2a	2b	2c	2d	2e	2f	2g
	d= dummy of "less than 45% of seats"	*d*= dummy of "less than 50% of seats"	*d*= dummy of "less than 55% of seats"	*d*= dummy of "less than 60% of seats"	*d*= dummy of "less than 65% of seats"	*d*= dummy of "less than 70% of seats	*d*= dummy of "less than 75% of seats"
$\lambda_1 \; on \; dWy$	0.189***	0.197***	0.196***	0.172***	0.172***	0.164***	0.162***
	(17.947)	(17.899)	(17.111)	(11.017)	(10.320)	(6.683)	(6.226)
$\lambda_2 \; on \; (1-d)Wy$	0.153***	0.146***	0.152***	0.178***	0.177***	0.178***	0.178***
	(10.594)	(10.741)	(11.745)	(17.612)	(18.121)	(20.513)	(20.755)
$\lambda_1 - \lambda_2$	0.037*	0.051***	0.045**	-0.005	-0.005	-0.014	-0.016
	(1.923)	(2.736)	(2.398)	(-0.264)	(-0.238)	(-0.504)	(-0.557)
Controls (X)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Spatially Lagged Indep. Vars. (WX)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Spatial Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.9324	0.9324	0.9324	0.9324	0.9324	0.9324	0.9324
N	25228	25228	25228	25228	25228	25228	25228
log-likelihood	12900.274	12901.504	12900.41	12895.754	12895.351	12901.532	12902.677

See notes on Table 1.5.

Elhorst and Fréret (2009) also find similar results for welfare spending, but instead, they consider the majority governments to be those whose incumbents have the support of more than 75% of the aldermen. The authors then re-estimate their model varying the cutoff from 55% to 85% of the seats to show that the maximum difference is reached at the 75% cutoff. We try a similar approach, re-estimating the model for several cutoffs. Table 1.6 presents the results of this exercise. Model 2a shows that the jurisdictions whose incumbents are supported by less than 45% of the aldermen tend to mimic the neighbors' behavior to a greater extent; 0.037 percentage points more to be precise. When we consider the cutoff of 50% (models 2 of Table 1.5 and 2b of Table 1.6) the difference reaches 0.051 percentage points and is statistically significant at 1%. Raising the cutoff to 55% of the seats (model 2c), we obtain a

difference of 0.045 percentage points Thus, it appears that the difference in spatial interaction between the minority and majority governments reaches its peak when the incumbents hold between 50% and 55% of the city council's seats.

The divergence on the peak level estimated for the Brazilian municipalities and those estimated by Elhorst and Fréret (2009) for the French departments could be due to the country-specific differences in the incumbents' incentives. In Brazil, it appears that once the local rulers obtain the support of the council's absolute majority, aside from being more confident about their reelection (or the maintenance of the ruling coalition in office), they also gain the power to approve all of their projects and the opportunity to extract more rent, thus discouraging mimicking behavior. In France, it could be the case that rent extraction is more severely punished if unveiled, and only the expectancy of electoral success plays a role in determining the need for mimicking.

Models 3 and 4 of Table 1.5 refer to the case where regime d denotes the disclosure of the average students' achievement. The regime variable takes a value of 0 from 2002 to 2006 and 1 from 2007 to 2008 (model 3) if we consider the disclosure of *Prova Brasil*'s results; or instead, assume a value of 1 only in 2008 (model 4) if we consider the disclosure of IDEB and its goals.

The results of models 3 and 4 show that from 2007 on, spatial elasticity in education spending decreased. Model 3 suggests that the spatial interaction after 2007 fell 0.037 percentage points (considering a 1% increase in the neighbors' expenditures), while model 4 indicates that the spatial interaction between neighboring jurisdictions was reduced by impressive 0.104 percentage points in 2008. These results agree with those of Revelli (2006) for welfare expenditures, i.e., the broad disclosure of educational quality indexes reduces the strategic interaction in education spending by improving the information available and diminishing the importance of the local information spillovers in voters' decision.

However, Revelli (*ibid*) recognizes that the empirical evidence found in his work reflects a situation at a given point in time, in the sense that he was able to build a panel with only one period immediately before and another immediately after the introduction of a national performance rating of social expenditures. The author admits that had he had access to information for the subsequent years, it could have been possible to evaluate whether the observed decrease on spatial interaction was indeed resultant from the introduction of performance ratings or due to other conjunctural factors.

Even though we do not have complete data for the most recent years after IDEB disclosure, we can use information from previous years to evaluate whether the spatial patterns over time are coherent with the hypothesis being tested. Therefore, to check the validity of the results in models 3 and 4 of Table 1.5, we estimate several two-regime models with regime variables based on year dummies, i.e., $D = I(t)$ and $(1 - D) = 1 - I(t)$. The results are reported in Table 1.7.[34]

Table 1.7- Two regime models: assigning year dummies as different regimes

	4a	4b	4c	4d	4e	4f	4g
	d= dummy of PNE (2002)	*d*= dummy of 2003	*d*= dummy of 2004	*d*= dummy of 2005	*d*= dummy of 2006	*d*= dummy of 2007	*d*= dummy of IDEB (2008)
$\lambda_1 \, on \, dWy$	0.153***	0.179***	0.174***	0.185***	0.194***	0.183***	0.160***
	(17.948)	(21.231)	(20.576)	(22.002)	(23.128)	(21.893)	(18.904)
$\lambda_2 \, on \, (1-d)Wy$	0.257***	0.159***	0.190***	0.088***	0.067***	0.116***	0.264***
	(13.849)	(7.990)	(9.662)	(4.188)	(3.192)	(5.853)	(14.608)
$\lambda_1 - \lambda_2$	-0.105***	0.020	-0.016	0.097***	0.127***	0.067***	-0.104***
	(-5.225)	(0.914)	(-0.772)	(4.314)	(5.670)	(3.180)	(-5.361)
Controls (X)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Spatially Lagged Indep. Vars. (WX)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Spatial Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.9324	0.9323	0.9323	0.9324	0.9325	0.9324	0.9324
N	25228	25228	25228	25228	25228	25228	25228
log-likelihood	12914.594	12897.732	12897.523	12905.047	12897.523	12901.902	12912.246

See notes on Table 1.5.

Spatial parameters λ_1 of models 4a to 4g have a more direct interpretation. The parameters show the spatial correlation in each year. The spatial parameter λ_2, on the other hand, has a less clear meaning because it reflects the average spatial correlation for all of the other years. Looking at these results, we can see that the spatial correlation was lower in 2002 (equal to 0.153) if compared to the period between 2003 and 2007. As discussed in Section 3, the explanation for that lies in the enactment of the National Education Plan (PNE) in 2001, which had its greatest impact in 2002. A portion of the incumbents felt compelled to make adjustments in the school infrastructure and the qualification of personnel on a tight budget. Consequently, the freedom to set expenditure levels was greatly limited, reducing the room for spending mimicking. From 2002 to 2006, i.e., from model 4a through model 4e, the spatial elasticity λ_1 increased until it reached its maximum of 0.194 in 2006. In 2007 (model 4f), the spatial coefficient decreased to 0.183, possibly because of the disclosure of *Prova*

[34] In principle, it could be possible to compare the spatial coefficients using an N-regime model. The log-likelihood function in (1.2) could be extended to include several spatial parameters (one for each regime). However, further investigation is still necessary to derive the properties of the estimator and to implement the routines, which is beyond the scope of this study.

Brasil results in the previous year. Finally, after the IDEB disclosure in 2008, the spatial coefficient declined to 0.160.

Note that the results exclude political cycles as the cause of spending interaction variability. According to Sollé Ollé (2003), in election years, we should observe higher spatial interaction. To test this hypothesis, in model 5 of Table 1.5, we consider the election years of 2004 and 2008 as one regime and the remaining years as another. The difference of -0.079 percentage points between both regimes is clearly influenced by the significantly smaller spatial parameter observed in 2008 (models 4 and 4g). Model 4c, in its turn (Table 1.7), indicates that the spatial parameter in 2004 is not too different from those of the previous and subsequent years

In general, the evidence that we obtain using the electoral accountability variables and the IDEB disclosure in a two-regime spatial Durbin model suggests that there is yardstick competition in education expenditures. The strategic interaction is found to be smaller among lame duck incumbents compared to those in their first term, which the literature credits to the lesser urge to signal their type to the voters. Moreover, the local rulers with minority support at the local council appear to interact more with their neighbors because they are less certain about the odds of reelection and thus they put more effort into signaling their type to the voters to increase the odds of reelection. Additionally, the Federal Government, by disclosing the IDEB results and goals, helped to reduce the information asymmetry between the voters and the incumbents, which led to the decline observed in the strategic interaction between local governments when setting education expenditure levels and can be interpreted as a reduction in yardstick competition. This evidence also suggests that the incumbents do not assume that "money does not matter," but identify (or at least believe in) a relationship between educational quality and education spending. The guidance provided by the Federal Government, academia, educational organizations, and media campaigns can also have helped to improve local governments' ability to distinguish what could be effective in improving students' achievement. However, we cannot tell whether this reduction in strategic interaction is associated with an improvement in the effectiveness of education expenditures in increasing students' performance.

1.5.3 Mechanisms by which IDEB Disclosure Affects Strategic Interaction in Education Spending

In this section, we seek to ascertain whether the decline in spending interaction that is observed after the IDEB disclosure reflects a true concern of the incumbents about pursuing national's best educational practices, i.e., the practices that can improve educational quality. For this purpose, we identify whether strategic interaction in the use of selected school inputs is also affected by the disclosure of the index and its goals. Favorable evidences are further signs of the existence of yardstick competition.

Unlike the strategic interaction in education spending, which benefits from the mandatory disclosure of budget information in the local newspapers or websites, strategic interaction in the setting of school inputs and other educational policies is facilitated by the way that the regional offices of the National Union of Municipal Leaders in Education (UNDIME) are organized, covering the groups of geographically close municipalities. These regional offices hold periodic meetings with the secretaries of education of the nearby jurisdictions to discuss experiences, conduct training, and exchange information on the successful or unsuccessful policies in their municipalities.[35]

We use variables that are known, or at least expected, to be important in improving students' achievement: computer to pupil ratio, TV to pupil ratio, log average school day length, log teacher to pupil ratio and log average size of class. All of these variables are considered to be a school input to some extent. The TV and computer to pupil ratios are considered to be important pedagogical resources that can complement the usual blackboard teaching methods.[36] The school day length is expected to affect the students' achievement through the longer exposure of the students to all of the other educational inputs. [37,38] It is also related to the intensity of use of all of the school resources and to the amount of the other inputs used for teaching purposes. A higher number of teachers per pupil can be indicative of

[35] Regarding strategic interaction between same regional office municipalities, see Gemignani (2011).
[36] Authors such as Leuven et al. (2007) and Rouse and Krueger (2004) cast doubt on the effectiveness of the use of Information and Communication Technologies in improving students' achievement. However, Carnoy (2004) argues that these types of findings often result from the difficulty for teachers in mastering the ICT Technologies and using them for teaching purposes in a proper manner.
[37] See Bellei (2009) for favorable evidence regarding school day length on students' performance using data from a natural experiment in Chile.
[38] Note that this variable informs the official length of a school day, which is only a proxy for the actual time students spend learning. Recent study by the Brazilian Institute of Public Opinion and Statistics (IBOPE, 2011) using a random sample of 36 high school classrooms distributed in 18 schools shows that the average time spent learning after discounting interruptions, teacher and student absences, and time spent organizing the classroom and enforcing students to pay attention is, on average, less than 2 hours (out of an average of 4 official hours).

a lower workload and longer time spent in class preparation for the teachers, which is expected to increase the students' performance.[39] Moreover, the teacher to pupil ratio is related to the effective teaching time (or effective school day length) because it accounts for the availability of substitute teachers that can cover the absences of regular staff. Finally, the average class size can account for the amount of attention that teachers can give to each student and the difficulty in delivering instruction to them.[40]

Both the education spending and the school inputs can be used to measure the provision of education. To see this relationship, it suffices to note that varying the amount of one input employed in the school environment, with the other inputs held constant, generates additional expenditures. Given this relationship, we keep the same specification for equation (1.1), replacing the dependent variable (and thus the spatial lag) with the input variables. However, it is important to observe that the expenditures are flow variables, while the inputs are stock measured. In addition, because the provision of each input has its idiosyncrasies, the estimates with input variables are not expected to be the same as the estimates with education expenditures.

Table 1.8 shows the models' estimates with school inputs using a two-regime spatial Durbin model that considers spatial and time fixed effects. Model 6 has the computer to pupil ratio as the dependent variable and assigns a value of 1 for the regime dummy in the years of 2007 and 2008, i.e., the period after the disclosure of the *Prova Brasil* results. As we can see, before the results' disclosure, the jurisdictions reacted to an increase of 1 computer per pupil in the neighboring jurisdictions by increasing their own inputs by 0.284 computer per pupil. After the results were made public, the input reaction declined by 0.131 computers per pupil. Model 7, on the other hand, indicates that the response to a 1 computer per pupil increase in the neighboring jurisdictions has dropped by 0.246 computers per pupil after the disclosure of the IDEB and its goals in 2008. Looking at the evolution of the spatial interaction over time, represented by the parameter λ_1 of models 7a through 7g of Table 1.9, we note that the spatial parameter was lower in 2002, equal to 0.191, and then increased until it reached the maximum of 0.229 in 2007, dropping sharply in 2008, to 0.143. This result is consistent with the model

[39] Hedges and Greenwald (1996) perform a meta-analysis of a sample of longitudinal studies and obtain evidence of a positive effect, i.e., the greater the number of teachers per student, the higher their achievement.
[40] Note that there are fundamental differences between the class size and the teacher-pupil ratio, especially in secondary schools (equivalent to the 2nd cycle in Brazil) where each discipline is taught by a different teacher, who usually deliver instruction to several classes in several school grades.

of education expenditures, where we observe a smaller strategic interaction in 2002 due to the PNE, and in 2008 due to the disclosure of the IDEB and its goals.

Model 8 shows the estimates using the TV to pupil ratio as the dependent variable. After the *Prova Brasil* results were made public, the spatial correlation declined by 0.170 TVs per pupil. Model 9 indicates that the spatial coefficient reduced by 0.125 TVs per pupil after the IDEB disclosure. Table 1.10 shows the evolution of the spatial correlation in the provision of the input over the entire period. In this case, we observe own jurisdiction's reaction to a 1 unit increase in the neighbors' inputs (given by coefficients λ_1) gradually diminishing over time, with a stronger decline in 2007 and 2008.

Models 10 and 11 of Table 1.8 consider the log average school day length as the dependent variable such that the spatial parameters can be interpreted as elasticities. The results of model 10 suggest that before 2007, a 1% increase in the neighbors' average school day length caused the municipalities to react with a 0.095% increase in own school day length. After the disclosure of the *Prova Brasil* results, the municipalities' reaction to the same change in the neighbors' input declined 0.041 percentage points. Model 11 shows that after the IDEB disclosure, the spatial elasticity reduced by 0.031 percentage points in response to the same change, although this difference is not statistically significant at the conventional levels. In Table 1.11, parameter λ_1 of models 10a through 10g show the same pattern that is observed in the education expenditures model; i.e., between 2002 and 2006, the spatial coefficients increased from 0.059 to 0.070, and then, in 2007 and 2008, it declined to 0.061 and 0.062, respectively, reinforcing the previous findings.

Models 12 and 13 of Table 1.8 have the log teacher to pupil ratio as a dependent variable. The spatial elasticities in model 12 indicate that, prior to 2007, a 1% increase in the neighbors' educational input induced a 0.162% reaction in own teacher to pupil ratio. After the referred period, the municipalities' reaction in response to the same increase in the neighbors' inputs declined by 0.075 percentage points. In model 13, we can observe that after the IDEB disclosure, the spatial interaction declined 0.083 percentage points. Table 1.12 shows that over the 2002 to 2008 period, the spatial parameter is the smallest in 2008.

Models 14 and 15 of Table 1.8 have the log average class size as the dependent variable. The differences between the spatial interaction after and before the disclosure of the *Prova Brasil* and the IDEB results, though negative, are not statistically significant. The evolution of the spatial parameter λ_1 from 2002 to 2008 in Table 1.13 shows the same pattern as the other

inputs' models, i.e., the spatial interaction reached the smallest values, smaller in 2002 and 2008.

Overall, the results using school inputs confirm those of the educational expenditure model. After the IDEB disclosure (and the disclosure of the *Prova Brasil* results to a lesser extent) the strategic interaction on input-setting declined significantly. This change of behavior by the incumbents when setting the levels of school inputs suggests a decrease in the relevance of local information spillovers and, thus, a decline in yardstick competition. This decline can be attributed to the incumbents' greater concern for pursuing the best educational practices that could improve educational quality in order to signal to voters that they are competent. The enactment of the PNE in 2001 also appears to have affected the strategic interaction in school inputs in the year of 2002, just as in the expenditure model.

Table 1.8- School inputs as dependent variables

	Computer to pupil ratio		TV to pupil ratio		Log average school-day length		Log teacher to pupil ratio		Log average class size	
	6	7	8	9	10	11	12	13	14	15
	d= dummy of Prova Brasil 2007-2008	*d* = dummy of IDEB 2008	*d*= dummy of Prova Brasil 2007-2008	*d* = dummy of IDEB 2008	*d*= dummy of Prova Brasil 2007-2008	*d* = dummy of IDEB 2008	*d*= dummy of Prova Brasil 2007-2008	*d* = dummy of IDEB 2008	*d*= dummy of Prova Brasil 2007-2008	*d* = dummy of IDEB 2008
$\lambda_1 \, on \, dWy$	0.153***	0.143***	0.104***	0.142***	0.054***	0.062***	0.087***	0.097***	0.108***	0.109***
	(16.357)	(16.565)	(10.902)	(16.463)	(5.494)	(6.965)	(8.969)	(11.016)	(11.263)	(12.356)
$\lambda_2 \, on \, (1-d)Wy$	0.284***	0.389***	0.275***	0.267***	0.095***	0.093***	0.162***	0.180***	0.114***	0.118***
	(21.003)	(22.775)	(20.145)	(14.159)	(6.219)	(4.308)	(11.100)	(8.939)	(7.552)	(5.542)
$\lambda_1 - \lambda_2$	-0.131***	-0.246***	-0.170***	-0.125***	-0.041**	-0.031	-0.075***	-0.083***	-0.006	-0.009
	(-8.060)	(-13.076)	(-10.349)	(-6.115)	(-2.265)	(-1.316)	(-4.357)	(-3.819)	(-0.321)	(-0.400)
Controls (X)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Spatially Lagged Independent Variables (WX)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Spatial Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.7508	0.752	0.7922	0.7916	0.8549	0.8549	0.8319	0.8319	0.8922	0.8922
N	26334	26334	26334	26334	26334	26334	26334	26334	26334	26334
log-likelihood	-37053.149	-36988.687	-8328.6402	-8360.1332	54247.274	54245.59	14716.983	14715.353	15680.834	15680.883

See notes on Table 1.5.

Table 1.9- Two regime models: assigning year dummies as different regimes and computer to pupil ratio as dependent variable

	7a	7b	7c	7d	7e	7f	7g
	d= dummy of PNE (2002)	*d*= dummy of year 2003	*d*= dummy of year 2004	*d*= dummy of year 2005	*d*= dummy of year 2006	*d*= dummy of year 2007	*d*= dummy of IDEB (2008)
$\lambda_1 \, on \, dWy$	0.191*** (22.657)	0.216*** (25.880)	0.224*** (26.966)	0.225*** (27.063)	0.223*** (26.723)	0.229*** (27.692)	0.143*** (16.565)
$\lambda_2 \, on \, (1-d)Wy$	0.299*** (15.844)	0.152*** (7.340)	0.064*** (2.971)	0.053** (2.412)	0.091*** (4.210)	0.097*** (4.631)	0.389*** (22.775)
$\lambda_1 - \lambda_2$	-0.108*** (-5.246)	0.064*** (2.877)	0.160*** (6.989)	0.172*** (7.389)	0.132*** (5.702)	0.132*** (5.958)	-0.246*** (-13.076)
Controls (X)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Spatially Lagged Indep.Variables (WX)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Spatial Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.7507	0.7504	0.7507	0.7508	0.7506	0.7509	0.752
N	26334	26334	26334	26334	26334	26334	26334
log-likelihood	-37073.812	-37083.102	-37068.961	-37067.236	-37074.181	-37068.195	-36988.687

See notes on Table 1.5.

Table 1.10- Two regime models: assigning year dummies as different regimes and TV to pupil ratio as dependent variable

	9a	9b	9c	9d	9e	9f	9g
	d= dummy of PNE (2002)	*d*= dummy of year 2003	*d*= dummy of year 2004	*d*= dummy of year 2005	*d*= dummy of year 2006	*d*= dummy of year 2007	*d*= dummy of IDEB (2008)
$\lambda_1 \, on \, dWy$	0.191*** (22.584)	0.177*** (20.760)	0.173*** (20.308)	0.166*** (19.363)	0.164*** (19.121)	0.142*** (16.520)	0.142*** (16.463)
$\lambda_2 \, on \, (1-d)Wy$	-0.007 (-0.311)	0.086*** (4.013)	0.096*** (4.504)	0.159*** (7.636)	0.171*** (8.282)	0.275*** (14.565)	0.267*** (14.159)
$\lambda_1 - \lambda_2$	0.198*** (8.401)	0.091*** (3.943)	0.077*** (3.363)	0.007 (0.304)	-0.007 (-0.332)	-0.133*** (-6.470)	-0.125*** (-6.115)
Controls (X)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Spatially Lagged Independent Variables (WX)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Spatial Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.792	0.7914	0.7913	0.7912	0.7912	0.7916	0.7916
N	26334	26334	26334	26334	26334	26334	26334
log-likelihood	-8346.6284	-8371.7517	-8374.364	-8378.4992	-8378.4895	-8359.2063	-8360.1332

See notes on Table 1.5.

Table 1.11- Two regime models: assigning year dummies as different regimes and log average school-day length as dependent variable

	11a	11b	11c	11d	11e	11f	11g
	d= dummy of PNE (2002)	*d*= dummy of year 2003	*d*= dummy of year 2004	*d*= dummy of year 2005	*d*= dummy of year 2006	*d*= dummy of year 2007	*d*= dummy of IDEB (2008)
$\lambda_1 \, on \, dWy$	0.059*** (6.645)	0.071*** (7.922)	0.076*** (8.503)	0.070*** (7.868)	0.070*** (7.867)	0.061*** (6.878)	0.062*** (6.965)
$\lambda_2 \, on \, (1-d)Wy$	0.108*** (5.014)	0.047** (2.138)	0.008 (0.363)	0.045** (2.056)	0.047** (2.119)	0.097*** (4.492)	0.093*** (4.308)
$\lambda_1 - \lambda_2$	-0.048** (-2.075)	0.024 (1.001)	0.068*** (2.830)	0.025 (1.052)	0.024 (0.993)	-0.035 (-1.516)	-0.031 (-1.316)
Controls (X)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Spatially Lagged Independent Variables (WX)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Spatial Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.8549	0.8549	0.8549	0.8549	0.8549	0.8549	0.8549
N	26334	26334	26334	26334	26334	26334	26334
log-likelihood	54246.897	54245.172	54248.187	54245.145	54245.112	54245.877	54245.59

See notes on Table 1.5.

Table 1.12- Two regime models: assigning year dummies as different regimes and log teacher to pupil ratio as dependent variable

	13a	13b	13c	13d	13e	13f	13g
	d= dummy of PNE (2002)	*d*= dummy of year 2003	*d*= dummy of year 2004	*d*= dummy of year 2005	*d*= dummy of year 2006	*d*= dummy of year 2007	*d*= dummy of IDEB (2008)
$\lambda_1 \, on \, dWy$	0.110*** (12.589)	0.117*** (13.337)	0.120*** (13.777)	0.118*** (13.542)	0.115*** (13.160)	0.107*** (12.284)	0.097*** (11.016)
$\lambda_2 \, on \, (1-d)Wy$	0.121*** (5.782)	0.081*** (3.781)	0.061*** (2.829)	0.061*** (2.785)	0.090*** (4.152)	0.138*** (6.721)	0.180*** (8.939)
$\lambda_1 - \lambda_2$	-0.011 (-0.492)	0.036 (1.548)	0.059** (2.545)	0.058** (2.468)	0.026 (1.105)	-0.030 (-1.377)	-0.083*** (-3.819)
Controls (X)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Spatially Lagged Independent Variables (WX)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Spatial Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.8318	0.8318	0.8319	0.8318	0.8318	0.8318	0.8319
N	26334	26334	26334	26334	26334	26334	26334
log-likelihood	14707.186	14708.107	14710.151	14709.444	14707.559	14708.014	14715.353

See notes on Table 1.5.

Table 1.13- Two regime models: assigning year dummies as different regimes and log average class size as dependent variable

	15a	15b	15c	15d	15e	15f	15g
	d= dummy of PNE (2002)	*d*= dummy of year 2003	*d*= dummy of year 2004	*d*= dummy of year 2005	*d*= dummy of year 2006	*d*= dummy of year 2007	*d*= dummy of IDEB (2008)
$\lambda_1 \, on \, dWy$	0.103*** (11.663)	0.112*** (12.789)	0.113*** (12.881)	0.116*** (13.205)	0.110*** (12.528)	0.111*** (12.608)	0.109*** (12.356)
$\lambda_2 \, on \, (1-d)Wy$	0.154*** (7.358)	0.098*** (4.575)	0.092*** (4.285)	0.065*** (2.990)	0.114*** (5.314)	0.109*** (5.141)	0.118*** (5.542)
$\lambda_1 - \lambda_2$	-0.051** (-2.263)	0.014 (0.610)	0.021 (0.929)	0.051** (2.159)	-0.004 (-0.156)	0.001 (0.051)	-0.009 (-0.400)
Controls (X)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Spatially Lagged Independent Variables (WX)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Spatial Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.8922	0.8922	0.8922	0.8922	0.8922	0.8922	0.8922
N	26334	26334	26334	26334	26334	26334	26334
log-likelihood	15683.445	15680.946	15681.132	15682.621	15680.784	15680.775	15680.883

See notes on Table 1.5.

1.6 Final Remarks

This paper aims to test the existence of yardstick competition in education spending. For this purpose, we use panel data from Brazilian municipalities from 2002 to 2008 and estimate the ML two-regime spatial Durbin models with time and spatial fixed effects, where the regimes represent different electoral and educational accountability institutional settings.

The results using the electoral accountability variables suggest that the lame duck incumbents mimic their neighbors' expenditures by 0.045 percentage points less (in response to a 1% increase in neighbors' spending) than those in their first term. This difference can be explained by the lower incentives – caused by the impossibility of reelection – for the second term incumbents to signal their type (good or bad) to the voters. Moreover, the findings suggest that the incumbents with minority support at the city council tend to mimic their neighbors' spending by 0.051 percentage points more than those with majority support at the council. That is, the minor political support at the council is related to the lack of support by the electorate, which leads the incumbents to mimic their neighbors to a greater extent to signal their quality and to increase their chances of reelection. These results are evidence of yardstick competition in education spending.

In addition, this paper estimates the effects of the institutional change introduced by the "Plan of Goals All Committed to Education" with the disclosure of the IDEB and its goals on the strategic interaction in local education provision. This relationship is not obvious, as observed from the discussion about the effects of education expenditures on students' achievement. Nevertheless, the evidence suggests that this institutional change did in fact reduce spatial interaction by 0.104 percentage points in 2008, i.e., when the effects of the IDEB disclosure were felt more intensely. The introduction of this institutional change potentially increased the incentives for the incumbents to follow the national (and perhaps international) best practices to signal their quality to voters, reducing the importance of local information spillover.

A further result indicates that the institutional change introduced by the PNE law (in 2001) reduced the spatial interaction in 2002 by setting the educational goals that required additional expenditure for the municipalities on tight budgets. However, this change could not resist the election of a new government in 2003, which did not enforce the goals established in that plan. Thus, we observe two institutional changes provided by the plans for the improvement of education, which produce the same result – i.e., which reduce the strategic interaction between the neighboring municipalities – but that are of different natures, in that one is legally enforced and the other is voluntary.

We have tested the same model using school inputs that are believed to improve students' performance in place of education spending. The results confirmed those obtained in the expenditure model, i.e., the introduction of IDEB and its goals reduced interaction in input-setting. The results using inputs even showed a reduction in spatial interaction in 2002 due to the PNE. Thus, it is possible to conclude that the change observed in the spending mimicking was accompanied by changes in the mimicking of inputs that are supposed to improve students' performance, revealing a greater concern from incumbents with educational quality after the introduction of the IDEB. Taken altogether, these findings suggest that the institutional change introduced by the IDEB and the Plan of Goals did incentive the incumbents to pursue higher standards, which ultimately led to the reduction of reduce yardstick competition.

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2 Altruism and Participation Costs in Local Redistribution: Empirical Evidence for Brazilian Municipalities

The literature on fiscal federalism usually states that income should be redistributed by the central government (see Oates, 1999, Brown and Oates, 1985, and Musgrave, 1971). In contrast, Pauly (1973) questions centralized redistribution policies. In his model, the income of the poor individuals of a jurisdiction is included in the utility function of the non-poor of that same jurisdiction, but this does not apply to the income of the poor belonging to a different jurisdiction.[41] The reason for such a discrimination lies in the combination of geographically delimited altruism and distressing circumstances provoked by local poverty (such as crimes against property or depredation of public property). The author finally argues that, under some assumptions, migration (recipients and/or taxpayers) could reduce the extent of redistribution and might prevent the local redistributive policy from being optimal.[42]

In an interesting paper, Ashworth, Heyndels and Smolders (2002) provide an empirical test for redistribution as a local public good. The authors find evidence for Flemish municipalities that a larger distance between potential transfer recipients and the non-poor – measured by population density and local geographic area – is associated with a lower number of beneficiaries and a smaller mean value of the benefit. Their main contribution consists of providing an empirical interpretation of the model proposed earlier by Pauly.

Another, less-explored aspect of redistribution is associated with the participation costs involved, i.e., all costs resulting from activities that are required to search and identify potential beneficiaries. Van de Wale (1998) argues that the participation costs of redistributive programs can represent a substantial share of the program's total cost. In addition, there is an increasing cost to reach potential beneficiaries the further away they live and the more accurate that the information necessary for targeting the correct

[41] Hochman and Rodgers (1969) argue that even individuals who finance transfers can gain utility in this process. The utilities of poor and non-poor individuals can therefore be interdependent. Ladd and Doolittle (1982) argue that altruism is unlikely to occur only towards the poor living in the same jurisdiction of the non-poor, but they admit that negative externalities of poverty are felt more strongly within the local community.

[42] The major criticism about the local supply of this public good concerns the possibility of migratory movements induced by the local management of transfer programs. In the scenario of decentralized provision with inter-jurisdictional competition, the public good might be undersupplied by each jurisdiction as a precaution against a possible inflow of poor individuals caused by a higher level of transfers, a phenomenon known in the literature as "Race to the Bottom" (see Brueckner, 2000).

group has to be. In this context, the farther away poor individuals live from the administrative center, the higher the marginal cost of providing benefits becomes. Although Ashworth, Heyndels and Smolders (2002) mention the importance of "production-function-characteristics", they do not attempt to separate the participation cost effect. Moreover, the dependent variables used in their study (number of welfare recipients and the average benefit level per recipient) may not necessarily refer to the poor or to the targeted group. If a cash-transfer program suffers from leakage problems, it may well be the case that non-poor individuals demand transfers for themselves, with altruism playing no role in an extreme scenario. In this case, the authors could be estimating the demand for a private good provided by the public sector.

This paper investigates the role played by the geographic distance between the poor and non-poor in the local demand for income redistribution. In particular, we provide an empirical test for a geographically limited altruism model proposed in Pauly (1973), incorporating the possibility of participation costs associated with the provision of transfers (see Van de Wale, 1998). These two effects of distance act by lowering the demand for transfers, making it difficult to disentangle the effect of altruism from the effect of cost. The strategy we propose seems to allow the determination of whether it is advantageous to carry out redistribution at the local level.

To a certain extent, this study is also related to work by Bardhan and Mookherjee (2000, 2003, 2005 and 2006a and 2006b), who point out the main concerns that should be taken into consideration regarding the decentralization of public services and the accountability process. They argue that there is a danger that local governments may be subject to influence by local elites such that targeting performance and responsiveness to the needs of the poor and minorities may deteriorate. The authors emphasize that this danger might be particularly relevant in rural communities that are characterized by high levels of poverty and inequality in land ownership, social status, literacy or political power.[43]

The fact that we observe local governments providing significant levels of social services, such as housing, health, and public welfare, leads to two possible explanations for the existence of local redistributive policy, according to Craw (2003). Either the local social welfare provision is driven by intergovernmental influences, i.e., federal and

[43] See Chavis (2006) for details on the efficiency-enhancing outcome role played by jurisdiction competition for block grants.

state governments use local governments to implement policy in these areas, or local governments proactively seek solutions to local poverty problems and therefore respond not only to intergovernmental incentives but also to local demands and fiscal constraints.

This paper, in turn, takes advantage of the fact that Brazilian municipalities are responsible for the registration of beneficiaries in federal redistributive programs, which gives them the power to decide on the provision of redistribution. This situation seems to be a unique opportunity to test a local model for redistribution with an explicit control for intergovernmental influences on local policy. The transfer values are financed by the central government, but the identification of the eligible poor and the follow-up of *conditionalities* for benefit granting are carried out by municipalities. That identification process is usually accomplished by the municipalities' pre-existing specialized local public departments or newly created departments and may thus be considered to be a local public good itself.

Our empirical strategy is as follows. We first identify the recipients of federal cash redistribution programs, whom local governments are responsible for registering, using two datasets: 2000 Census data and panel data from 2001 to 2007[44] at the individual level, both produced by the Brazilian Geography Statistics Institute (IBGE). This process is not trivial because these surveys do not explicitly ask about these programs for some years of the analysis. We approach this issue using a technique that identifies the typical values of those transfers, which allows us to calculate our dependent variables. We are interested in whether poor individuals are receiving the benefit (targeting variable, given by the proportion of beneficiaries among the poor), how many benefits (number of benefits) and how much (mean value of the benefits) they get and whether the non-poor have access to such programs (leakage). Next, we compute several measures of geographical distance between poor and non-poor individuals, such as percentage of poor people living in isolated areas, population density, area of the municipality, urban density, and the probability that the poor are present in the neighborhood of the non-poor. The main advantage of using the panel data set is that it allows us to identify the commuting time for both groups, which is a much more direct measure of distance than area or density and enables us to decompose

[44] PNAD, *Pesquisa Nacional por Amostra de Domicílios,* a sample-based Brazilian suvey at the household level, very similar to the CPS in the United States.

the altruism effect and the participation cost effect in some circumstances. Lastly, we estimate a median taxpayer demand for local redistribution through two procedures: Tobit regression for dependent variables in proportion – taking into account the fixed effects – and a fixed effect within estimator whenever the dependent variable is not top or bottom coded.

Our results demonstrate that a greater proximity between poor and non-poor individuals – based on our geographical distance measure variables – increases the demand for transfer, i.e., increases the targeting of the programs. For instance, we estimate that a 1-hour increase in the time spent commuting by poor individuals reduces the proportion of recipients among this same group by 3.158 percentage points. Nevertheless, it is not possible to determine whether this result is due to a geographically delimited altruism or to the cost of registering families who live further away to receive the benefits. Then, we proceed to our second result and find that while considering only beneficiaries in the sample (henceforth excluding/limiting the registration cost): 1) the more distant the non-poor individuals are, the less willing they are to make transfers and 2) there is no effect of geographical living distance of the poor on the mean value of benefits and there is a positive effect on the number of benefits. While the first result suggests support for geographically delimited altruism, the second seems to suggest that registering costs play a role in targeting.

The remainder of this paper is organized into five additional sections. Section 2.1 presents a description of the Cash Transfer Programs in Brazil. Section 2.2 presents the theoretical motivation for the demand for the monetary transfers, taking into account the geographic distance between the poor and non-poor. Section 2.3 defines the empirical strategy. Section 2.4 describes the results and the robustness tests, and finally, Section 2.5 presents our final remarks.

2.1 CCT programs in Brazil

The Conditional Cash Transfer (CCT) Programs in Brazil were first introduced by the local governments of Campinas (in the state of São Paulo), Recife (Pernambuco state) and Brasilia (the capital of Brazil) in 1995, although there is still debate about which of them implemented the program first. Other local governments followed suit in

the subsequent months or years, such as Ribeirão Preto (in the state of São Paulo), Porto Alegre (in the state of Rio Grande do Sul) and Belo Horizonte (in the state of Minas Gerais). By 1999, 60 local programs existed, each of which had its own eligibility criteria, conditionalities and values of benefits (WORLD BANK, 2001).[45] According to a survey conducted by Amaral and Ramos (1999), the majority of such programs targeted families living in the locality for more than 2 years, with children of school age (from 0 to 14 years), and with a current per capita family income varying from ¼ of minimum wage (in Jundiaí in the state of São Paulo, which equaled 28.00 reais at the time it was implemented in 1996, or approximately 28 US dollars) to 1 minimum wage (at Porto Alegre in the state of Rio Grande do Sul, which amounted to 120,00 reais at the time it was implemented in 1997, or approximately 112 US dollars). Because the minimum wage in Brazil is adjusted every year, the eligibility criteria of these programs and, therefore, the targeted population, changed periodically.[46]

The asymmetry of fiscal capacity to fund local CCT programs between poorer and richer municipalities demonstrates the problem of enacting this policy at the local level. The academic view that CCT programs should be centralized and the experiences of successful local initiatives also contributed to this urge to expand programs at the national level. From the legal viewpoint, the National Law of Social Assistance (LOAS) had already established the foundations for the future creation of national CCT programs with its enactment in December of 1993.

First, the federal government enacted law number 9.533 in December of 1997, in which it established the National Program of Guaranteed Minimum Income. The purpose of this program was to help municipalities in greater need (due to a lack of fiscal capacity or average income below the state and national levels) with local CCT programs (with educational requirements) to maintain a minimum acceptable level of benefits. The federal government committed to contributing to the expenses such that the minimum benefit would not be lower than 15 reais (approximately 14 US dollars).

[45] The most important conditionality was a school attendance rate of between 75% to 90%, though the beneficiaries often had to fulfill health monitoring requirements.

[46] The minimum wage is adjusted by Presidential Decree every year, usually around Labor Day (May 1st.). The amount of increase is determined by budget availability – because an important part of the Government personnel expenditure and Social Security are indexed to minimum wage – or political pressures rather than by some specific criteria. Depending on the year, the percent of adjustment can be higher or lower than inflation, so there can be gains or losses in real terms each year.

During the same period (in 1996), the federal government created the Program for the Eradication of Child Labor (PETI), a pilot program that was first aimed at families with per capita income below ½ of minimum wage (approximately 56 reais, or 55 US dollars, when the program was created in 1996) with children working in charcoal furnace facilities in the state of Mato Grosso do Sul. The program was gradually expanded to other localities at risk for child labor until it was enacted nationally in September 2000, allowing any municipality in such conditions to participate. The program requires a minimum school attendance rate of each participating child, who received a benefit of 25 reais, or 25 US dollars, if living in a rural area or 40 reais, or 40 US dollars, if living in an urban area.[47]

In April 2001, law number 10.219 instituted the National *Bolsa Escola* Program (or Education Allowance), which replaced the National Program of Guaranteed Minimum Income and assured benefits of 15 reais (approximately 7 US dollars) per child between 6 and 15 years (up to 3 children per family) for those families with a per capita income below 90 reais (approximately 41 US dollars). The requirement in this case was that children maintained an attendance rate of no less than 85%.

Other federal CCT programs were subsequently created. *Bolsa Alimentação* (or Food Stipend), a CCT program enacted by the Interim Measure (Medida Provisória) number 2.206-1 of September 2001, targeted families with income below 90 reais per capita including pregnant and nursing mothers and children from 6 months to 6 years and 11 months at risk of malnutrition. The benefit value per child was 15 reais (approximately 6 US dollars), limited to 3 children per family, and the requirements involved periodical health check-ups. *Auxílio Gás*, a program enacted by Interim Measure number 18 of December 2001 and by Presidential Decree number 4.102 of January 2002, was a coupon for families with a per capita income below ½ of minimum wage that allowed the recipients to buy cooking gas.[48]

After the election of President Luiz Inácio Lula da Silva in 2002, more CCT programs were created. First, law number 10.689 of June 2003 and Decree number 4.675 of April 2003 instituted the "*Cartão Alimentação*", a food voucher with a value of 50 reais (approximately 17 US dollars) distributed to families with a per capita income below ½ of minimum wage. At the end of President Lula's first year in office, there

[47] Note that these values refer to the year 1996.
[48] In fact, this program did not impose conditionalities on its beneficiaries.

were several CCT programs with different targeted populations, criteria of eligibility, values of benefits and conditionality requirements. A typical poor family could receive several types of benefits; the only programs that technically could not overlap were *Bolsa Escola* and PETI, although they did in practice.

Finally, law 10.836 of September 2004 enacted the *Bolsa Família* Program (Family Stipend). This program was the main CCT program of President Lula's government and consisted of a basic benefit of 50 reais (approximately 17 US dollars) to families whose per capita income was below 60 reais (21 US dollars)[49]. The benefit could be increased by 15 reais (approximately 5 US dollars) for each child between 0 and 15 years old (limited to 3 children). In case the per capita family income amount to between 60 and 120 reais (between 21 and 42 US dollars), the family could receive 15 reais per child attending school (up to 3 children). *Bolsa Familia* was intended to unite the other programs and expand the coverage. The unification process was gradual. By 2006, a number of people were still receiving benefits from pre-existing CCTs.

There are common operational aspects to all programs funded by the federal government that are crucial for this study. The Ministry of Social Development (MDS) is in charge of managing the programs' budgets, defining the values of their benefits and the targeted groups, designing and performing studies, establishing intergovernmental agreements, and coordinating the agents involved in the process. According to Ribas and Soares (2011), the Brazilian Institute of Geography and Statistics develops poverty maps based on the National Household Sample Survey and the Population Census. These maps allow the MDS to define quotas of benefits for each municipality, although those quotas may be revised if the municipalities claim that the maps do not reflect the local reality.

The municipalities interested in participating in the federal programs must first formalize an agreement with the federal government on the conditions for participation in the program. Among these conditions is the enactment of a municipal law that creates a local guaranteed minimum income program. The municipality must also create a Social Control Council of which at least 50% is comprised of representatives of the civil society, i.e., individuals who are not affiliated with the local government. This council must supervise the actions of the local executive; approve the list of families registered

[49] Families receiving only the basic benefit were not required to meet any conditions.

to receive the benefit and the quarterly reports by the local administration, and propose and take actions to improve control over the program's execution at the municipal level.

The local administration must establish an agency of technical staff that is in charge of identifying the families who meet the eligibility criteria and registering them to receive the benefits in *Cadastro Único*, the registry used by MDS to check if families are indeed eligible based on proof of income and other criteria. Ribas and Soares (2011) point out that the municipalities are free to determine the priority areas and to decide how the registration process will take place. Afterwards, the local agency has to send the documentation of each applicant family to the MDS, which returns the ratified documents. If the family is approved, the local agency communicates this information to the family, the family receives a smart card, and they must go to the Federal Bank (*Caixa Econômica Federal*) to obtain the smart card's password and receive the first payment. Finally, the local government has to monitor the conditionalities of the programs, whether they involve school attendance or health check-ups. If a family fails to meet the requirements, local agents must remove them from the program.

The expenses for maintaining these services are not negligible and are covered by the local governments. Considering all of these characteristics of CCTs in Brazil, it is reasonable to assume that they started at the local level; however, even after the federally funded expansion, the municipalities still have a huge amount of control over who receives the benefits and who does not. This fact is extremely important in this work, as will become clear later on.

2.2 Theoretical Motivation

There are many explanations for altruism. Baumeister and Leary (1995), for instance, argue that human beings have an inborn need to belong to a group as a mechanism of self-preservation that developed further with natural selection. Therefore, altruism can be understood as a way in which individuals establish themselves as members of the group. In addition, the appearance of pure altruism and the resulting interdependence of utilities may be due to the direct social interaction between individuals, which can imply more or fewer transfers to a given group. Bohnet and Frey (1999) conducted an experiment with first-year undergraduate students to assess the

effect of social interactions between potential recipients and "dictators" (those who have the resources) on the total amount of transfers. After interacting with potential transfer recipients and thus no longer being unknown to them, the dictators tended to transfer higher amounts to the recipients. This literature is tied closely to the results found in empirical studies that associate redistribution with the groups of interest (social, ethnic, income or age heterogeneity; see, for instance, Alesina, Baqir and Easterly, 1999, Poterba, 1997, Alesina and La Ferrara, 2000).

On the other hand, Andreoni (1989, 1990) points out that altruism may not be a necessary condition for the existence of a demand for redistribution. The act of giving, in itself, may represent an increase in utility due to the so-called "warm glow feeling."[50] Another reason that is found in the literature for having transfers in the absence of pure altruism is that these transfers may work as social security. Varian (1980) emphasizes that (non-poor) taxpayers see transfers (and the related taxation) as insurance that prevents their income from falling below a minimum value if they lose their job or if they have to cope with extreme financial hardship. Based on this justification, taxpayers would prefer higher levels of government to perform the transfers to better guarantee the continuity of transfer.

Here, we consider the model proposed in Pauly (1973), focusing on a positive analysis. Suppose that the utilities of individuals are interdependent and present a spatial dimension. Specifically, consider the case that the redistributive function is performed at the local level by person *M,* with median preferences in locality A.[51] This median voter is concerned with his consumption level and with the welfare of the poor located in his community. Also, he faces proportional income taxes. Poor people (like taxpayers) do not migrate to other communities and present the same level of income. Transfers take the form of a welfare program, but its effect on work effort is ignored in this paper. Assume that every community has poor individuals, but only the preferences of those not receiving the benefit are relevant so as to avoid self-redistribution. Lastly, we restrict our analysis to the case in which voter preferences are single-peaked.

[50] This model supposes that there exists an egoistic reason for transfers, also known in the literature as "impure altruism", which is related to the feeling of welfare and prestige in the community related to the act of giving.

[51] We ignore the subscript for locality here because it does not harm the analysis. It is assumed that the model works for every local community.

Consider that N poor individuals have an income below the minimum welfare level and must receive w as income transfers. Suppose they live at the same geographic distance from the median voter d, and the median voter's utility function can be written as

$$U^M = u^M(c, w, N, d) \tag{2.1}$$

where c denotes his level of consumption. Assume that $u^M_{wN} \leq 0$, i.e., the level of w desired by the median voter, declines with the increase in the number of poor individuals. First, note that d plays no role here because every poor individual lives in the same place. Therefore, the model proposed in Pauly (1973) does not discriminate within the poor families living in the same community, i.e. it does not suggest that because some poor people live farther from the center of their communities, those communities have a lesser degree of altruism and should provide fewer transfers to them.[52] This is the implicit interpretation of Ashworth, Heyndels and Smolders (2002), who claim that the larger the area or population density of Flemish municipalities, the less altruism that can be observed in the form of fewer transfers. This interpretation would be perfectly correct if median voter preference assigned weight for transfers (w) that are inversely related to geographical distance (d).

Now, introduce a (simple) 'iceberg cost' of redistribution associated with the distance between poor and non-poor individuals (see Samuelson, 1952). The reason for this cost could be the difficulty in finding beneficiaries who live very distant from the local administrative centers that manage those redistributive policies. Keeping the same utility as before, the budget constraint of the median voter now becomes

$$pc + qdwN \leq y \tag{2.2}$$

where p is the price level of private consumption, normalized to 1; q is the tax share for the median voter; and y is the median voter's pre-tax income.[53] The problem of the

[52] Even if one considers his Equation (1a) , it does not say $\partial^2 U^M / \partial^2 d < 0$, i.e., that the marginal utility decreases with distance.
[53] Note that, as in Pauly (1973), $q = y^M / \sum_{i\ in\ A} y^i$.

median voter is then to maximize (2.1) subject to (2.2) by choosing w, the optimal transfer level to poor individuals, which leads to the optimum condition:

$$\frac{u_w^M}{u_c^M} = dqN \tag{2.3}$$

With this model, the larger the distance between poor and non-poor individuals, the fewer transfers are provided. Also, the larger the number of benefited individuals, the lower the benefits should be.

Note that the same result could be obtained if we allow the preference of the median voter to discriminate against the poor in his or her community because they live far away. A very simple case assigns an inverse relation between *d* and transfers. To see this, ignore iceberg costs but assume a weighting scheme in which weight is inversely related to distance. The first order condition for the median voter remains the same, $u_w^M/u_c^M d = qN$.

We plan to disentangle these two effects empirically, but before doing so, notice that once the beneficiary receives the benefits, the iceberg cost tends to zero, and only the eventual geographical altruism effect is in place. This is the argument used in Ashworth, Heyndels and Smolders (2002) for the dependent variable *average benefit level*. However, this argument only holds if there is just one type of benefit in the community or the process of registering for more than one benefit is unified. Lastly, the model predicts that the number of eligible individuals (*N*) affects the amount of transfers. Therefore, the result of this maximization gives the median voter's demand for transfers to the poor.

Now, consider the following estimable linear demand:

$$w = \alpha + \delta y + \gamma t + \beta d + \varphi N + Z\Gamma + \nu + \varepsilon \tag{2.4}$$

where *t* is the tax price of the publicly provided good *w* such that it might be equal to dq^iN if the cost varies with distance or to q^iN if not. Z is a vector of covariates (described in detail later) that addresses particular local characteristics that may shift the

preferences of the population for redistribution.[54] The fixed-effect term ν also tries to capture these differences in local preferences.[55]

To retrieve the utility function that rationalizes such demand, we follow Burtless and Hausman (1978), Hausman (1980, 1981, 1985) and Conway (1997) and obtain the following utility function:

$$U^M(w,c,d\ N) = \left(\frac{w}{\delta} + \frac{\gamma}{\delta^2}\right) exp\left[\frac{\alpha + \frac{\gamma}{\delta} + \delta c + \beta d + \varphi N + Z\Gamma + \nu + \varepsilon}{w + \frac{\gamma}{\delta}} - 1\right] \qquad (2.5)$$

Maximizing (2.5) subject to the budgetary constraint ($c + tw \leq y$) results in the demand for transfers described in (2.4).[56] This is the utility function that is tested in our paper versus an alternative without altruism but with iceberg costs of redistribution. We expect $\gamma\ and\ \beta\ < 0$.

Finally, some additional assumptions are necessary for demand identification. First, the median voter must be non-poor. According to Pauly (1973), this assumption prevents the analytical problem in which the poor can obtain transfers by placing the entire burden on the non-poor by means of voting in elections or referendums. Also, the non-poor and the poor must be immobile across jurisdictions. Bergstrom and Goodman (1973) summarize the assumptions for demand identification (that, jointly considered, constitute Bowen's equilibrium) as follows: (i) the cost of supply of a given good provided by any municipality is constant and equal to μ (here, we have normalized this value to 1); (ii) each consumer *i* of any municipality or jurisdiction pays a share q^i (tax share) of the total supply cost;[57] (iii) each consumer knows her tax price, $t = q^i N$ (we also consider the possibility that $t = dq^i N$,), and is able to determine the desired amount for the given municipality because she has to pay a share q^i of the overall local

[54] Z is assumed not to change the relation between the main determinants of the demand for redistribution, i.e., the consumption technology is Hicks neutral – Edwards (1992) and Mendes and Sousa (2006a,2006b) make the same assumptions.

[55] Z and *v* also attempt to address differences in preferences, circumstances or behavior of the targeted population that may affect the participation rate in the redistribution program and consequently the average value of the benefits.

[56] Borcherding and Deacon (1972), Bergstrom and Goodman (1973), Doi (1999), Sanz and Velázquez (2002), and Mendes and Sousa (2006a,2006b) also estimate demands for public goods, but they do so using log-linear functional forms. In this case, although an indirect utility function exists, there is no specific direct utility function that rationalizes the demand for public goods.

[57] This fraction is a function of income, wealth and other individual characteristics and is unrelated to the magnitude of local expenditures and to individuals' preference for the supply of public goods.

expenditures; to do so, it is necessary to maximize her preferences subject to budgetary constraint (2.3); and (iv) in each municipality, the supplied amount of a public good is equal to the median demand. In addition, Bergstrom and Goodman make the following additional assumption: (v) the local median demand is equal to the amount demanded by the local citizen with the median income. Based on this set of assumptions, it is possible to proceed with the identification of the local demand for transfers in (2.4).

2.3 Empirical Strategy

Our first step is to identify the poor or the targeted group in Brazilian municipalities. Note that we are considering different transfer programs with many eligibility criteria over time, but they generally share one specific objective: to reduce poverty. Therefore, we use an absolute measure that allows comparison over time: the extreme absolute poverty line criterion calculated by the Brazilian Institute for Labor and Society Studies (IETS). For instance, its value in October 2008 for Brazil was 93.00 reais(approximately 50 US dollars) per month, which is close to the average eligibility criteria for federal income transfers in Brazil. Therefore, those individuals whose per capita family income net of transfers was below this line, hereinafter referred to as the poverty line,[58] are considered to be poor.

To implement our test, we consider the general model, represented as

$$w_{jt} = \alpha + \delta y_{jt} + \gamma t_{jt} + \beta d_{jt} + \varphi N_{jt} + Z_{jt}\Gamma + \lambda_t + \nu_j + \varepsilon_{jt} \quad (2.6)$$

where subscript t represents the year and j denotes the municipality . The data aggregated by municipality reflect the fact that the proposed model is based on the assumption that the median voter is represented by the data of her municipality. The term λ_t is a set of dummy variables for each year, ν_j is the fixed effect specific to each municipality, and ε_{jt} is the random error term. The remaining terms are the same as for the demand represented in (2.4). Thus, the dependent variables (represented by w_{jt})

[58] Prices are adjusted by the Brazilian Consumer Price Index (IPCA).

consist on 1) the proportion of poor families who receive transfers (targeting)[59], which measures the municipality's effort in registering the eligible poor to receive benefits and allows us to assess more precisely the demand for redistribution for altruistic purposes; 2) leakage (the proportion of non-poor that receive the benefits); 3) the number of benefits per family member; and 4) the value of benefits per family member.[60] The variable y_{jt} is the median income, t_{jt} is the median voter's tax price, d_{jt} is the variable that captures the geographical distance between the poor and non-poor, N_{jt} is the number of poor in the municipality and Z_{jt} is a line vector of local covariates that affect the median voter's preference for transfers. [61] Each of the variables is described in Table 2.1.

It must be emphasized that, ideally, the distance variables should identify the average distance from the median voter's residence to the residence of the poor, which cannot be obtained with the data available. However, we managed to obtain reasonable alternatives. Considering that the median voter is non-poor, one such proxy for distance is the proportion of "isolated" poor (variable "isolated poor" in Table 2.1), i.e., those poor families who live outside of town. We assume that the larger the proportion of poor families living in isolated areas, the greater their geographical distance is from the non-poor and the lower the probability of interaction between the two groups, which implies a lower demand for transfers to the poor. As in Ashworth, Heyndels and Smolders (2002), we also use population density and the land area covered by the municipality to capture the distance between the poor and non-poor. We also use urban density (see Table 2.1) as estimated by the Brazilian Agricultural Research Corporation (Embrapa).

[59] Note that when the dependent variable is the proportion of the poor who receive a benefit, we do not use the number of individuals eligible to receive transfers as an explanatory variable because, otherwise, we would only be capturing correlations with the numerator of the dependent variable.

[60] Note that the data on transfer programs refer mostly to federal programs. However, as previously mentioned, municipalities register potential beneficiaries so that they can be covered by federal transfer programs. This system implies that even though municipalities do not have to defray the costs allocated by federal transfer programs, they render a local public service. In other words, municipalities offer a public good that consists of identifying individuals in need of social assistance. Thus, it makes sense to think of a local demand for transfers because the municipality has the political power to decide who will and will not receive them.

[61] This vector contains some of the factors pointed out by Bardhan and Mookherjee (2006b) that could affect pro-poor targeting, such as schooling, percent of households headed by couples and race (non-white). Other control variables include the relative size of the program, population, attendance rate, percentage of elderly, percentage of young, average number of family members younger than 15 years old, percentage of male headed households and percentage of male individuals.

In addition, we compute the average distance between the poor and non-poor in terms of the amount of time spent commuting by each group. This proxy is reasonable for monocentric cities, i.e. if there is only one Central Business District; as is the case of the the large majority of Brazilian municipalities, which have small urban areas and are very little populated. A drawback of this variable is that it does not take into account how people commute. If poor and non-poor residents live next to each other and work at same place (although this situation is not realistic), they may still spend different amounts of time commuting if the non-poor drive to work but the poor walk. However, it could be argued that this variable still measures lack of contact between the two groups.

The last variable we use to capture distance is the average probability of a poor individual interacting with a non-poor individual in their neighborhood. To generate this variable, we calculate the proportion of non-poor individuals in the subdistrict of each poor individual living in non-rural areas.[62] Poor individuals living in rural areas were assigned a null probability of meeting the non-poor. Then, we average the proportions across all poor individuals to obtain the indicator. If a municipality is formed by two different subdistricts and there is perfect group segregation among them, the indicator will assume a value of zero. If all of the poor individuals live in rural areas, the probability of interaction will also be null even if non-poor individuals live in their sub-district. This variable can also be thought of in terms of social segregation, just as in Mele (2010). The author builds an algorithm that allows for the assessment of the effects of policies aimed at increasing race heterogeneity in schools and concludes that, in fact, the more balanced the sizes of race groups in schools are, the more segregated the groups will be in terms of social interaction (measured by links in social networks). So, if this effect occurs among socioeconomic groups as well, having a small group of poor in a non-poor neighborhood would make it more likely to interact socially with the non-poor group. From this interaction, the non-poor would develop a greater sense of altruism towards this specific group of poor individuals.

As stated earlier, the information used to calculate the demand for transfers come from two sources: the 2000 Census and the PNAD from 2001 to 2007. We use only the 2000 Census and not previous ones because there is no information on transfer

[62] A subdistrict in Brazil 2000 Census is the smallest identified geographical unit. Although the Census Tracts are the smallest geographic unit, they cannot be identified on 2000 Census data.

programs in other years. The advantage of using this database is the possibility of adding information such as the "area", "population density", "urban density", and the "probability of the poor meeting the non-poor in their neighborhood". In such a case, the econometric model in (2.6) is modified by removing the subscripts *t* and the year dummies. To correct the possible bias resulting from the correlation between time-invariant variables and the regressors, a series of local level variables related to geographic and institutional factors is used (see the last row in Table 2.1), which constitutes a proxy for the term ν_j in equation (2.6).

Table 2.1 – Description of the variables used in the econometric analysis

	Variable	Description
w	Proportion of benefited poor	Proportion of poor who are beneficiaries of transfer programs. A poor beneficiary is that individual who belongs to a poor family that is entitled to at least one benefit. It is a measure of pro-poor targeting (in %).
	Average value of benefit	Average per capita value of the benefits received by the poor that participate in some cash transfer program– information from the special supplements of the 2004 and 2006 PNADs. (in R$ per capita of 2008)
	Number of benefits per capita	Average number of benefits per capita accumulated among the poor families that participate in some cash transfer program. The following benefits considered: *Bolsa Escola* (Education Allowance), *Auxílio Gás* (Cooking Gas Coupon), *Bolsa Alimentação* (Food Stipend), *Cartão Alimentação* (Food Voucher), Program for Eradication of Child Labor and *Bolsa Família* (Family Stipend). (information from the special supplement of the 2004 and 2006 PNADs).
	Proportion of non-poor beneficiaries	Proportion of non-poor who are recipient of at least one transfer program. It is a measure of program leakage (in %).
d	Isolated poor	Proportion of poor who live in isolated areas. The following areas are considered to be isolated, according to the Census and PNAD: i) Town or village, non-urbanized area; ii) Isolated urban area; iii) Rural clusters with urban extension and isolated clusters (villages, hubs and other clusters); iv) Rural area excluding clusters. (in %)
	Pop. density	Population density. (100 inhabitants/km2 – IBGE data)
	Urban density	Ratio between the local urban population and the estimated size of the urban area (in 100 inhab./km2 – estimated by Embrapa)
	Area	Area of the municipality. (in 100 km2 – IBGE data)
	Time commuting	The time spent commuting by poor and non-poor. The original variable is categorized in classes of time. The midpoints of each class were weighted by the percentage of people in each class so as to make this variable continuous, (in hours – PNAD-IBGE).
	Prob. poor meets non-poor	Proportion of non-poor in the subdistrict of the poor not living in rural areas. Poor living in rural areas were assigned a null probability of meeting the non-poor. Then we average it over the poor to get the indicator. (Census 2000-IBGE)
y	Income	Median per capita family income net of transfers among people aged over 18 years. (in R$100,00 per capita of 2008)
t	Inequality/ Proxy for tax price	With the data available we cannot create a true tax price measure. In turn, we use an inequality measure that constitute a proxy for the this variable given by the ratio between the median per capita family income and the mean per capita family income net of transfers. This proxy is also used by Mendes and Sousa (2006a, 2006b) who argues that the income can constitute a good indicator of the real tax base. Note also that the property tax is not as important in terms of revenues to local government in Brazil as it is to other countries such as United States.
N	N. of poor	Total poor individual in the municipality. (in 1,000 inhabitants)
Z	Size of the program	The proportion of people in the municipality that participate in some transfer program. Tries to capture federal participation on redistributive policy. Also controls for scale effect, i.e. when the transfer programs in a municipality reach everyone, regardless of which social group the individuals belong, the pro-poor targeting is maximized. Controlling for this variable allow us to isolate the effects of other variables that represent the taste for pro-poor targeting (in %).
	Population	Overall population. (in 1,000 inhabitants)

(Continued)

	Variable	Description
	Schooling	Mean schooling among people aged over 25years. (in years)
	Non-whites	Proportion of black, brown or indigenous individuals. (in %)
	Attendance rate <15 years	Proportion of young individuals aged less than 15 years enrolled in school. (in %)
	Members < 15 years	Average number of family members aged less 15 years.
	Young	Proportion of individuals aged less than 18 years. (in %)
	Elderly	Proportion of individuals older than 65 years. (in %)
	Male heads	Proportion of male household heads. (in %)
	Couples	Proportion of married household heads. (in %)
	Gender	Proportion of male individuals. (in %)
	N.recipients	Total individual receiving benefits. (in 1,000 inhabitants)
ν_j	Fixed effect variables	Variables used when only cross-sectional 2000 Census data were available. It intends capture the local effects that are relatively constant over time and possibly correlated with the regressors. The following variables are used: latitude; distances to state and the federal capital and to Portugal (proxy for export intensity); altitude; rainfall; 12 dummies for soil type; dummies for participation in sugarcane and gold cycles; date of foundation of the municipality; a dummy indicating if the municipality is the capital of the state and dummies indicating the existence of slums, tenements and illegal land occupation – Mattos and Innocentini (2010) and 2002 Profile of Brazilian Municipalities (IBGE).

Note: In cases where there are no information about the source of data, consider that both the Census 2000 and the PNAD were used to get the variable.

On the other hand, PNAD data consists of a sample of individuals from 817 municipalities between 2001 and 2007, which we aggregate in order to build a panel of municipalities. Soares and Pianto (2003) and Foguel and Barros (2010) are two examples of studies that use the PNAD panel of municipalities to assess the effects of income transfer programs on labor supply. Some of the limitations of this data source include i) because this is a sample, the variables aggregated at the municipality level will be measured with error; ii) the sample scheme was conceived such that it reflects the population characteristics, which causes the most populated municipalities to be overrepresented in the data set; and iii) IBGE does not identify the municipalities (for confidentiality reasons), preventing the addition of variables obtained elsewhere; e.g., it was only possible to build distance variables such as “isolated poor” and “time spent commuting”.

Furthermore, except for the years 2004 and 2006 (when the PNAD has special supplements), it is not possible to precisely identify which and how many benefits each household receives. The earnings from income transfers, interests and dividends are all measured by the same variable (“other sources of income”). However, it is possible to assign participation in the federal cash transfer programs with good accuracy by

Table 2.2 – Test for determining the accuracy of the procedure for identification of beneficiaries of income transfer programs based on the 2004 PNAD data

		Individuals belonging to benefited families (2004 PNAD)		
		Does not receive	Receives	Total
Procedure (typical values)	Does not receive	76.76%	1.36%	78.12%
	Receives	2.52%	19.36%	21.88%
	Total	79.28%	20.72%	

Source: Authors' calculation based on the 2004 PNAD data.

Table 2.3 – Descriptive statistics of local variables according to 2000 Census and PNAD data from 2001 to 2007 – data on municipalities where the median voter is above the poverty line

	2000 Census		PNAD (2001 to 2007)	
Variable	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev**
Proportion of benefited poor (in %)	3.77	9.21	32.69	29.41
Average benefit value– PNAD 2004 and 2006 – (in R$ of 2008)	-	-	16.68	9.79
N. of benefits per capita (PNAD 2004 and 2006)	-	-	0.26	0.11
Proportion of non-poor beneficiaries (in %)	0.89	2.21	12.67	12.34
Isolated poor (in %)	49.66	26.88	28.39	31.38
Pop. density (100 inhab./km2)	1.03	5.47	-	-
Area (in 100 km2)	14.50	54.23	-	-
Urban density (in 1000 inhab./km2)	14.24	85.86	-	-
Prob. poor meets non-poor (in %)	45.37	24.98	-	-
Commuting time of the poor (in hours)	-	-	0.46	0.27
Time commuting non-poor (in hours)	-	-	0.43	0.14
Income (in R$100.00 per capita for 2008)	2.31	1.07	2.74	1.32
Inequality/Proxy for tax price (index)	0.62	0.10	0.67	0.12
Size of the program – coverage (in %)	1.61	4.05	16.51	15.63
Population (in 1.000 inhab.)	28.05	177.34	207.35	488.75
N. of recipients (in 1.000 inhab)	2.51	9.76	27.40	36.72
Number of poor (in 1.000 inhab)	4.41	12.66	29.63	49.23
Schooling (in years)	4.06	1.24	5.60	1.65
Non-whites (in %)	44.74	25.60	48.57	25.32
attendance rate <15 years (in %)	92.12	5.20	95.73	3.91
Members < 15 years (number of family members)	1.09	0.31	0.89	0.25
Young (in %)	40.11	6.23	35.50	6.08
Elderly (in %)	7.01	2.11	7.05	2.95
male heads (in %)	80.60	5.42	75.21	91.86
Couples (in %)	69.24	9.28	71.35	8.69
Gender (in %)	50.75	1.56	49.42	2.85
Obs	5140		4791	

identifying the families that receive typical values of the major programs.[63] To do so, we consider the following programs: the Program for Eradication of Child Labor, *Bolsa Escola* (Education Allowance), *Bolsa Família* (Family Stipend), *Bolsa Alimentação* (Food Stipend), *Auxílio Gás* (Cooking Gas Coupon) and *Cartão Alimentação* (Food

[63] This procedure is based on Barros, Carvalho and Franco (2007) and Foguel and Barros (2010). The values were gathered from specific legislation and can be obtained from the authors upon request.

Voucher).[64] The accuracy of this procedure can be verified with the 2004 and 2006 PNAD data. The results of this procedure are quite satisfactory, as observed in Table 2.2.

Table 2.3 shows the descriptive statistics of the variables used in the econometric models. The variables are expressed in different aggregate units (e.g., in percentage values, per 1,000 inhabitants, per 100 km^2, in 100 reais per capita). We consider these units to facilitate the visualization of the effects that are estimated and described in the next section. Note that there is a major difference between the proportion of benefited poor obtained from PNAD and Census data.[65] This difference arises because the number of CCT beneficiaries in 2000 (when the Census was taken) was smaller compared to subsequent years. As explained before, at the time the Census was taken, the only major federal program was PETI, and local programs still predominated. It was only after 2001, with the implementation of *Bolsa Escola*, that the coverage began to expand. From 2001 to 2007 (when only PNAD data are available), federal CCT programs proliferated, with steady growth in the number of beneficiaries. To account for this fact in the estimation of the models so that we can compare Census and PNAD results and compare PNAD data over time, we use a variable that captures the size of the program.

It also should be highlighted that only those municipalities in which the income of the median voter (or the median income) is above the poverty line are considered in the analysis. Otherwise, the reason to demand transfers from local government would most likely be related not to altruism but rather to the possibility that the voter could obtain benefits for him- or herself, placing all of the burden upon the non-poor. We also exclude from the datasets individuals who migrated less than 5 years ago to exclude the possibility of endogenous location decisions.

The format of the dependent variables in this paper greatly affects the estimation strategies. Because one of the regressands is a proportion that is top- and bottom-coded at 0 and 1, respectively, and is considerably concentrated at 0, the Tobit method is

[64] Note that only benefits less than one minimum wage are considered, so we exclude the Benefício de Prestação Continuada (BPC), which is targeted at the social protection of the elderly through the Brazilian Social Security System.

[65] The same reasoning is valid when the dependent variable of the models is the proportion of non-poor beneficiaries.

appropriate (see Long, 1997). Moreover, this situation can be treated as a problem of a corner solution rather than censoring. [66]

When using the PNAD panel data, additional problems arise regarding specifications. As indicated in Greene (2004), the Tobit fixed effects estimator suffers from the incidental parameters problem, which produces an upward bias in the coefficients. However, a Monte Carlo simulation exercise shows that the bias on that estimator seems very small. For a number of periods equal to 7, as in our case, the bias is approximately 0.4%. The problem, according to Greene, lies with the standard error estimates of the coefficients. For T = 2, the bias for the standard error estimation can be as high as 33%, but it vanishes as T increases. For T = 7, the bias is only approximately 9%. Thus, the maximum likelihood fixed Tobit estimator may be informative, but it must be used carefully.

In addition to the estimation of equation (2.6) using 2000 Census data on the proportion of poor individuals who participate in any transfer program and the "distance variables", three additional robustness procedures are conducted. The first consists of repeating the same exercise using the PNAD panel data. The second procedure assesses the effects of the "distance" variables on the percentage of non-poor individuals who participate in some transfer program. Our goal in this analysis is to verify whether the worse targeting of poor families resulting from a greater distance is simply due to a greater difficulty of identifying the poor, which would indicate an increased amount of program leakage. Finally, the purpose of the third robustness procedure is to test if a possible negative association between targeting of poor families and a longer distance is due to higher costs of granting benefits to those poor families living farther away. We use 2004 and 2006 PNAD panel data for this particular procedure. The fixed effects within estimator is our choice for performing this last robustness check, whose dependent variables are not top or bottom coded and consist of the average number of benefits per capita and the average per capita value of the benefits granted to the poor households that were entitled to at least one benefit.

[66] Wooldridge (2002) argues that, in some cases, a concentration at zero is not due to censoring but to a corner solution; i.e., people find this choice optimal.

2.4 Results

This section is divided into four subsections. Subsection 2.4.1 presents the estimates of equation (2.6) using the 2000 Census data and the proportion of poor individuals that receive benefits (targeting) as the dependent variable. In this same subsection, the Census sample is divided according to some characteristics to check the heterogeneity of its results. Subsection 2.4.2 shows the estimates of the same model using PNAD data. Subsection 2.4.3 describes the results for the model in which the dependent variable is the proportion of non-poor individuals who receive some benefit, which is a measure of program leakage, using both Census and PNAD data. Finally, subsection 2.4.4 presents the results using as dependent variables the number and the value of the benefits (in per capita terms) among those poor families who participate in some program.

2.4.1 Targeting: 2000 Census data

Table 2.4 shows the marginal effects for model (2.6) using the Tobit method on 2000 Census data. Specifications I through V are the same except for the different measures of distance, designed to capture the geographical effects on the demand for transfers. The control variables were chosen to reflect both the local demand for transfers and the characteristics that determine eligibility to programs. All of the specifications include state dummies and variables used to capture the fixed effects of each municipality, considering institutional and historical aspects, geography, geomorphology, climate and the existence of particular types of housing agglomerations that may influence the targeting policies, e.g., slums[67]. Obviously, trying to control all of the fixed effects is almost impossible; our goal is that, after using these controls, the remaining fixed effect will not be correlated with the main variables of interest.

[67] These fixed-effects variables explain 4.5% of the variation of the dependent variable measured by the pseudo R-squared, which represents approximately 19% of the total explained variation. Also, the BIC statistics suggest that the specification with all regressors is superior. The complete estimates can be seen in the Appendix A.2..

Table 2.4 – Tobit marginal effects estimates on the proportion of beneficiaries among the poor Median voter above the poverty line (data from the 2000 Census)

	I	II	III	IV	V
Population density	0.034**				
	(0.014)				
Urban density		0.002*			
		(0.001)			
Area			-0.003		
			(0.002)		
Isolated poor				-0.018**	
				(0.007)	
Prob. poor meets non poor					0.026***
					(0.009)
Income	-0.898*	-0.826*	-0.806	-0.951*	-1.150**
	(0.500)	(0.496)	(0.498)	(0.503)	(0.519)
Inequaity/Proxy for tax price	-3.910***	-3.745**	-3.783**	-3.795**	-3.855**
	(1.509)	(1.501)	(1.501)	(1.501)	(1.500)
Size of the program	2.295***	2.297***	2.295***	2.297***	2.301***
	(0.052)	(0.052)	(0.052)	(0.052)	(0.053)
Population	0.001	0.001	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Schooling	0.687**	0.690**	0.693**	0.571**	0.544*
	(0.291)	(0.291)	(0.291)	(0.290)	(0.288)
Family members less than 15 years old	-1.854	-1.820	-1.830	-1.187	-0.887
	(1.656)	(1.658)	(1.654)	(1.704)	(1.707)
School attendance	0.107***	0.106***	0.103***	0.104***	0.101***
	(0.034)	(0.034)	(0.035)	(0.034)	(0.035)
Nonwhite	0.014	0.015	0.016	0.014	0.015
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
Elderly	0.168	0.156	0.151	0.202*	0.230**
	(0.113)	(0.112)	(0.112)	(0.113)	(0.115)
Young	0.152	0.150	0.150	0.133	0.123
	(0.094)	(0.093)	(0.094)	(0.095)	(0.095)
Men head of the family	-0.057	-0.061	-0.060	-0.042	-0.039
	(0.055)	(0.055)	(0.055)	(0.055)	(0.055)
Couple	0.045*	0.047*	0.046*	0.055**	0.055**
	(0.026)	(0.026)	(0.026)	(0.026)	(0.026)
Gender	-0.103	-0.096	-0.105	-0.082	-0.073
	(0.157)	(0.156)	(0.157)	(0.159)	(0.160)
Constant	-20.813**	-21.113**	-20.637**	-21.399**	-23.768**
	(10.152)	(10.100)	(10.157)	(10.201)	(10.333)
State dummies	Yes	Yes	Yes	Yes	Yes
Fixed Effects Variables†	Yes	Yes	Yes	Yes	Yes
Pseudo R^2	0.239	0.239	0.239	0.240	0.240
Bic	13973.518	13973.359	13974.969	13968.017	13966.011
N	4135	4134	4135	4135	4135

Note: see the full estimates in the Appendix A.2.

Robust standard errors in parenthesis. * p<0.10, ** p<0.05, *** p<0.01.

† Fixed Effects Variables: dummies for the existence of slum, Tenement, and Illegal land occupation; latitude, longitude; distances to state and the federal capitals and to Portugal; altitude; rainfall; 12 dummies for soil type; dummies for participation in sugarcane and gold cycles; Date of foundation of the municipality and a dummy indication if the municipality is the capital of the state.

Table 2.5 – Tobit marginal effects estimates on the proportion of beneficiaries among the poor for the samples with the 50% richest and poorest municipalities Median voter above the poverty line (data from the 2000 Census)

	I		II		III		IV		V	
	50% richest	**50% poorest**	**50% richest**	**50% poorest**	**50% richest**	**50% poorest**	**50% richest**	**50% poorest**	**50% richest**	**50% poorest**
Population density	0.044***	0.020								
	(0.017)	(0.049)								
Urban density			0.002	0.001						
			(0.006)	(0.001)						
Area					-0.007	-0.001				
					(0.005)	(0.002)				
Isolated poor							-0.020*	-0.018**		
							(0.012)	(0.008)		
Prob. poor meets non poor									0.028*	0.033**
									(0.015)	(0.013)
Income	-1.288	2.014	-1.224	1.974	-1.195	2.067	-1.348	1.765	-1.510*	1.220
	(0.846)	(1.410)	(0.843)	(1.415)	(0.846)	(1.413)	(0.854)	(1.434)	(0.865)	(1.507)
Inequality/proxy for tax price	-6.452**	-0.327	-6.148**	-0.284	-6.206**	-0.351	-6.115**	-0.300	-6.123**	-0.316
	(2.865)	(1.260)	(2.845)	(1.257)	(2.846)	(1.257)	(2.850)	(1.242)	(2.848)	(1.237)
Covariates †	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects Variables††	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R^2	0.204	0.348	0.204	0.348	0.204	0.348	0.204	0.348	0.205	0.349
Bic	6901.810	6673.950	6896.116	6672.030	6903.439	6673.702	6892.952	6666.065	6891.879	6663.222
N	2177	1958	2176	1958	2177	1958	2177	1958	2177	1958

Note: see the full estimates in the Appendix A.2.

Robust standard errors in parenthesis. * p<0.10, ** p<0.05, *** p<0.01.

†Covariates: size of the program, population, schooling, number of family members less than 15 years old, school attendance rate, nonwhite, elderly, young, men head of the family, couple and gender.

†† Fixed Effects Variables: dummies for the existence of slum, Tenement, and Illegal land occupation; latitude, longitude; distances to state and the federal capitals and to Portugal; altitude; rainfall; 12 dummies for soil type; dummies for participation in sugarcane and gold cycles; Date of foundation of the municipality and a dummy indication if the municipality is the capital of the state.

Table 2.6 – Tobit marginal effects estimates on the proportion of beneficiaries among the poor for the samples with the 50% most and least populated municipalities
Median voter above the poverty line (data from the 2000 Census)

	I		II		III		IV		V	
	50% most pop	**50% least pop**	**50% most pop**	**50% least pop**	**50% most pop**	**50% least pop**	**50% most pop**	**50% least pop**	**50% most pop**	**50% least pop**
Population density	0.014	-0.233								
	(0.010)	(0.412)								
Urban density			-0.002	0.003						
			(0.001)	(0.002)						
Area					-0.002	-0.014				
					(0.002)	(0.019)				
Isolated poor							-0.005	-0.029**		
							(0.005)	(0.013)		
Prob. poor meets non poor									0.208	0.043***
									(0.728)	(0.017)
Income	-0.986**	-1.855*	-0.954**	-1.878*	-0.919**	-1.784	-0.973**	-2.058*	-0.969**	-2.399**
	(0.383)	(1.106)	(0.381)	(1.105)	(0.381)	(1.112)	(0.389)	(1.115)	(0.398)	(1.156)
Inequality/proxy for tax price	-0.911	-4.632*	-0.762	-4.752*	-0.795	-4.832*	-0.808	-4.554*	-0.774	-4.631*
	(1.293)	(2.555)	(1.272)	(2.557)	(1.271)	(2.561)	(1.274)	(2.561)	(1.277)	(2.559)
Covariates†	Yes	Yes	Yes	yes	yes	yes	yes	Yes	yes	yes
State dummies	Yes	Yes	Yes	yes	yes	yes	yes	Yes	yes	yes
Fixed Effects Variables††	Yes	Yes	Yes	yes	yes	yes	yes	Yes	yes	yes
Pseudo R^2	0.295	0.236	0.295	0.236	0.295	0.236	0.295	0.237	0.295	0.237
Bic	6936.170	6631.914	6936.429	6630.993	6936.544	6631.525	6936.568	6627.011	6937.260	6625.001
N	1952	2183	1952	2182	1952	2183	1952	2183	1952	2183

Note: : see the full estimates in the Appendix A.2.
Robust standard errors in parenthesis. * p<0.10, ** p<0.05, *** p<0.01.
†Covariates: size of the program, population, schooling, number of family members less than 15 years old, school attendance rate, nonwhite, elderly, young, men head of the family, couple and gender.
†† Fixed Effects Variables: dummies for the existence of slum, Tenement, and Illegal land occupation; latitude, longitude; distances to state and the federal capitals and to Portugal; altitude; rainfall; 12 dummies for soil type; dummies for participation in sugarcane and gold cycles; Date of foundation of the municipality and a dummy indication if the municipality is the capital of the state.

The coefficient of income has a negative slope in specification I, suggesting that a per capita increase of 100 reais in the median income (measured by per capita family income) diminishes the proportion of the poor who receive benefits by roughly 1 percentage point[68]. The coefficient of inequality (the proxy for tax price) shows the expected sign such that a variation of 1 point on the index (a situation in which the median voter has to pay a greater share of the total expenditure on the publicly provided good) implies a decrease of 3.910 percentage points in the proportion of poor recipients of transfers.

Our variable that controls for federal participation in local decisions, the size of the program, has a positive effect on our dependent variable for every model.[69] This variable is omitted in Asworth, Heyndels and Smolders (2002), but it is very important in our case. This variable controls for the influence of the budget (quotas) for redistribution provided by the federal government. Although the decision to register beneficiaries belongs to the municipalities, the funds for such transfers come from the federal government. As stressed in Craw (2003), we have to control for the possibility that local governments represent only an instrument by which the federal and state governments redistribute funds. We estimate that a 1-percentage point increase in the total population covered by transfer programs increases by 2.295 percentage points the proportion of poor beneficiaries (the targeted population).

An additional year of schooling is associated with a 0.687-percentage point increase in the dependent variable. Because school attendance is one of the most common program conditionalities for families with children younger than 15 years old, it is not surprising that we observe a positive coefficient. Hence, a 1-percentage point increase in this variable increases the proportion of poor recipients of transfers by 0.107 percentage points. A 1-percentage point increase in the proportion of households whose head has a partner (couples variable) increases the proportion of beneficiary poor by 0.045 percentage points. These results are almost the same in specifications II through V because only the "distance" variables change from one model to another. The exception is the percentage of elderly in the population, for which the coefficient is positive and significant only in specifications IV and V, indicating that a 1-percentage point increase in this variable increases the proportion of transfers to the targeted population by approximately 0.2 percentage points. Other control variables, such as population, average number of family members younger than 15 years old,

[68] The negative effect of income on demand for transfers is not robust when we consider our panel data set.
[69] Although we omit its estimation from future tables to save space, this variable is significant for every model we considered. See full estimates in the appendix A.2.

percentage of non-white individuals, percentage of youth, percentage of males, and percentage of households with male heads do not show significant coefficients for the proposed models.

Regarding the measures of "distance" between poor and non-poor, the results show consistency with what is expected. In specification I, population density – the same variable used by Ashworth, Heynels and Smolders (2002) to assess distance between the two groups – has a positive effect on the proportion of the poor who receive benefits, indicating that an increase of 100 inhabitants per square kilometer increases the percentage of beneficiaries among the poor by 0.034 percentage points. The urban density, which, as mentioned elsewhere, consists of the number of inhabitants living in the urban area per square kilometer of urban sprawl, also increases the level of transfers to the targeted population. An additional 1000 inhabitants per square kilometer of urban sprawl increases the proportion of recipients among the poor by 0.002 percentage points. The coefficient of area was not significant, but the sign is negative as expected.

It is important to emphasize that the variable "isolated poor", when used as a regressor, along with the proportion of the poor who receive transfers as the dependent variable could capture only a correlation because the denominators of both variables are the same, i.e., the number of poor families. In this case, the expected correlation should be positive because the higher the number of isolated poor families in a given locality, the higher the total population size of the poor will be and, consequently, the more of these families that receive some type of benefit. On the other hand, if the location of the poor has a negative influence on their probability of receiving some benefit because the demand for transfers or the provision cost have spatial components, then the expected relation should be negative. A perfect association would imply that if 100% of the poor lived in an isolated area, none would receive transfers. In specification IV, the negative effect of the coefficient on this variable suggests that we are capturing a geographic aspect of the demand for transfers or provision costs. A 1 percentage point increase in the proportion of poor living in isolated areas reduces the proportion of recipients of transfers among the poor by 0.018 percentage points.

The other variable of interest – the index built to reflect the probability of interaction between the poor and non-poor – shows a coefficient with the expected sign. Thus, a 1-percentage point increase in the probability of a poor individual meeting a non-poor

individual who lives in the same neighborhood improves the targeting of benefits to the poor by 0.026 percentage points.

Tables 2.5 and 2.6 present the results for the sample divided according to income and size of the population, respectively. These analyses assess the heterogeneous aspects of the dataset. In Table 2.5, the dataset is divided between the 50% richest and 50% poorest municipalities. The coefficient of population density is significant only among the richest municipalities, possibly because there is more variability in the population size of these municipalities, which are located mainly in the Southeast and South regions. Neither the "urban density" nor the "area" variable shows a significant coefficient. On the other hand, the coefficients of the "isolated poor" and "probability of poor meeting non-poor" variables retain statistical significance using both samples.

In Table 2.6, the dataset is divided between the 50% most and least populated municipalities. As both the population density and the urban density are calculated based on the size of the population and there is less variation in these variables in each subsample, it is no surprise that the coefficients appear statistically non-significant.

The coefficient of "isolated poor" is statistically significant only among the least populated municipalities. The same is true for the coefficient of the "probability of poor meeting non-poor" variable. This result means that the average effects of these last two variables for the entire sample rely heavily on the variation observed among the least populated municipalities. Still, there are no conflicting effects among each of the subsamples.

Overall, the results indicate that the distance between the poor and non-poor plays a significant role in determining the level of demand for transfers represented by the proportion of poor that receive benefits. However, it is still not possible to disentangle the altruism effect from the cost of reaching potential beneficiaries. Thus far, provided that we could control the fixed effects adequately, we can only conclude that the greater the distance between the groups, the worse the targeting to the poor is. The next section tries to provide further evidence to support this finding by using other measures of distance and panel data that allow us to control the fixed effects properly.

2.4.2 Targeting: 2001-2007 panel data

In this section, we attempt to further investigate the demand for transfers to the poor using the same demand specifications, but using the panel data from 2001 to 2007 (PNAD) to correct for the eventual correlation between the omitted fixed effects and the regressors.[70]

Table 2.7 – Tobit Marginal Effect estimates on the proportion of beneficiaries among the poor using municipality dummies to capture the fixed effect
Median voter above the poverty line (PNAD data from 2001 to 2007)

	Tobit FE-I	Tobit FE-II
Time commuting poor	-3.158**	
	(1.394)	
Time commuting non poor	3.946	
	(4.779)	
Isolated poor		-0.009
		(0.024)
Income	7.051***	4.275***
	(1.406)	(1.466)
Inequality/Proxy for tax price	-8.596*	-0.284
	(4.512)	(4.919)
Covariates†	Yes	yes
Year dummies	Yes	yes
Municipality dummies	Yes	yes
Pseudo R^2	0.164	0.143
Bic	31907.350	36930.058
N	3928	4790

Note: Standard errors in parenthesis. * p<0.10, ** p<0.05, *** p<0.01.
See the complete results in the Appendix A.2.
†Covariates: size of the program, population, schooling, number of family members less than 15 years old, school attendance rate, nonwhite, elderly, young, men head of the family, couple and gender.

With the data from PNAD we can calculate another measure of distance between the poor and non-poor: the time spent commuting by each group. The longer the time spent commuting by the poor, with the time spent commuting by the non-poor held constant, the farther away one group should be from the other. The same reasoning is valid when varying the commuting time of the non-poor. Note that the majority of cities in Brazil are market oriented – as opposed to centrally planned – and small both in size and area, which increases the probability that they have a single central business district where the majority of the jobs are located; i.e., they are most likely monocentric. This is a sufficient (but not necessary) condition for the variable "time spent commuting" to be a good proxy for the distance between the groups. These two variables (time spent commuting for each group) allow us to

[70] This dataset has its drawbacks as well. One of such drawbacks is that the most populated municipalities are overrepresented in the sample. Other drawback is that we are not able to use distance variables related to area and proportion of non-poor in a given subdistrict.

distinguish the reasons why a greater distance between the poor and non-poor may affect the demand for transfers. If a longer commuting time among the poor implies an increasing distance from the non-poor, a negative relationship between the time spent commuting by the poor and the demand for transfers may be due either to geographically delimited altruism or to a higher cost of reaching the poor when they live further away. On the other hand, a change in the time spent commuting by the non-poor, with the time spent commuting by the poor held constant, implies that the former group is distancing itself from the later. A negative relationship with the demand for transfers would reflect only geographically delimited altruism, as the time the poor spend commuting is fixed.

Table 2.7 shows the results using these two variables to capture distance as well as the proportion of isolated poor. In specification I, a 1-hour increase in the time spent commuting by the poor reduces the proportion of benefit recipients among the poor by 3.158 percentage points. The coefficient of the time spent commuting by the non-poor is not significant.

In specification II, the coefficient of the proportion of isolated poor is not significant. Because most of the municipalities that make up the PNAD sample are highly populated, this result is not unexpected considering that a similar result is obtained for the 2000 Census subsample including only the most populated municipalities (Table 2.6).

In general, these results reinforce the hypothesis that the distance between the poor and non-poor has some influence on the demand for transfers, but it is still not possible to state if the reason is because of a geographically delimited altruism or because of a simple matter of higher costs of reaching the poor and offering them benefits whenever they live farther away from the administrative center.

Also, the negative sign on the median income using the cross-sectional data from the 2000 Census changes to positive when taking into account the unobserved fixed effects with the panel data from PNAD. Thus, the redistribution seems to be a normal good such that a 100 reais per capita increase in the median voter income increases the proportion of the poor who receive some benefit by 7.051 percentage points. Additionally, the expected negative sign of inequality means that an increase in the price of redistribution perceived by the median voter implies a lower demand for this good.

2.4.3 Geographical distance and program leakage

In this section, we change the dependent variable to the percentage of non-poor families that participate in some transfer program, which is a measure of leakage of the redistribution programs. The purpose of this exercise is to rule out another explanation for the negative effect of the "distance" variables on the demand for transfers, e.g, that because the poor live distant from the administrative center of the municipality, the benefits are inappropriately directed to non-poor individuals. This situation might occur either because it is more difficult and expensive to identify the poor if they live far away or because poor individuals are too distant to understand their rights and might not have proper access to information, resulting in non-poor individuals capturing those transfers (see Bardhan and Mookherjee, 2000).

Table 2.8 –Tobit marginal effects estimates on the proportion of non-poor beneficiaries (leakage) Median voter above the poverty line (Census 2000)

	I	II	III	IV	V
Pop. density	0.00001 (0.002)				
Urban density		0.00001 (0.000)			
Area			-0.00001 (0.001)		
Isolated poor				0.002 (0.001)	
Prob. poor meets non poor					0.001 (0.002)
Income	-0.098 (0.081)	-0.098 (0.081)	-0.094 (0.081)	-0.062 (0.085)	-0.084 (0.088)
Inequality/Proxy for tax price	-0.106 (0.287)	-0.111 (0.285)	-0.110 (0.285)	-0.105 (0.285)	-0.117 (0.285)
State dummies	yes	yes	yes	yes	yes
Covariates†	yes	yes	yes	yes	yes
Fixed Effects Variables††	yes	yes	yes	yes	yes
Pseudo R^2	0.354	0.354	0.354	0.354	0.354
Bic	9901.598	9900.455	9901.315	9894.713	9896.889
N	4140.000	4139.000	4140.000	4135.000	4135.000

Note: Robust standard errors in parenthesis. * p<0.10, ** p<0.05, *** p<0.01.
See the complete results in the Appendix A.2.
†Covariates: size of the program, population, schooling, number of family members less than 15 years old, school attendance rate, nonwhite, elderly, young, men head of the family, couple and gender.
†† Fixed Effects Variables: dummies for the existence of slum, Tenement, and Illegal land occupation; latitude, longitude; distances to state and the federal capitals and to Portugal; altitude; rainfall; 12 dummies for soil type; dummies for participation in sugarcane and gold cycles; Date of foundation of the municipality and a dummy indication if the municipality is the capital of the state.

Table 2.9 – Tobit marginal effects estimates on the proportion of non-poor beneficiaries (leakage) using municipality dummies to capture the fixed effect
Median voter above the poverty line (PNAD data from 2001 to 2007)

	Tobit FE-I	Tobit FE-II
Time commuting poor	0.279 (0.230)	
Time commuting non poor	1.284 (0.810)	
Isolated poor		-0.0001 (0.003)
Income	0.432* (0.227)	0.452** (0.179)
Inequality/Proxy for tax price	2.490*** (0.753)	1.791*** (0.635)
Covariates†	yes	Yes
Year Dummies	yes	Yes
Pseudo R^2	0.383	0.384
Bic	24034.386	27933.592
N	3928	4790

Note: Standard errors in parenthesis. * p<0.10, ** p<0.05, *** p<0.01.
See the complete results the Appendix A.2.
†Covariates: size of the program, population, schooling, number of family members less than 15 years old, school attendance rate, nonwhite, elderly, young, men head of the family, couple and gender.

Accordingly, we use data from both the 2000 Census and the 2001-2007 panel (PNAD). The results based on Census data are shown in Table 2.8. Clearly, these results show no correlation between our distance-related variables and the percentage of non-poor beneficiaries. In fact, the model does not explain the variation in the dependent variable, suggesting that distance does not drive the demand for benefits from non-poor individuals.

In Table 2.9, we estimate the same model using our panel data from PNAD, which allows us to assess the effects of distance by using the time spent commuting by the poor and non-poor as well as the "isolated poor" variable. Similarly, the results are not significant, which leads us to conclude that distance may not be related to leakage. Therefore, the reason why a greater distance lowers the demand for redistribution seems not to be because the transfers are going to the wrong "hands".

2.4.4 Geographical distance, number of benefits and average benefit level

This last subsection attempts to determine which effect causes the negative effect of distance on the demand for transfers: altruism or cost of identification of the beneficiaries. We

use two different dependent variables based on 2004 and 2006 PNAD data that encompass only families participating in some program: the average number of benefits per family member received by households that participate in at least one program and the average level of benefits received per member of recipient families[71]. The 2004 and 2006 surveys are the only two that include these variables.

Table 2.10 – Within Estimator effects on the average number of benefits per capita in the poor households that receive at least one benefit
Median voter above the poverty line (data from 2004 and 2006 PNAD)

	FE-I	FE-II	FE-III
Time commuting poor		0.10848**	0.10885**
		(0.04308)	(0.04182)
Time commuting non poor		-0.13851*	-0.14779*
		(0.08126)	(0.08227)
Isolated poor	0.00078		0.00065
	(0.00059)		(0.00058)
Income	0.00365	-0.01216	-0.00682
	(0.02651)	(0.02676)	(0.02683)
Inequality/Proxy for tax price	0.06050	0.07507	0.06963
	(0.06922)	(0.07055)	(0.06944)
Covariates†	Yes	Yes	yes
Year Dummies	Yes	Yes	yes
R^2	0.075	0.109	0.114
Bic	-2128.156	-2100.107	-2098.506
N	726.000	700.000	700.000

Note: Robust standard errors in parenthesis. * p<0.10, ** p<0.05, *** p<0.01.
See the complete results in the Appendix A.2.
†Covariates: size of the program, population, schooling, number of family members less than 15 years old, school attendance rate, nonwhite, elderly, young, men head of the family, number of recipients, income of the poor in isolated areas, couple and gender.

To decompose the effects of altruism and the cost of registering, we use the commuting time variables for the poor and non-poor. If altruism is the phenomenon dominating the effect estimated in the previous sections, then the more distant the non-poor are from the poor, measured by the commuting time of the non-poor, the lower their demand for redistribution and the average number of benefits given to the poor families. Similar reasoning is valid for the commuting time of the poor; that is, everything else constant, the more distant they are from the non-poor (given by a greater commuting time) less redistribution the later will demand for them. The idea is that once the poor are receiving one benefit, there would be no (or very low) additional cost for receiving more benefits. So negative effects in this case reflect altruism disentangled from cost effects. On the other hand, a non-significant effect of

[71] There are several programs in which the responsibility of registering the families is given to the municipality. Thus, a single municipality can give more than one benefit to families that they find to be eligible.

the distance of the poor individuals, measured by the commuting time of the poor, might indicate that the cost of registering is influencing the result.

Table 2.10 shows our fixed effects estimates using the average number of benefits per capita as the dependent variable.[72] Specification FE-I shows that the proportion of poor living in isolated areas has no effect on the number of benefits per capita, reinforcing the importance of the role played by costs of registering in affecting transfers to the poor. The specification FE-II indicates an unexpected result, a positive and significant effect for time spent commuting by the poor on the number of benefits received per family member. In particular, we estimate that a 1-hour increase in the commuting time increases by 0.10848 the average number of benefits per capita granted to poor families. Moreover, the time spent commuting by the non-poor has a negative sign and is statistically significant, but with a greater magnitude: a 1-hour increase in the commuting time for the non-poor decreases by (approximately) 0.14 the average number of benefits per capita, corroborating the results in Ashworth, Heyndels and Smolders (2002) and reinforcing the observation that altruism seems to be geographically delimited. Even when one inserts both groups of variables (isolation of the poor and time commuting) at the same time, as in specification FE-III, the magnitude and significance of the coefficients on the two commuting variables remains practically unchanged. Note also that although the altruism-related effect seems to be larger in magnitude, it is not more statistically significant. We next evaluate their effect on the average level of benefits.

Table 2.11 shows the results for the average per capita value of transfers among families that receive at least one benefit, and it presents one important difference. In specifications II and III, the time spent commuting by poor individuals seems to have no effect on the average per capita value of the benefit. On the other hand, a 1-hour increase in the time spent commuting by the non-poor lowers the average value of the benefits by 12.064 reais per capita (specification III).

This result reinforces the geographically delimited altruistic behavior of the non-poor individuals in Brazilian municipalities. On the other hand, the non-significance of the variables "time spent commuting by the poor" and "proportion of isolated poor" indicate that the related effects (cost-based and geographically delimited altruism) might be cancelling each other out, leading to statistically non-significant effects. Therefore, based on the results

[72] Note that both dependent variables used here are not censored below or above, so we use the within estimator to take into account the fixed effects.

of Table 2.11, even though not all variables indicate the existence of a geographically delimited altruism, the unambiguous variable (commuting time of the non-poor) shows a strong effect, supporting the relevance of the phenomenon. Nevertheless, the non-significant impact of cost-based distance variables in this setup (in which everyone receives at least one benefit) suggests, reasonably, that costs only affect the number of benefits on the part of the poor individuals, not the amount of transfers to them.

Table 2.11– Within Estimator effects on the per capita value of benefits received by the poor households contemplated by at least one benefit
Median voter above the poverty line (data from 2004 and 2006 PNAD)

	FE-I	FE-II	FE-III
Time commuting poor		4.458	4.505
		(2.871)	(2.784)
Time commuting non poor		-11.379*	-12.064**
		(6.078)	(6.096)
Isolated poor	0.099		0.056
	(0.071)		(0.040)
Income	3.227	-0.131	0.334
	(2.774)	(1.689)	(1.734)
Inequality/Proxy for tax price	-10.118*	-5.290	-5.786
	(5.182)	(4.527)	(4.438)
Covariates†	yes	Yes	yes
Year Dummies	yes	Yes	yes
R^2	0.220	0.235	0.244
Bic	4171.690	3678.409	3676.065
N	718.000	693.000	693.000

Note: Robust standard errors in parenthesis. * p<0.10, ** p<0.05, *** p<0.01.
See the complete results in the Appendix A.2.
†Covariates: size of the program, population, schooling, number of family members less than 15 years old, school attendance rate, nonwhite, elderly, young, men head of the family, number of recipients, income of the poor in isolated areas, couple and gender.

These results deserve some discussion. Comparing the results from Tables 2.10 and 2.11, it can be seen that the direction of the effect of the variable “time spent commuting by the non-poor” is consistent and robust for all models. On the other hand, the positive and significant coefficients in Table 2.10 for the variable "time spent commuting by the poor" suggest an unexpected effect. Although we cannot provide a final answer to this question, we are able to present some possible explanations for its occurrence; however, all of them rely on cost-related rationalizations and not on altruism.

A more plausible explanation addresses the fact that the *Bolsa Familia* program has been incorporating many other redistributive programs. Since 2004, various existing benefits have been integrated into the *Bolsa Família* program. For families already receiving other benefits, this process means the substitution of their benefits by *Bolsa Família*. For families

not covered by any benefit, since 2004, local government officials have registered them directly in *Bolsa Família*. If this process of incorporation was first carried out in the areas nearest the local government centers (which are more easily accessible), we might observe those poor families living closer to the non-poor receiving fewer benefits, but not a smaller amount, which is similar to our estimation results. Table 12 shows a strong decline in the number of participants in the first four federal programs and, concomitantly, a huge increase in the number of beneficiaries of *Bolsa Familia*. We claim that the change might have taken place heterogeneously, starting with closer recipients and moving to the more distant ones.

Our second hypothesis relates to monitoring cost. Because it can be harder to monitor the benefits accumulated by each household in more remote areas, a single household could claim and possibly accumulate benefits that, in principle, should not overlap. If beneficiaries are more closely monitored in areas nearer the local government center, we should observe poor individuals that are closer to the center receiving fewer benefits and lower amounts of benefits. The first prediction is confirmed in our results, but the second conclusion is not.

Table 2.12 – Evolution of Recipients of cash transfers

Number of beneficiary families	2004	2006	% Change
Auxílio Gás	5.965.475	641.638	-89%
Bolsa Alimentação	62.644	2.900	-95%
Bolsa Escola	3.296.568	88.270	-97%
Cartão Alimentação	112.312	33.930	-70%
Bolsa Família	5.385.597	11.009.341	104%

Source: The Ministry of Social Development of Brazil

Third, if it is much more difficult and costly to reach the poor living at greater distances, the local administration may prefer to grant as many benefits as they can once they find a poor family living far away so they do not have to return in the future if the family claims an additional benefit. Although this scenario seems less plausible, it cannot be ruled out as a possibility. However, we should also observe larger benefit values, which is not the case.

Nevertheless, all explanations seem to point to the very same conclusion: once the costs of registering are properly addressed, distant poor individuals might receive equal (or more, depending on costs) benefits than those who live closer to the local government center. This result suggests that the cost of registering beneficiaries affects targeting.

On the other hand, the results regarding the variable "time spent commuting by the non-poor" are unambiguous. This variable is not related to the groups targeted by the programs, but it exhibits a consistently negative effect on local redistribution, suggesting that geographically delimited altruism indeed influences the demand for benefits. Therefore, both effects seem to be lowering the quality of targeting for redistributive policies and should be considered when analyzing local redistribution schemes.

2.5 Final Remarks

This paper attempts to further investigate the role played by the geographic distance between the poor and non-poor on the local demand for income redistribution. In particular, we provide an empirical test for the geographically limited altruism model proposed in Pauly (1973), incorporating the possibility of participation costs associated with the provision of transfers (see Van de Wale, 1998). We motivate this discussion by adding the possibility of distance-related 'iceberg costs' of delivering benefits to poor individuals (Samuleson, 1952). We show that these two effects of distance may act to lower the demand for transfers, making it difficult to distinguish between the two effects.

To estimate the local demand for transfers, we consider both the 2000 Census data and panel data from 2001 to 2007 (PNAD). Additionally, we use a shorter panel from the 2004 and 2006 PNAD in which more detailed information is available on the number and values of the benefits received by the households.

Our results using the Census and panel data indicate that a greater distance between the poor and non-poor decreases the demand for redistribution. In the case of the Census, a higher population density, urban density, and probability that the poor meet the non-poor in their neighborhood increase targeting. Furthermore, more time spent commuting by the poor (with the time spent commuting by the non-poor held constant) and a higher proportion of poor people living in isolated areas have negative effects on the targeting variable. In particular, we estimate that a 1-hour increase in the time spent commuting by the poor reduces the proportion of poor recipients by 3.158 percentage points. This estimate seems to support the model proposed in Section 3 and the model proposed by Pauly (1973) and is not dissimilar from the results obtained in Ashworth, Heyndels and Smolders (2002). Moreover, we show

that our result is not due to program leakage; i.e., the fact that the poor live distant from non-poor individuals does not indicate that the non-poor are receiving the benefits.

We also show that the federal government influences the local decision to redistribute. Using the size of each program, which captures the budget for redistribution in a locality, we find a positive effect on targeting that is in accordance with Notten and Gasmann (2008). Although the decision to register beneficiaries belongs to the municipalities, the funds for the transfers come from the federal government. As stressed in Craw (2003), we have to control for the possibility that the local governments are only an instrument for redistribution used by the federal and state governments. We estimate that a 1-percentage point increase in the total population covered by transfer programs increases by 2.295 percentage points the proportion of beneficiaries who are poor (the targeted population).

However, this negative effect on targeting of the geographical distance between poor and non-poor individuals may be due to both the cost of registering potential recipients who live in areas distant from the administrative center and/or to geographically delimited altruism. To empirically disentangle the two effects, an additional test is conducted with the 2004 and 2006 PNAD panel data.

We consider the average number of benefits per capita and the average per capita value of benefits received by family program participants as dependent variables and our commuting time variable for poor and non-poor individuals as explanatory variables. If altruism is the phenomenon that dominates the effect estimated for targeting, then the more distant the non-poor are from the poor (measured by the commuting time of the non-poor), the lower the demand of the non-poor for redistribution will be and the fewer benefits the families will receive on average. However, a positive or non-significant effect of the distance of the poor individuals (measured by the commuting time of the poor) might indicate that the cost of registering for benefits is preventing them from doing so.

The results show that the more distant the non-poor are from the poor – measured by increased time spent commuting among the non-poor (with the commuting time of the poor held constant) – the lower the demand for redistribution becomes. Because cost plays no role here, there is a straightforward interpretation of geographically delimited altruism. On the other hand, the positive (and significant for number of benefits) result for the variable "time spent commuting by the poor" suggests an unexpected effect. Although we cannot provide a final answer to this question, we can present some possible explanations for its occurrence;

however, all of them rely on cost-related rationalization and not altruism. The most plausible reasoning for this finding is related to the fact that the *Bolsa Familia* program has been incorporating many other benefits since 2004; i.e., families that received several benefits are beginning to receive just one, from *Bolsa Família*. If this process of incorporation is first carried out in the most accessible areas, we might observe that those poor individuals living closer to the non-poor receive fewer benefits than their more distant counterparts. However, because this change is merely an incorporation of several programs under the umbrella of *Bolsa Familia*, we do not expect any effect on the average benefit level, similar to our estimation results. Therefore, both participation costs and geographically delimited altruism seem to be operating to reduce targeting in local redistributive policies.

The next question that arises is whether these results will positively or negatively affect local redistribution. Our results suggest that a totally centralized supply of transfers may be more inefficient than local redistribution in terms of targeting, either due to higher participation costs or because of the eventual greater geographical distance between the national median voter and poor individuals. However, a partial role for the federal government, such as providing funds for redistribution, seems to improve targeting. In addition, in order for the full decentralization of transfer programs to be effective, it is necessary to impose rules to mitigate the migration problem that is emphasized by the traditional fiscal federalism theory, which is not addressed in this paper.

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3 Median Demand for Public Services and Electoral Performance: Evidence from the Median Voter Model for Brazilian Municipalities

Initially developed by Bowen (1943), Black (1948) and Donws (1957), the median voter model, under the hypothesis that voters' preferences are "single-peaked", in a majority system, determines that voters will choose the candidate whose bundle of goods and services is akin to that which is demanded by the median voter. This model is rather reasonable, but few studies have tested its validity empirically. A possible empirical test to check its validity should include the estimation of the median voter's demand and information about the bundles actually offered by candidates.

Regarding the bundles offered by each candidate, note that it would be difficult to measure them, because they are potential other than observed bundles. However, there is a special case in which that is possible: when the candidate has already been elected and runs for reelection. In this case, it should be assumed that the bundle offered by him is given by both the amount and the allocation of expenditures during his term in office.

As to the representative demand, Bergstrom and Goodman (1973) propose some alternatives to estimate it.[73] Under the hypotheses that "the median of the quantities demanded is the quantity demanded by citizen with the median income" and that "the quantity supplied of the municipal commodity is equal to the median of the quantities demanded by its citizens", they manage to identify the local median demand for public goods. The latter hypothesis is quite restrictive, as it posits that incumbents always offer the bundle preferred by the median voter, i.e., they have perfect information. Were that true, with the possibility of reelection, those candidates running for reelection should always win the election, which is not the case. Thus, this hypothesis is disproportionately strong and constrains the application of an empirical test that seeks to assess the possibility of punishment due to deviations of the bundle offered by incumbent running for reelection from the bundle demanded by the median voter.

By relaxing this hypothesis of perfect information of incumbents and by adopting a weaker alternative, of rational expectations, incumbents running for a second term could then undertake non-systematic misperceptions about the true median demand. Therefore, an empirical test for the median voter model would be feasible for the Brazilian case. For this

[73] See also the seminal study by Borcherding and Deacon (1972), wherein they reach similar conclusions using analogous hypothesis.

test, the possibility of reelection is crucial; otherwise, the offered bundle would have to be measured by surveying information about the candidates' intentions.

Inman's (1978) and Gramlich and Rubinfeld's (1982) are some of the studies which empirically test the validity of the median voter model using U.S. survey data. Both studies provide evidence in favor of this model. Whereas the first one concludes that median income families play a key role in determining the level of spending, the second one shows that the majority of voters is satisfied with the combination of spending and taxation levels. Doi (1999), on the other hand, also finds evidence in favor of this model for subnational Japanese governments using aggregate data.

There exist no empirical studies that test the validity of the median voter model for the Brazilian case as proposed herein, but there are studies that assess the determining factors for reelection. The aim of this study adds to this literature as it contemplates the possibility that reelection is determined, to some extent, by the incumbents' ability to meet the median voter's demand. In general, studies indicate other variables as determinants for the electoral performance, such as: (i) incumbents' share of votes in the first election; (ii) incumbents' performance in their first term, e.g., if there were improvement in educational and health indicators, increase in the access to public services, increase in employment and income levels, among others ; (iii) personal characteristics of the politicians such as age and schooling; (iv) involvement of the politicians in scandals and crimes during their first term; (iv) political conditions such as the strength of the political party and the existence of strong competitors; (vi) characteristics of the municipality such as population, urbanization rate, geographic region, among others; (vii) expenditures with the electoral campaign and (vii) public spending patterns – in accordance with the political cycle model. Among the empirical studies assessing reelection determinants for the Brazilian case, we have Mendes (2004), Meneguin, Bugarin and Carvalho (2005) and Mendes and Rocha (2007).

The present study evaluates the validity of the median voter model for Brazilian municipalities by determining the impact of deviations of the bundle actually offered from that demanded by the median voter on electoral success (given by the proportion of votes or by the probability of reelection). To achieve that, based on some hypotheses described further ahead, we show that it is possible to estimate the demand for local public services (also for different spending functions) and to measure deviation or the incumbents' misperceptions about median demand at the local level. Then, it is possible to assess the impact of this

deviation measure on the share of votes received by the incumbent and on the probability of reelection using selection models. This "deviation" measure can also be understood as a performance indicator of the candidate, which justifies the insertion of this work in the aforementioned literature on determinants of electoral success. Finally, negative impacts of this indicator on the proportion of votes or on the probability of reelection can provide evidence in favor of the median voter model.

The paper is organized into five sections, in addition to this introduction. Section 3.1 introduces the test strategy, i.e., it presents: i) the theoretical model of median voter's demand and the econometric model for estimating such demand; ii) the hypotheses that allow estimating the incumbents' misperceptions about the median demand, which cause the offered bundles to differ from those demanded by the median voter of each municipality; and iii) the selection models for estimating the impacts of these deviations between demanded and offered bundles on the electoral performance of incumbents. Section 3.2 describes the data used on the empirical test. Section 3.3 presents the results and, finally, section 3.4 presents the final remarks.

3.1 Theoretical Model and Estimation Strategy

First, it is important to note that the estimations are based on the initial assumption that candidates for a first term seek to meet the preferences of the median voter by providing information about their potential bundles of public goods and services. Conversely, incumbents running for a second term seek to meet the preferences of the median voter by providing bundles they believe coincide with those demanded during their term in office. Thus, we cannot measure the bundle of public goods of candidates running for their first term, but only of those running for reelection. Therefore, using some hypotheses laid out in the subsequent subsections, we can empirically test the median voter model using information on the jurisdictions in which incumbents are running for a second term.

3.1.1 Identification of the Median Voter's Demand

The identification of the median voter's demand is based on hypotheses which, jointly considered, lead to *Bowen's* equilibrium. According to Bergstrom and Goodman (1973), these hypotheses can be summarized as follows: (i) the supply cost of a given commodity provided by a municipality *j* is constant and equal to q_j; (ii) each consumer *i* of municipality *j* pays for a fraction τ_i^j of the overall supply cost – this fraction is determined as a function of income, wealth and other individual characteristics and does not depend on the size of local expenditures and on the preferences for the supply of public services –; (iii) each consumer *i* of a municipality *j* is aware of her tax price, $\tau_i^j q^j$, and can determine the amount to be demanded since he must pay a fraction τ_i of the overall local expenditures – to do that, he must maximize his preferences according to the individual budget constraint – and, (iv) in each municipality *j*, the supplied quantity of a public good in a jurisdiction is equal to the median of the quantities demanded by its citizens. Also, Bergstrom and Goodman (1973) assume that: (v) the median of quantities demanded is equal to the amount demanded by the individual with median income. Under this set of hypotheses, the median voter's demand for local public services can be estimated.

Note first that the median voter model is a collective choice model and that the aim of this paper is to check whether this choice mechanism somehow holds up. This means that we do not stumble upon the ecological inference problem, according to which the use of aggregate data to infer individual behaviors would yield biased estimates.[74] In short, we try to make inferences about the collective behavior using typical characteristics of the median voter, variables for the price levels of private and publicly provided goods, characteristics of the municipality and local aggregate variables which reflect the median voter's preferences for public goods.[75]

[74] See King (1997) for further details on the major ecological inference problem, and Canêdo-Pinheiro (2009) for an abridged discussion.

[75] It should be remarked that since the early 1980s, studies such as those of Bergstrom, Rubinfeld & Shapiro (1982), Gramlich & Rubinfeld (1982) and Rubinfeld, Shapiro & Roberts (1987) have sought to estimate the demand for public goods based on the revealed preferences of respondents. This type of information is the ideal one, but a similar survey has never been conducted for Brazil. Anyway, these authors obtained results that were similar to those based on the median voter model that uses expenditure data on public goods.

This way, consider the median voter of a municipality j who maximize his preference $u_m^j(c_m^j, g^j)$ subject to the following budget constraint[76]:

$$p^j c_m^j + (t^j + \bar{\theta}) b_m^j \leq y_m^j \tag{3.1}$$

where subscript m denotes the median voter, c_m^j is the consumption of private goods; g^j is the constant amount of public services consumed by each inhabitant of municipality j; p^j is the price level of privately provided goods in municipality j; b_m^j is the median voter's tax base; t^j is the average local tax rate; $\bar{\theta}$ is the constant average national tax rate[77] and y_m^j is the individual income. Local tax rate t^j is determined by the budget constraint of the municipality:

$$q^j G^j = Z^j + t^j B^j \tag{3.2}$$

which, after being rearranged, yields:

$$t^j = \frac{q^j G^j - Z^j}{B^j} \tag{3.3}$$

where G^j is the amount of public goods and services; q^j is the constant average cost; Z^j is the amount of transfers received by the municipality and $B^j$is the total tax base of this municipality. The amount of public goods and services can be denoted alternatively by $G^j = n^\gamma g^j$, where n stands for the total population of municipality j, and γ is the degree of congestion of the publicly provided goods. If γ is equal to one, the publicly provided goods (or services) are purely private (exclusive) and if it is equal to zero, they are pure public (non-exclusive and non-rival)[78]. For intermediate values of γ, we have mixed characteristics for

[76] This model is similar to the one used by Mendes and Sousa (2006), differing only in some aspects and in the relaxation of hypothesis iv. This does not imply differences in the estimated parameters, but allows interpreting the error term associated with the estimation of demand in a distinct manner, with important consequences for this study.
[77] For simplicity, it is assumed in this model that there is only one higher level of government, the Central Government.
[78] Also known in the literature as *Samuelsonian* pure public goods. Samuelson (1954) defines public goods as those which can be consumed collectively, and underlines the difficulty in identifying the preferences for this type of goods since consumers are not encouraged to reveal their preferences as they do in the private goods market.

public and private goods. Values greater than one indicate that public goods are overcongested.[79]

The national tax rate $\bar{\theta}$ is determined by the central government's budget constraint:

$$D + \sum_{j=1}^{J} Z^j = \bar{\theta} \sum_{j=1}^{J} B^j \tag{3.4}$$

where D is the central government's overall spending; $\sum_{j=1}^{J} Z^j$ is the total amount of transfers to municipalities and $\sum_{j=1}^{J} B^j$ is the country's total tax base.[80] Inserting (3.3) in budget constraint (3.1) and, for simplicity, keeping rate $\bar{\theta}$ in its reduced form (since it is the same for all municipalities), algebraic manipulations yield a modified constraint:

$$y_M^j + z^j \left(\frac{b_m^j}{\overline{b^j}}\right) - \bar{\theta} b_m^j = p^j c_m^j + q^j n^{\gamma-1} \left(\frac{b_m^j}{\overline{b^j}}\right) g^j \tag{3.5}$$

where the term on the left-hand side of (5) represents the net income,[81] and can be denoted by y_m^{jL}. The only new terms are $\overline{b^j}$ and z^j, which represent, respectively, the average tax base and per capita fiscal transfers in municipality j. Additionally, normalizing (3.5) by the price level of private sector p^j, we obtain the following reduced-form expression:

$$\frac{y_m^{jL}}{p^j} = c_m^j + \frac{q^j}{p^j} n^{\gamma-1} \left(\frac{b_m^j}{\overline{b^j}}\right) g^j \tag{3.6}$$

The demand function for publicly provided goods is based on Borcherding and Deacon (1972) and Bergstrom and Goodman (1973), and is given by :

$$g^j = A\left(\tau_m q^j n^{\gamma}\right)^{\eta} \left(y_m^j\right)^{\epsilon} \tag{3.7}$$

[79] The degree of congestion indicates, to some extent, the divisibility of a good. A pure public good is not congested and all can consume the overall supplied amount. Public goods with degrees of congestion between zero and one indicate that each individual can consume an amount smaller than that offered. Public goods with a degree of congestion equal to one have the characteristics of private goods: they are exclusive. Finally, overcongested public goods, with a degree of congestion greater than one, may arise due to diseconomies of scale.

[80] In other words, equation (3.4) represents the equality between expenditures and revenues.

[81] The net income, in this case, is given by the total individual income plus the amount of transfers received by individual *i*, minus the tax paid to the Central Government.

which is log-linear in income and in tax price, given by $\tau_m^j q^j n^\gamma = n^{\gamma-1}\left(\frac{b_m^j}{\overline{b^j}}\right) q^j$. Note that this functional form cannot be rationalized by a direct utility function, but it can be rationalized by an indirect utility function that can be obtained from the duality theorem. This functional form is attractive because it is econometrically tractable, making it very popular in the specific literature.[82]

Here we relax hypothesis "iv", which means assuming that incumbents do not have perfect information. Instead, it is assumed that the median demand is not directly observable by the agents, but that they have rational expectations about the median demand. Hence, in a sufficiently long time horizon, officeholders will not make systematic errors by trying to provide the median amount of demanded public services, i.e.:

$$E\left[g_t^j - E\left[g_t^j \middle| \Omega_t^j\right]\right] = 0 \tag{3.8}$$

where g_t^j is the median demand for public services, and $E\left[g_t^j \middle| \Omega_t^j\right]$ is the incumbents' expectation in municipality *j* about the median demand based on their information set at *t*, Ω_t^j, and therefore, it consists of the amount of public services effectively supplied. Note that, since the median demand is not directly observable by the officeholders, g_t^j and $E\left[g_t^j \middle| \Omega_t^j\right]$ can differ in a given period.

Therefore, the median voter's demand and the effective supply (given by the incumbent's expectation about the median demand), in each period, can differ as to a multiplicative term, v^j, associated with the incumbent's incapacity of providing the amount that precisely equals the demand. Denoting supply $E\left[g_t^j \middle| \Omega_t^j\right]$ by g^{j*}, we then have for a given period:

$$g^{j*} = g^j v^j \tag{3.9}$$

[82] See Borcherding and Deacon (1972), Bergstrom and Goodman (1973), Doi (1999), Sanz and Velázquez (2002), and Mendes and Sousa (2006).

Thus, the determinants of this error v^j should be related mainly to incumbents' information problems.[83,84] Note also that the association between the amount of public goods actually provided *per capita* g^{j^*} and the mean expenditure *per capita* e^j is given by:[85]

$$g^{j^*}q^j = \frac{G^{j^*}q^j}{n^\gamma} = \frac{E^j}{n^\gamma} = \frac{e^j}{n^{\gamma-1}} \tag{3.10}$$

Thus, replacing the tax price and the net income normalized by price level p^j in (3.7), and also the *per capita* amount of public goods actually provided g^{j^*} in terms of average spending per individual, e^j, we get:

$$e^j = A\left(\frac{q^j}{p^j}\, n^{\gamma-1}\frac{b_m^j}{\overline{b^j}}\right)^\eta \left(\frac{y_m^{jL}}{p^j}\right)^\epsilon n^{\gamma-1}q^j v^j \tag{3.11}$$

Finally, a vector $\Psi^j = \prod_{k=1}^{K}\left(x_k^j\right)^{\beta_k}$ of explanatory variables and an error term ε^j for unobservable factors that influence the median voter's demand can be multiplicatively incorporated into the right-hand side of (3.11).[86] Taking the logarithm on both sides of this expression, we obtain:

$$\ln e^{j*} = \ln A + (\gamma-1)(\eta+1)\ln n^j + \eta\ln\frac{b_m^j}{\overline{b^j}} + \epsilon\ln y_m^{jL} + (1+\eta)\ln q^j \tag{3.12}$$
$$-(\eta+\epsilon)\ln p^j + \beta_k\sum_{k=6}^{K}x_k^j + \ln v^j\varepsilon^j$$

The population coefficient, $\alpha = (\gamma-1)(\eta+1)$, along with the price elasticity of public good η, yields the congestion parameter, given by $\gamma = \frac{\alpha+\eta+1}{\eta+1}$.

The error term $\ln v^j\varepsilon^j$ is crucial for the test strategy proposed herein, since its estimates (residuals) contain information on the local incumbents' incapacity to meet the median voter's demand. Further ahead, we show how this information helps with the empirical test.

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[83] If $v^j = 1 \Rightarrow g^{j^*} = g^j$. If $0 \le v^j < 1 \Rightarrow g^{j^*} < g^j$. If $v^j > 1 \Rightarrow g^{j^*} > g^j$.
[84] We assume that $\mathrm{Cov}(g^j, v^j) = 0$.
[85] The variables in capital letters are not expressed in *per capita* terms.
[86] This is the same as assuming a Hicks-neutral technical change. See Edwards (1990) and Mendes (2005, p.83).

Now, some difficulties in estimating equation (3.12) should be remarked. First, there are not enough data for variables q^j and p^j (price levels of public and private goods and services, respectively) at the local level. Bergstrom, Rubinfeld and Shapiro (1982) deal with this problem by using mean wages in the public and private sectors as proxies.[87] Hence, we proceed the same way.

Another difficulty concerns the tax base measure. Studies on the local demand for public goods in the USA often use the median voter's property value as tax base measure. This is quite reasonable given that, in that country, most local revenue comes from property taxes. In Brazil, local taxes are not as important for the budget of most municipalities. Therefore, following Mendes and Sousa (2006), we use the median and mean incomes of municipality j as median tax base measure b_m^j and mean tax base measure $\overline{b^j}$, necessary to obtain $\frac{b_m^j}{\overline{b^j}}$ (the proxy for tax price) and, therefore, to estimate (3.12).

Finally, supposing that the full rank assumption hold and that the composite error term $\ln v^j \varepsilon^j$ is orthogonal to the regressors of (3.12), we can consistently estimate the median voter's demand by ordinary least squares as well as the residuals, which are of special interest as they contain information (given by v^j) on the local incumbents' incapacity to meet the median voter's demand. [88]

3.1.2 Reelection Candidates' Misperceptions about the Median Demand

According to the median voter model, the incumbents more likely to be reelected are those whose the offered bundle of goods and services is akin to the median voter's preferences. In a context in which reelection is certain, it is then assumed that the bundle of goods supplied by the incumbent is considered by voters to be identical with the one that had been previously supplied by him . So, it is reasonable to suppose also that the degree of misperception of reelection candidates about the median demand during their first term has a negative impact on the proportion of votes canvassed and on the probability of their reelection.

[87] The aim of the authors was to estimate the demand for education expenditures. To do that, they used proxies for the public and private educational price levels, which were explanatory variables in the model. The solution found by the authors consisted in using the average wage of public and private school teachers from the district.

[88] Supposing that there is neither spatial autocorrelation, as advocated by Mendes and Sousa (2006), nor Tiebout bias, as suggested by Gramlich and Rubinfeld (1982) and Rubinfeld, Shapiro and Roberts (1987).

In fact, the magnitudes of misperceptions v^j are unknown. However, it is possible to estimate the residual of (3.12):

$$\widehat{U}^j = \widehat{\ln v^j \varepsilon^j} = \widehat{\ln v^j} + \widehat{\ln \varepsilon^j} = \widehat{\ln v^j} + \varepsilon_0^j \tag{3.13}$$

where the emphasis denotes the estimated value. Nonetheless, the interest lies in the magnitude of $\widehat{\ln v^j}$, which cannot be estimated separately. A strong hypothesis is that there are no unobservable factors ε_0^j that exercise influence on the demand for public services and, therefore, $\widehat{U}^j = \widehat{\ln v^j}$.

Another possibility, which seems more reasonable, is to assume that $\widehat{U}^j = \widehat{\ln v^j} + \varepsilon_0^j$ can be regarded as a variable measured with error. Accordingly, v^j and ε^j must be uncorrelated. Thus, to obtain a measure of the degree of incumbent's misperception, we can estimate its module.[89] For simplicity, this estimated variable is designated as "$mod\widehat{U}$" such that

$$mod\widehat{U} = \left|\widehat{U}^j\right| \tag{3.14}$$

Supposing that the variable $mod\widehat{U}$ has a measurement error, in a linear regression model in which this variable enters the right hand side, its coefficient will be inconsistent. Yet, the bias will be towards zero, i.e., it will be "attenuated." Non-significant results can actually be underestimated. But if only the sign of the coefficient matters, estimates that yield significant coefficients, even if attenuated, are enough to make statistical inferences.

Such properties of variables with measurement errors apply to linear models. Nevertheless, Edgerton and Jochumzen (2003) use simulations to show that in nonlinear models (e.g., *Probit*), the coefficient of an explanatory variable measured with error is also attenuated. As will be shown in the subsequent section, we use nonlinear estimation methods, in which the variable $mod\widehat{U}$ enters the right hand side of the econometric model, and therefore, there may be attenuation.

This way, whether $\widehat{U}^j = \widehat{\ln v^j}$ or $\widehat{U}^j = \widehat{\ln v^j} + \varepsilon_0$, we expect to find the true sign of the coefficients of the variable $mod\widehat{U}$ for regressions having the proportion of votes and the

[89] This variable can be squared without remarkable changes in the results.

probability of reelection as dependent variables, i.e., we expect to estimate the effect of the degree of misperception about the median demand on the election outcome. To do that, we use Heckman selection models, given that candidates self-select in order to run for the elections.[90]

3.1.3 Selection Models: Estimation of Electoral Performance

Doi (1999) runs a similar test to the one used herein for subnational Japanese governments, using the residual module to estimate the effect on the probability of reelection based on the *Probit* method. However, the author does not contemplate the selection bias problem that underlies the reelection process. In this regard, it is reasonable to suppose that the officeholder only runs for reelection if he believes he has a good chance of being reelected, which denotes a self-selection bias.[91] Hence, the analysis of reelection determinants, without taking into account the self-selection problem, would lead to biased results.

Mendes and Rocha (2004), in spite of not addressing the median voter's demand, warn against the selection bias problem when estimating the determinants of the proportion of votes and of the probability of reelection of incumbents using data for the year 2000. The authors use the Heckman selection model when the dependent variable is continuous and the *Probit* model with selection when the dependent variable is binary. Thus, they manage to consistently estimate the determinants of the proportion of votes and of the probability of reelection.

In this case, ecological inference problem should not be observed as it should be the case of models that try to assess the wiliness of each citizen to vote in a given candidate given their characteristics[92]. Here we seek to assess the determinants of electoral success of all those who decided to run for reelection rather than of one candidate only. This is a general model for the determination of the success of candidates running for a second term. There is no reason to model individual behavior in this case, i.e., we cannot infer that people with specific characteristics are all in favor of mayors' reelection. As outlined ahead, all of the explanatory

[90] See Mendes and Rocha (2007).
[91] For further reference on this topic, see Heckman (1979).
[92] See Canêdo-Pinheiro (2009). The authors estimate a model that evaluates citizens' willingness to vote in ex-President Lula in the 2006 election based on voters' aggregate characteristics.

variables of models (3.15-3.16) and (3.18-3.19) refer to the political framework during the first term of the incumbent running for reelection or to the incumbents' own characteristics. There are neither aggregate individual variables nor a theoretical basis to include them.

We thus propose the following specification for the equation referring to the continuous dependent variable *proportion of votes* of the incumbent running for reelection in municipality *j*:

$$\ln(proportion\ of\ votes^j) = X_1^j\,\beta\ + \varphi mod\widehat{U}^j + u^j \tag{3.15}$$

$$candidate^j = 1\left[X_2^j\alpha + \varepsilon^j > 0\right] \tag{3.16}$$

Expression (3.15) is the equation of interest that gives the parameter φ of variable $mod\widehat{U}$, and X_1^j is a line vector of explanatory variables regarding characteristics of municipality *j* and of the candidate from this municipality. Expression (3.16) consists of the selection equation, such that the dependent variable, $candidate^j$, is always observable and takes on values equal to 0 if the incumbent is not running for reelection, and equal to 1, otherwise. The line vector of explanatory variables X_2^j determines the candidature, and should include at least one variable excluded from (3.15). The dependent variable in (3.15), $proportion\ of\ votes,^j$ is only observable if $candidate^j = 1$. The estimation method for identification of (3.15) is that of Heckman (aka *Heckit*), where:

$$E\left(proportion\ of\ votes^j \middle| X^j, candidate^j = 1\right) = X_1^j\,\beta\ + \varphi mod\widehat{U}^j + \gamma_1\lambda\left(X_2^j\alpha\right) \tag{3.17}$$

where $\lambda(\cdot)$ is the inverse Mills ratio. Under usual regularity conditions, the Heckman method allows estimating the model's parameters consistently.

In fact, the literature describes some distributions that are more suitable to the econometric modeling of dependent variables in proportions than conventional models, such as those estimated by OLS (or Heckit). Actually, the maximum likelihood estimator based on the beta distribution, henceforth BMLE, is commonly regarded as the best solution to model rates and ratios compared to estimators based on other possible distributions.[93,94]

[93] See Ferrari and Cribari-Neto (2004), Paolino (2001), Abensur, Cribari-Neto and Menezes (2007), and Kieschnick and McCullogh (2003).

However, Paolino (2001), after analyzing data from several studies, states that "this is not to say that (...) all analysis of political science proportions data must be done using BMLE (p. 345)." The author replicated the estimations of Atkeson (1998, *apud* PAOLINO, 2001) and Lowery and Gray (1998, *apud* PAOLINO, 2001) and concluded that the use of this estimator did not make any difference compared to the results obtained from normal methods. Also according to that author, in both cases, the data "(...) had no values close at either boundary and were fairly symmetrically distributed. In these circumstances, the analysis (...) does not suggest that BMLE will necessarily provide much insight beyond what we get from normal methods (p. 345)."

Bearing that in mind, we built a histogram with the data on the proportion of votes received by incumbents running for reelection in 2000 in order to assess the symmetry of the empirical distribution. To achieve that, we included an overlapping normal distribution function in the histogram, which was used as benchmark.

As depicted in panel A of figure 1, the empirical distribution of the proportion of votes canvassed for mayoral reelection candidates is rather symmetrical and, although it is not the same as a normal distribution,[95] it is quite close to it, with values a little bit more centered around the mean. The asymmetry and kurtosis of the empirical distribution of the proportion of votes yielded values equal to -0.18 and 3.71, respectively. These values are very close to those of the normal distribution (equal to 0 and 3, respectively), especially considering that the data are extracted from nature. Moreover, there is no concentration of observations at the boundaries of the unit interval. The graph in panel B shows that the closest to the 45º straight line the full line is, the closest to normal distribution the empirical distribution will be.[96] Note that there is substantive overlapping, confirming that the data on the proportion of votes yield a symmetrical non-flat distribution.

Finally, given the self-selection problem in the present paper, the use of an estimator based on the beta distribution (or on any other distribution) would be algebraically and computationally challenging as far as the development of a hybrid estimator is concerned, aside from the fact that this is not within the scope of this paper and would not substantially

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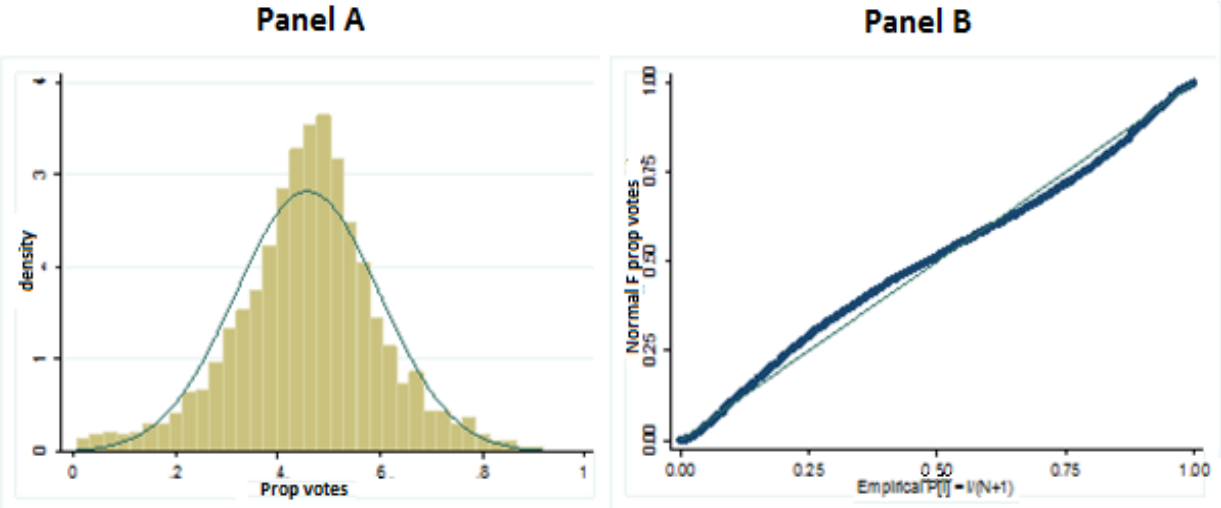
[94] Tobit estimator censored at 0 and 1 is also commonly used for this problems. See Long (1997) and Wooldridge (2002) in this regard.

[95] In fact, the test proposed by Shapiro & Francia (1972) rejects that the empirical distribution is identical to the normal case, but the statistics value is very low (4.228).

[96] This graph, referred to as *Probability-Probability Plot* (or PP-Plot), in which axis x represents the cumulative function of the empirical distribution, and axis y represents the cumulative function of the normal distribution.

improve the reliability of the results. So, the Heckman selection model appears to be more advantageous when the data structure used in this paper is taken into account.



Source: Built by the authors using TSE data for the year 2000.

Figure 3. 1– Empirical distribution of the proportion of votes for reelection candidates in 2000

To estimate the impact of $mod\widehat{U}$ on the probability of reelection, it is recommended that the *Probit* model with selection be used. The specifications of the main equations and of selection equations in this case are:

$$reelected^j = 1\left[X_1^j\,\beta + \varphi mod\widehat{U}^j + u^j > 0\right] \quad (3.18)$$

$$candidate^j = 1\left[X_2^j\alpha + v^j > 0\right] \quad (3.19)$$

where the variable $reelected^j$ takes on a value equal to 0 if the mayor is not reelected and 1 otherwise. Thus, this variable is only observable if $candidate^j = 1$. The coefficients, although they are denoted by the same symbol (for simplicity), will be different, since equation (3.18) contains the binary dependent variable $reelected^j$ compared to the continuous variable $proportion\ of\ votes^j$ in (3.15).

Even though equations (3.15) and (3.18) are different, their purpose is just the same: to test the median voter model. A negative and significant sign of the coefficient of variable $mod\widehat{U}$ implies that the empirical results support this model. Again, it is important to underscore that the coefficient φ should be interpreted as the impact of the degree of

misperception about the median demand on electoral performance (larger proportion of votes or higher reelection probability).

Finally, given the possible attenuation of the coefficients in the *Heckit* model and *Probit* model with selection due to measurement errors, it would be necessary to use some instrumental variable (which does not seem, at first, to be easily available) to find the actual value of the coefficient of $mod\widehat{U}$. This instrument should be correlated with the term $\widehat{\ln v^j}$ of $mod\widehat{U}$ and uncorrelated with the random error term of equations 3.15 and 3.18. Given that this component ($\widehat{\ln v^j}$) should be associated with the information about the median demand available for each candidate, this instrument cannot be easily obtained, and should therefore be dealt with in a future study. So, this paper investigates the sign and significance of coefficients $\varphi's$ of variable $mod\widehat{U}$, as this should suffice for the validity of the proposed tests.

3.2 Data

The variables used for the estimates of the median demand and of the selection models refer to the year 2000. In that year, two factors contributed to building a database that was more suitable for the proposed test. First, the year 2000 corresponds to the latest census carried out by the Brazilian Institute of Geography and Statistics (IBGE), which allowed obtaining data for the estimation of the median demand. Furthermore, coincidentally and fortunately, local elections were held in that same year, allowing, for the first time, candidates in executive positions to run for reelection. Therefore, as pointed out by Mendes and Rocha (2007), all of the mayors elected in 1996, without any legal impediment, were eligible for candidature in 2000, and these were already aware of this fact at the very onset of their first term, and could thus adjust their governing strategies to that goal. The electoral information used in the estimations of selection models were obtained from the Brazilian Supreme Electoral Court (TSE), except for two variables: *New_municipality* and *Split_municipality*, obtained from IBGE.

Local public expenditure data were obtained from Finbra, a database containing annual fiscal information on Brazilian municipalities, available from the Brazilian National Treasury Office. In addition to current expenditure, other types of expenditure were used as dependent variables, grouped according to common characteristics of the delivered goods. This allowed checking whether the demand model is reasonably stable according to the set of goods

considered and estimating the congestion parameter for each set of goods, which is particularly interesting. It is also interesting to check whether the misperceptions about the median demand are more or less punished at the polls according to the types of goods considered.

Table 3.1 – Description of variables used to estimate the median demand

Dependent variables	**Description**
Current Expenditure	Overall expenditure minus capital expenditure.
Merit Goods Expenditure	Sum of expenditures with education, culture, housing, urbanization, health and sanitation.
Pure Public Goods Expenditure	Sum of expenditures with the legislative and judicial branches, planning, and public safety.
Economic Goods Expenditure	Sum of expenditures with agriculture, industry, trade, transport, regional development, energy, mineral resources, communications, among others.
Welfare Expenditure	Expenditures with social assistance and social security.
Independent variables	**Description**
med_income	Median household income per capita. Is used as a proxy for the original median income net of transfers received and taxes paid to Central Government. Due to the difficulty in accurately estimating the national tax rate, it is assumed that there is no redistribution via transfers, i.e., the amount received from transfers and the national tax collected are the same.
tax_price	According to Mendes and Sousa (2006), it is defined as the median to mean income ratio. Actually, the expression for tax price in section 3.1.1 also include the price level of public goods and the population of the municipality, but after calculating the logarithm of this composite term, it is possible to estimate the coefficients of each variable and to identify the price elasticity of demand for public goods η separately.
population	Population of the municipality.
private_wage	Mean wage of the private sector, used as proxy for the price level in the private sector. Based on Bergstrom, Rubinfeld and Shapiro (1982).
public_wage	Mean wage of the public sector, used as proxy for the price level in the public sector. Based on Bergstrom, Rubinfeld and Shapiro (1982).
density	Population density of each municipality.
urbanization	Proportion of individuals living the urban area.
state capital	Dummy that assumes value 1 if the municipality is the state capital and zero otherwise.
HH_employ_prop	Proportion of employed people aged 18 years or older living in the household.
municipality_res	Proportion of people living in the municipality for over 5 years.
Non-white	Proportion of non-white individuals living in the municipality.
age_17	Porportion of people aged less than 18 years.
age_65	Proportion of people aged over 65 years.
schooling_yrs_25	Average years of schooling among people aged over 25 years.
Population variation	Percentage variation of the population of each municipality between 1991 and 2000.
State dummies	Dummies for each state, excluding the state of São Paulo (taken as baseline).

Source: Finbra/STN (expenditure variables), IPEADATA (population density) and 2000 Census /IBGE (remaining variables).

The types of goods were classified according to Oxley and Martin (1991), by categorizing the expenditures into *merit* and *pure goods*, *economic services* and *welfare*.[97] The classification proposed by these authors was adapted based on the available information for Brazilian municipalities, but some differences are inevitable given the way the data from Finbra are aggregated.

[97] See description in Table 3.1.

Table 3.1 describes the dependent and independent variables used for the estimation of the median demand. Table 3.2 describes the dependent and independent variables used for the estimation of the selection models in order to assess the determinants of electoral performance.

Table 3.2 - Description of variables used to estimate the selection models

Dependent Variables	**Description**
Prop00	Ratio between the number of votes received by the candidate and the total number of votes in the municipality in 2000;
Reel00	Binary variable with value 1 if the incumbent is reelected in 2000 and zero otherwise;
Cand00	Binary variable with value 1 if the incumbent elected in 1996 ran for reelection in 2000 and zero otherwise.
Independent Variables	**Description**
Prop96	Ratio between the number of votes received by the candidate and the total number of votes in the municipality in 1996;
President_party	dummy with value 1 if the incumbent running for reelection in 2000 is of the same party as that of the President and zero otherwise;
President_diff_party	dummy with value 1 if the incumbent runs for reelection (in 2000) against an adversary of the same party from that of the President and zero otherwise;
Governor_party	dummy with value 1 if the incumbent running for reelection in 2000 is of the party of the Governor of his respective state and zero otherwise;
Governor_diff_party	dummy with value 1 if the incumbent pertain to a party opponent to the governor's and is running for reelection (in 2000) against an adversary of the same party from that of the governor and zero otherwise. Opponent parties are defined as those that placed in second in the previous election for governor, in 1998;
New_municipality	dummy with value 1 if the incumbent ran for elections in a municipality created between 1993 and 1996 – when the elections for the first term were held– and zero otherwise;
Split_municipality	dummy with value 1 if the incumbent ran for elections in a municipality which lost part of its territory during his first term from 1997 to 2000 – and zero otherwise;
Reelected_micro-region	Proportion of municipalities in which the mayor was reelected in 2000 belonging to the same micro-region as that of the reference municipality;
Candidate_reel_micror	Proportion of municipalities in which the incumbent is running for reelection in 2000 belonging to the same micro-region as that of the reference municipality– this variable is used only to explain the candidature ;
Age_candidate00	Candidate's age in 2000;
Mean_age00	Mean age of mayoral candidates in the respective municipality in 2000;
Competition	Number of candidates per seat;
Fragmentation	Given by expression $1 - \sum_{i=1}^{I} v_i^2$, where v_i is the participation of the i-th party in the total number of seats available at the City Council.
$mod\hat{U}$_"*type of expenditure*"	It denotes the residual module for equation (3.12) estimation. A different variable $mod\hat{U}$ was obtained for each dependent variable (*total expenditure*, *current expenditure*, *merit goods*, *pure goods*, *economic services and welfare*), and each of them is used to estimate equations (3.15) and (3.18).

Source: IBGE (New_municipality and Split_municipality) and Supreme Electoral Court (other variables).

In the estimations of the demand and of the selection models, all the continuous variables were used in their logarithmic form. Tables 3.3 and 3.4 show the descriptive statistics of the dependent and independent variables used to estimate the demands and the selection models, all in absolute values (instead of logarithms). In Table 3.4, note that there are electoral data for 5,401 municipalities. In these municipalities, 3,521 incumbents (65%) ran for reelection in 2000, of which 2,044 (58%) were reelected.

Table 3.3 – Descriptive statistics of the variables used in the estimation of the median demand

variables / statistics	obs	mean	sd	min.	max.
med_income	5510	113.482	59.525	0.000	580.000
tax_price	5510	0.686	0.100	0.000	1.351
population	5510	30837	186713	795	10406116
private_wage	5510	364.560	172.690	70.303	1835.549
public_wage	5495	391.764	216.335	65.843	5699.764
density	5510	97.975	533.490	0.132	12915.980
urbanization	5509	0.588	0.233	0.016	1.000
HH_employ_prop	5177	0.510	0.103	0.120	0.854
municipality_res	5177	0.891	0.066	0.321	1.000
Non-white	5177	0.457	0.255	0.000	0.993
age_17	5177	0.379	0.059	0.216	0.613
age_65	5177	0.065	0.020	0.007	0.165
schooling_yrs_25	5510	4.040	1.301	0.604	9.686
Population variation	5177	0.111	-0.240	0.516	3.440
Current Expenditure	5174	470.44	992.97	0.280	55317.31
Merit Goods Expenditure	5174	319.48	548.33	0.130	33550.82
Pure Public Goods Expenditure	5174	128.67	423.61	0.000	22255.74
Economic Goods Expenditure	5174	61.78	81.21	0.000	2931.04
Welfare Expenditure	5174	36.11	117.88	0.000	6753.24

Source: Finbra/STN (expenditure variables), IPEADATA (population density) and 2000 Census /IBGE (remaining variables).

Table 3.4 – Descriptive statistics of the variables used in the estimation of the selection models

variables / statistics	obs	mean	sd	min.	max.
Prop00	3555	0.458	0.141	0.006	0.919
Reel00	3521	0.581	0.494	0.000	1.000
Cand00	5401	0.660	0.474	0.000	1.000
Prop96	5401	0.513	0.102	0.053	0.920
President_party	5401	0.196	0.397	0.000	1.000
President_diff_party	5401	0.207	0.405	0.000	1.000
Governor_party	5349	0.279	0.449	0.000	1.000
Governor_diff_party	5349	0.180	0.385	0.000	1.000
New_municipality	5401	0.093	0.290	0.000	1.000
Split_municipality	5401	0.009	0.095	0.000	1.000
Reelected_micro-region	5328	0.384	0.175	0.000	1.000
Candidate_reel_micror	5401	0.660	0.185	0.000	1.000
Age_candidate00	5382	47.759	6.381	27.000	76.000
Mean_age00	3605	49.333	9.273	24.000	83.000
Competition	5094	4.804	3.060	1.000	26.048
Fragmentation	5242	0.696	0.125	0.000	1.000
$mod\hat{U}\_Current\_expenditure$	5158	0.213	0.337	0.000	7.097
$mod\hat{U}\_Merit\_goods\_expenditure$	5158	0.243	0.350	0.000	7.199
$mod\hat{U}\_Pure\_goods\_expenditure$	5157	0.323	0.392	0.000	7.294
$mod\hat{U}\_Economic\_goods$	5097	0.637	0.663	0.000	8.086
$mod\hat{U}\_welfare$	5084	0.583	0.576	0.000	9.219

Source: IBGE (New_municipality and Split_municipality) and Supreme Electoral Court (other variables).

Since the main purpose of this paper is to assess the impact of deviations from the median voter's demand on the electoral performance of incumbents running for a second term, it is implicitly assumed that only one dimension of incumbents' performance is relevant.

Nonetheless, the specialized literature describes several other variables as determinants of an election outcome or of the decision to be a candidate. However, in the present study, some unavailable variables had to be left out, such as the ages of the mayors who did not run for reelection, campaign expenditures, and existence of criminal lawsuits against mayors. This way, for the validity of the estimates made herein, we assume that these omitted variables are not correlated with the regressors.

3.3 Empirical Test Results for the Median Voter Model

Table 3.5 presents the OLS estimates with robust standard errors of median demands for public goods using the following dependent variables: *Current Expenditure*, *Merit Goods Expenditure*, *Pure Public Goods Expenditure*, *Economic Goods Expenditure* and *Welfare Expenditure*. In general, the coefficients had the expected signs, especially for the main variables. The continuous variables are expressed in logarithmic form, allowing us to interpret the coefficients as elasticities.

The income elasticities (referring to *med_income*) are positive, indicating that the characteristics of publicly provided goods are the same as those of normal goods. The price elasticities, given by the coefficients of *tax_price* based on Mendes and Sousa (2006), are negative, as expected, given that an increase in the price of public goods must slow down the demand. Population elasticities are negative, revealing that the larger the population, the lower the expenditure per inhabitant. The proxy variables of the public and private price levels, *public_wage* and *private_wage*, also show consistent signs with the theoretical model in (3.11). An increase in public prices increases expenditure, whereas an increase in private sector prices reduces expenditure.

In general, the coefficients obtained for the control variables also have the expected signs. The population density elasticities relative to expenditure *per capita* are negative, possibly due to economies of scale in the supply of public goods. The coefficients of the variable *state capital* yield positive signs, around 1 for all estimations, indicating that expenditures *per capita* in capital cities are twice as high as those observed in other municipalities. The coefficients of the variable *HH_employ_prop*, which denotes the proportion of employed individuals aged over 18 years in the household, show negative signs,

indicating that a higher employment rate in the households is associated with lower expenditures *per capita*. The negative coefficients of the variable *municipality_res* suggest that the higher the rate of people living in the municipality for over 5 years, the lower the expenditure *per capita*. The schooling of people aged over 25 years (represented by *Schooling_yrs_25*) has a positive effect on the demand for public goods, as expected.

Table 3.5 – OLS estimates of the median voter demand

Indep. Var\Dep. Var.	Current Expenditure	Merit Goods Expenditure	Pure Public Goods Expenditure	Economic Goods Expenditure	Welfare Expenditure
med_income	0.609[a]	0.599[a]	0.696[a]	0.683[a]	0.486[a]
	(0.071)	(0.077)	(0.092)	(0.163)	(0.151)
tax_price	-0.342[a]	-0.320[a]	-0.383[a]	-0.745[a]	-0.444[a]
	(0.080)	(0.086)	(0.100)	(0.181)	(0.167)
population	-0.280[a]	-0.259[a]	-0.344[a]	-0.315[a]	-0.242[a]
	(0.012)	(0.012)	(0.014)	(0.022)	(0.019)
private_wage	-0.148[a]	-0.134[a]	-0.204[a]	-0.208[b]	-0.186[c]
	(0.048)	(0.051)	(0.062)	(0.103)	(0.106)
public_wage	0.080[a]	0.070[a]	0.104[a]	0.082[b]	0.053
	(0.022)	(0.023)	(0.026)	(0.042)	(0.037)
capital	0.922[a]	0.887[a]	0.846[a]	1.591[a]	1.164[a]
	(0.078)	(0.102)	(0.099)	(0.185)	(0.179)
density	-0.031[a]	-0.024[a]	-0.022[b]	-0.091[a]	-0.045[a]
	(0.007)	(0.008)	(0.009)	(0.018)	(0.015)
urbanization	-0.005	0.006	0.044[b]	-0.360[a]	0.185[a]
	(0.015)	(0.016)	(0.021)	(0.041)	(0.036)
age_65	-0.300[a]	-0.351[a]	-0.361[a]	-0.128	-0.190[a]
	(0.032)	(0.032)	(0.041)	(0.079)	(0.067)
age_17	-0.084	-0.079	-0.108	-0.503[b]	-0.500[b]
	(0.108)	(0.113)	(0.139)	(0.253)	(0.222)
Non-white	0.046[a]	0.043[a]	0.070[a]	-0.050[b]	0.114[a]
	(0.013)	(0.014)	(0.017)	(0.024)	(0.029)
municipality_res	-0.045	0.022	-0.246[c]	-0.618[a]	0.527[b]
	(0.115)	(0.125)	(0.145)	(0.230)	(0.229)
HH_employ_prop	-0.314[a]	-0.276[a]	-0.466[a]	-0.177	-0.268[b]
	(0.053)	(0.057)	(0.067)	(0.114)	(0.114)
schooling_yrs_25	0.095[b]	-0.005	0.251[a]	-0.057	0.188[c]
	(0.045)	(0.049)	(0.057)	(0.105)	(0.098)
Population variation	-0.076[a]	-0.005	-0.123[a]	-0.102	-0.216[a]
	(0.027)	(0.029)	(0.038)	(0.075)	(0.064)
Constant	5.183[a]	4.707[a]	3.474[a]	2.992[a]	3.244[a]
	(0.228)	(0.237)	(0.284)	(0.487)	(0.443)
State Dummy	yes	yes	yes	yes	yes
R-squared	0.462	0.361	0.429	0.444	0.313
N	5.158	5.158	5.157	5.097	5.084
Congestion Parameter	0.574[a]	0.619[a]	0.443[a]	-0.236	0.565[a]
	(0.055)	(0.052)	(0.095)	(0.897)	(0.140)

a – Statistically significant at 1%; b – Statistically significant at 5%; c – Statistically significant at 10%. Note: i) Robust standard-errors in parenthesis; ii) Continuous variables in logarithm.

The coefficients of the variable *non-white*, indicate, in general, that a higher proportion of non-white individuals is associated with a higher expenditure *per capita*. Conversely, a higher proportion of young people and elderly (variables *age_17* and *age_65*, respectively), implies lower expenditures *per capita*. This may result from the fact that the incidence of economically active people in these age groups is smaller, resulting in lower collection of local taxes, and thus, lower expenditures.

Most of the coefficients reinforce the results obtained in the literature on the estimation of public service demand. Only the proportion of elderly and the employment rate have different signs from those obtained by Bergstrom and Goodman (1973). The magnitudes of the coefficients also are quite similar to the ones obtained by those authors and by Mendes and Sousa (2006).

In fact, the median demands calculated by Mendes and Sousa (2006) are based on the same dataset used herein, but show some differences regarding the control variables, which yields different estimates. This influences the estimation of congestion parameters. In this paper, the estimates of these parameters for the current expenditure are 0.574,[98] whereas the estimates of the authors are closer to 0.7. The degrees of congestion found here are therefore reasonably low, implying a higher degree of publicness of goods compared to the results obtained by Bergstrom and Goodman (1973) and by Mendes and Sousa (2006).

The aforementioned classification for expenditures proposed by Oxley and Martin (1991) according to the characteristics of the goods did not reveal any remarkable differences. But, as expected, the merit goods present a higher degree of congestion (0.619), whereas the pure public goods and economic goods parameters are lower, i.e., less congested. While the estimate for the congestion of pure goods is 0.443, the estimate for economic goods is -0.236, the latter of which is statistically not different from zero. Economic goods were expected to be more congested. However, note in Table 3.1 that the classification into economic goods refers to expenditures associated with the productive infrastructure of the municipality, which have characteristics of pure public goods, since all economic agents benefit from this type of expenditure. Welfare expenditures also seem to be fairly congested, equal to 0.565.

Finally, supposing that the demands were estimated consistently, we can obtain the residuals which, in module, provide a measure of the magnitude of local incumbents' incapacity (or misperception) to meet the median demand. Therefore, each demand estimated

[98] The standard error of this parameter is calculated by the Delta Method, allowing the estimation of its p-value.

in Table 3.4 yields a different $mod\widehat{U}$ variable – *current expenditure*, expenditures with *merit goods*, *pure public goods*, *economic goods* and *welfare.*[99] This allows checking whether the incapacity to meet the median demand is more or less punished at the polls depending on the type of public good.

Table 3.6 shows the estimates for the Heckman selection model, whose dependent variable is Prop00, which refers to the *proportion of votes* obtained by the reelection candidate. Table 3.7 presents the results obtained by the *Probit* model with selection, whose dependent variable, Reel00, indicates the reelection status in 2000. In all cases, the independence tests between the main and selection equations are rejected, showing that selection models are more appropriate than those which disregard the self-selection problem.

We check the predicted values of the dependent variable (Prop00) based on the estimation of (3.15) to determine whether they are within the unit interval. As mentioned earlier, this is a common criticism about the use of conventional methods for cases in which the dependent variable is a proportion, which often yield estimated values outside this interval. However, all the predicted values lie within the unit interval,[100] confirming that the results obtained by normal distribution-based methods (e.g., Heckman selection model) must not differ from those based on distributions that are considered suitable to the modeling of proportions as regressands (e.g., beta distribution, among others).

In general, when significant, the coefficients of the Heckman selection models (*Heckit*) and of *Probit* models with selection have the same sign, which is quite reasonable given that the proportion of votes and the fact that the mayor was reelected or not are closely related.

In Tables 3.6 and 3.7, the variable *Prop96* measures the incumbent's performance in the 1996 elections, when he was elected for the first term, i.e., it tries to measure the "stock" of votes built in the previous election. The positive and significant coefficients of this variable on the first and second stages equations of Heckit and Probit models are consistent with the hypothesis advocated in the literature that there exist voters who are loyal followers of a party or candidate, regardless of his performance during his term, and that these voters constitute the "initial stock" of votes the politician relies on in his reelection campaign (PELTZMAN, 1992, MENDES; ROCHA, 2004). That is, the larger the proportion of votes obtained in the first election (1996), the higher the probability of candidature for a second term, the higher the

[99] See descriptive statistics of these variables in Table 3.4.
[100] These results can be obtained from the authors upon request.

probability of reelection and the proportion of votes obtained in the subsequent election (in 2000).

Table 3.6 – Estimates of Heckman selection models

	I		II		III		IV		V	
	Prop00	Cand00	Prop00	Cand00	Prop00	Cand00	Prop00	Cand00	Prop00	Cand00
Prop96	0.502[a] (0.038)	0.335[a] (0.105)	0.502[a] (0.038)	0.332[a] (0.105)	0.502[a] (0.038)	0.339[a] (0.105)	0.508[a] (0.038)	0.334[a] (0.106)	0.510[a] (0.038)	0.324[a] (0.106)
President_party	-0.020 (0.017)	0.126[b] (0.055)	-0.019 (0.017)	0.125[b] (0.055)	-0.019 (0.017)	0.127[b] (0.055)	-0.020 (0.017)	0.134[b] (0.056)	-0.018 (0.017)	0.116[b] (0.056)
President_diff_party	-0.123[a] (0.018)	-0.292[a] (0.049)	-0.123[a] (0.018)	-0.291[a] (0.049)	-0.124[a] (0.018)	-0.293[a] (0.049)	-0.125[a] (0.018)	-0.286[a] (0.050)	-0.125[a] (0.018)	-0.292[a] (0.050)
Governor_party	0.053[a] (0.015)	0.200[a] (0.049)	0.053[a] (0.015)	0.200[a] (0.049)	0.053[a] (0.015)	0.198[a] (0.049)	0.053[a] (0.015)	0.199[a] (0.050)	0.056[a] (0.015)	0.211[a] (0.050)
Governor_diff_party	0.033[c] (0.020)	-0.206[a] (0.053)	0.033[c] (0.020)	-0.207[a] (0.053)	0.034[c] (0.020)	-0.206[a] (0.053)	0.030 (0.020)	-0.207[a] (0.053)	0.034[c] (0.020)	-0.209[a] (0.053)
New_municipality	0.134[a] (0.022)	0.619[a] (0.083)	0.133[a] (0.022)	0.620[a] (0.083)	0.131[a] (0.022)	0.616[a] (0.083)	0.133[a] (0.022)	0.608[a] (0.084)	0.130[a] (0.022)	0.629[a] (0.084)
Reelected_micro-region	0.006[a] (0.000)	0.000 (0.002)	0.006[a] (0.000)	0.000 (0.002)	0.006[a] (0.000)	0.000 (0.002)	0.006[a] (0.000)	0.000 (0.002)	0.006[a] (0.000)	0.000 (0.002)
Mean_age00	0.264[a] (0.064)	0.537[a] (0.144)	0.264[a] (0.064)	0.535[a] (0.144)	0.267[a] (0.064)	0.538[a] (0.144)	0.256[a] (0.064)	0.528[a] (0.145)	0.252[a] (0.064)	0.549[a] (0.145)
Age_candidate00	-0.526[a] (0.045)	- -	-0.525[a] (0.045)	- -	-0.526[a] (0.046)	- -	-0.527[a] (0.046)	- -	-0.519[a] (0.046)	- -
Split_municipality	0.005 (0.069)	0.283 (0.204)	0.006 (0.069)	0.280 (0.204)	0.008 (0.069)	0.283 (0.204)	0.006 (0.069)	0.284 (0.204)	0.010 (0.071)	0.263 (0.206)
Competition	-0.046[a] (0.016)	0.142[a] (0.048)	-0.046[a] (0.016)	0.143[a] (0.048)	-0.048[a] (0.016)	0.137[a] (0.048)	-0.042[a] (0.016)	0.148[a] (0.049)	-0.050[a] (0.016)	0.134[a] (0.049)
Fragmentation	-0.100[b] (0.042)	-0.082 (0.127)	-0.099[b] (0.042)	-0.082 (0.127)	-0.097[b] (0.042)	-0.080 (0.127)	-0.097[b] (0.042)	-0.101 (0.128)	-0.097[b] (0.042)	-0.069 (0.128)
Candidate_reel_micror	- -	0.030[a] (0.002)	- -	0.030[a] (0.002)	- -	0.030[a] (0.002)	- -	0.030[a] (0.002)	- -	0.030[a] (0.002)
$mod\hat{U}\_Current$	-0.048[b] (0.020)	-0.043 (0.058)	- -	- -	- -	- -	- -	- -	- -	- -
$mod\hat{U}\_Merit\_g$	- -	- -	-0.044[b] (0.019)	-0.066 (0.056)	- -	- -	- -	- -	- -	- -
$mod\hat{U}\_Pure\_go$	- -	- -	- -	- -	-0.021 (0.017)	0.019 (0.050)	- -	- -	- -	- -
$mod\hat{U}\_Econom$	- -	- -	- -	- -	- -	- -	-0.038[a] (0.010)	-0.005 (0.030)	- -	- -
$mod\hat{U}\_welfare$	- -	- -	- -	- -	- -	- -	- -	- -	-0.008 (0.011)	0.012 (0.035)
Constant	0.279 (0.197)	-3.633[a] (0.567)	0.281 (0.197)	-3.621[a] (0.567)	0.273 (0.197)	-3.645[a] (0.567)	0.327[c] (0.198)	-3.623[a] (0.570)	0.308 (0.198)	-3.686[a] (0.572)
Inverse Mills ratio	0.067[a] (0.016)		0.067[a] (0.016)		0.068[a] (0.016)		0.068[a] (0.016)		0.068[a] (0.016)	
N	4.975		4.975		4.974		4.920		4.907	
N Censored	1.670		1.670		1.670		1.654		1.647	
Indep. between Eqs.$(p > \chi^2)$	0.000		0.000		0.000		0.000		0.000	

a – Statistically significant at 1%; b – Statistically significant at 5%; c – Statistically significant at 10%. Note: i) Bootstrapped standard-errors in parenthesis; ii) Continuous variables in logarithm.

Table 3.7 – Estimates of *Probit* selection models

	I		II		III		IV		V	
	Reel00	Cand00	Reel00	Cand00	Reel00	Cand00	Reel00	Cand00	Reel00	Cand00
Prop96	0.951[a] (0.114)	0.352[a] (0.105)	0.950[a] (0.115)	0.349[a] (0.105)	0.953[a] (0.114)	0.355[a] (0.104)	0.958[a] (0.115)	0.353[a] (0.105)	0.954[a] (0.116)	0.345[a] (0.105)
President_party	0.094[c] (0.052)	0.107[b] (0.054)	0.094[c] (0.052)	0.106[c] (0.054)	0.097[c] (0.052)	0.108[b] (0.054)	0.095[c] (0.052)	0.112[b] (0.054)	0.085 (0.053)	0.097[c] (0.054)
President_diff_party	-0.267[a] (0.051)	-0.279[a] (0.048)	-0.266[a] (0.051)	-0.280[a] (0.048)	-0.266[a] (0.051)	-0.280[a] (0.048)	-0.268[a] (0.051)	-0.274[a] (0.048)	-0.269[a] (0.051)	-0.280[a] (0.049)
Governor_party	0.122[a] (0.046)	0.193[a] (0.048)	0.122[a] (0.046)	0.194[a] (0.048)	0.122[a] (0.046)	0.192[a] (0.048)	0.119[b] (0.047)	0.192[a] (0.048)	0.132[a] (0.047)	0.204[a] (0.049)
Governor_diff_party	-0.049 (0.057)	-0.197[a] (0.052)	-0.049 (0.057)	-0.198[a] (0.052)	-0.049 (0.056)	-0.197[a] (0.052)	-0.056 (0.057)	-0.198[a] (0.052)	-0.040 (0.057)	-0.202[a] (0.053)
New_municipality	0.616[a] (0.071)	0.615[a] (0.081)	0.617[a] (0.071)	0.616[a] (0.081)	0.614[a] (0.071)	0.612[a] (0.080)	0.623[a] (0.072)	0.608[a] (0.081)	0.618[a] (0.072)	0.622[a] (0.081)
Reelected_micro-region	0.029[a] (0.001)	0.000 (0.001)	0.029[a] (0.001)	0.000 (0.001)	0.029[a] (0.001)	0.000 (0.001)	0.029[a] (0.001)	0.000 (0.001)	0.029[a] (0.001)	0.000 (0.001)
Mean_age00	0.607[a] (0.178)	0.531[a] (0.141)	0.607[a] (0.178)	0.530[a] (0.141)	0.603[a] (0.177)	0.532[a] (0.140)	0.588[a] (0.179)	0.517[a] (0.141)	0.592[a] (0.179)	0.542[a] (0.142)
Age_candidate00	-1.013[a] (0.127)	- -	-1.015[a] (0.127)	- -	-1.008[a] (0.127)	- -	-1.007[a] (0.128)	- -	-0.995[a] (0.128)	- -
Split_municipality	0.054 (0.216)	0.287 (0.203)	0.052 (0.216)	0.284 (0.203)	0.052 (0.215)	0.288 (0.203)	0.055 (0.216)	0.290 (0.203)	0.070 (0.217)	0.270 (0.205)
Competition	0.188[a] (0.048)	0.120[b] (0.047)	0.189[a] (0.047)	0.121[b] (0.047)	0.184[a] (0.047)	0.116[b] (0.047)	0.196[a] (0.048)	0.126[a] (0.047)	0.181[a] (0.048)	0.110[b] (0.047)
Fragmentation	-0.204 (0.129)	-0.095 (0.126)	-0.205 (0.129)	-0.095 (0.126)	-0.202 (0.129)	-0.094 (0.126)	-0.204 (0.130)	-0.109 (0.127)	-0.183 (0.130)	-0.081 (0.127)
Candidate_reel_micror	- -	0.030[a] (0.001)	- -	0.030[a] (0.001)	- -	0.030[a] (0.001)	- -	0.030[a] (0.001)	- -	0.030[a] (0.001)
$mod\hat{U}\_Current$	-0.013 (0.056)	-0.053 (0.053)	- -	- -	- -	- -	- -	- -	- -	- -
$mod\hat{U}\_Merit\_g$	- -	- -	-0.031 (0.055)	-0.072 (0.052)	- -	- -	- -	- -	- -	- -
$mod\hat{U}\_Pure\_go$	- -	- -	- -	- -	0.038 (0.049)	-0.002 (0.046)	- -	- -	- -	- -
$mod\hat{U}\_Econom$	- -	- -	- -	- -	- -	- -	-0.027 (0.030)	-0.019 (0.029)	- -	- -
$mod\hat{U}\_welfare$	- -	- -	- -	- -	- -	- -	- -	- -	-0.005 (0.034)	0.010 (0.034)
Constant	0.415 (0.594)	-3.537[a] (0.555)	0.426 (0.594)	-3.531[a] (0.555)	0.404 (0.593)	-3.541[a] (0.555)	0.472 (0.599)	-3.501[a] (0.558)	0.419 (0.598)	-3.584[a] (0.559)
Inverse Mills ratio	0.067[a] 0.016		0.067[a] 0.016		0.068[a] 0.016		0.068[a] 0.016		0.068[a] 0.016	
N	4.951		4.951		4.950		4.896		4.883	
N Censored	1.670		1.670		1.670		1.654		1.647	
Indep. between Eqs.($p > \chi^2$)	0.000		0.000		0.000		0.000		0.000	

a – Statistically significant at 1%; b – Statistically significant at 5%; c – Statistically significant at 10%. Note: i) Bootstrapped standard-errors in parenthesis; ii) Continuous variables in logarithm.

President_party, President_diff_party, Governor_party and *Governor_diff_party* are variables that seek to capture the effect of belonging or not to the same party as the president or the governor on reelection performance. Belonging to the same party of the president or governor, besides having their popularity transferred to the mayor, could facilitate the access

to federal or state funds, increasing public spending without any pressure for tax collection. Such privileges would then translate into better electoral performance. The contrary is true for the president's or governor's opponents.

In the case of support from the president, the results indicate that belonging to the president's party has positive effects on the probability of reelection. This result can be observed by the estimates of the *Probit* model with selection (Table 3.7). The results for the Heckit model are not statistically significant (Table 3.6). On the other hand, coefficients of the variable *President_diff_party* are negative and significant in both models, i.e. competing against a candidate that has the president's support reduces the proportion of votes and the probability of reelection.

In the case of support from governors, Table 3.6 results show that incumbents running for a second terms, whether they belong to the same party as the governor's or to opposition parties (which had the second largest proportion of votes in the previous governor's election), have a larger proportion of votes than do other candidates.

According to Mendes and Rocha (2004), individuals who lead the emancipation of their jurisdictions enjoy immense political prestige, which enables their candidature and election as mayors, as well as their later reelection. In addition, a new municipality "does not have debts or problems passed on from the past; it arises with the guarantee of federal transfers; besides, a large number of voters can be pleased with construction works such as the new city hall, the city council headquarters and with the hiring of new local employees" (p. 23).[101] The positive and significant coefficients of the variable *New_municipality*, in the main and selection equations, using either the Heckman model (Table 3.6) or the *Probit* model with selection (Table 3.7), strengthen this hypothesis.

On the other hand, incumbents who lost part of their territories as a result of the emancipation of their districts into new municipalities may have lost their political prestige" (MENDES; ROCHA, 2004, p 23).[102] In other words, mayors of split municipalities are believed to be less likely to become candidates, to receive a smaller share of total votes and to have a lower reelection probability. The results obtained herein do not confirm this hypothesis, though. The coefficients of variable *Split_municipality* are not significant in the

[101] Text originally written in Portuguese and translated by the authors.
[102] Text originally written in Portuguese and translated by the authors.

main and selection equations when estimating their effect on the proportion of votes (Table 3.6) and on reelection probability (Table 3.7).

The variables *Reelected_micro-region* and *Candidate_reel_micror* (the latter of which is excluded from equations of interest (3.15) and (3.18) and included in selection equations (3.16) and (3.19)) seek to capture the influence of factors that are common to neighboring municipalities on each of the municipalities – for instance, "a micro-region going through a local economic crisis tends to have a lower reelection rate, while another region, with large federal investments, may have higher reelection rates" (MENDES; ROCHA, 2004, p. 22). Thus, the larger the proportion of reelection candidates in the micro-region, the higher the probability of an incumbent to become a candidate, the larger the proportion of votes received, and the reelection probability. The positive and significant coefficients of these variables, using the Heckit model and the *Probit* model with selection, reinforce this hypothesis.

The coefficients of the variables *competition* and *fragmentation* are negative and significant, as expected. A higher party system *fragmentation* in the legislative branch is positively associated with a larger fragmentation of the preferences of the electorate, which reduces the proportion of votes received by each candidate as well as his reelection probability. Likewise, the larger the number of candidates running for the elections, the lower the proportion of votes received, even when irrelevant alternatives are included.

Finally, the coefficient of the variables $mod\widehat{U}\_Current\_expenditure$, in model I of Table 3.6, whose dependent variable is the proportion of votes, has a negative sign that is significant at 5%. This result supports the median voter model, since it indicates that misperceptions or deviations from the median demand reduce the proportion of votes of reelection candidates. If the variables of interest are measured with error, these results may have been attenuated, underestimating the magnitude of their effect. When the deviations from the median demand are analyzed with respect to the different types of goods and services, we have a negative coefficient, significant at 5%, for the variable $mod\widehat{U}\_Merit\_goods\_expenditure$ (model II of Table 3.6), and for the variable $mod\widehat{U}\_Economic\_goods$, (model IV of Table 3.6). The coefficients of variables $mod\widehat{U}\_Pure\_goods\_expenditure$ and $mod\widehat{U}\_welfare$ (models III and V in Table 3.6) are negative but nonsignificant at conventional levels; however, as mentioned earlier, they can be attenuated due to a measurement error.

The coefficients of the variables of interest, when the *Probit* model *with selection* is used, are all negative (except for the variable $mod\widehat{U}\_Pure\_goods\_expenditure$), but, in no case, statistically significant at 10%.

Overall, in models in which electoral performance is measured by the proportion of votes instead of by the "reelected" or "not reelected" status, the coefficients of the variables of interest are negative and significant, indicating that the median voter model is somehow valid. The fact that this result does not hold when the dependent variable is binary may be associated with the possibility of attenuation of the coefficients and with the lower variability when the variable is dichotomous.

3.4 Final Remarks

This paper sought to test the median voter model for Brazilian municipalities. According to this model, the farthest the offered bundles are from the median demand, the lower the chances of reelection. Therefore, for the empirical test, we first estimate the median voter's demand for public goods. The estimation of this demand is based on the hypothesis that local officeholders do not have perfect information, i.e., they make nonsystematic errors in their forecasts (expectations) about the actual median demand. Since the "1997 Reelection Amendment" allows the president, mayors and governors to run for elections, it is possible to consider the bundles offered by these candidates to be identical with the expenditure actually realized in 2000, when the elections were held. This way, it was possible to measure the magnitude of the reelection candidates' misperception about the median voter's demand.

In order for the test to be valid, at least one of the assumptions about the measurement of misperception ($mod\widehat{U}$) had to be verified. In one of them, it is hypothesized that the estimated demand residual is the sole consequence of misperceptions, which is considerably strong. The other assumption is that $mod\widehat{U}$ can be regarded as a variable measured with error.

If the first hypothesis holds as well as the other conditions of ortogonality between the error term and the regressors included in the models, the estimates of the impact of the variable $mod\widehat{U}$ on the proportion of votes and on the reelection probability using the Heckman (*Heckit*) selection models and the *Probit* model with selection will be consistent. If, however, the variable $mod\widehat{U}$ is deemed to have been measured with error, the coefficients

will be “attenuated” (biased towards zero). Even though this is not the best scenario, it does not invalidate the results, as significant coefficients provide estimations with the correct sign. Therefore, if the interest is in the direction of the effect only, as is the case of the present study, it is possible to reach valid conclusions from the estimations.

The results obtained in this study, based on local data from the National Treasury Office, IBGE’s Census and from the Brazilian Supreme Electoral Court for the year 2000, provide favorable evidence for the median voter model for Brazilian municipalities. An increase in the degree of misperception of local politicians running for reelection about the median demanded bundle has a negative effect on the proportion of votes received by the candidate, which is precisely the idea of the median voter model. On the other hand, the results for reelection probability using the *Probit* model with selection are not significant. By taking into account different sets of goods, it is observed that deviations from the median demand for merit and economic goods are more severely punished by voters than are deviations from the median demand for the other types of goods.

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A. Appendix

A.1 Appendix to Chapter 1: Tables with full results of spatial models

Table A.1.1 – Full results of standard one regime models of municipalities' log education spending

	OLS	WITHIN	GM	GM	ML	ML
	POLS	FE	SARFEGM	SDFEGM	SARFE	SDFE
$Wy - Spatial\ parameter\ \lambda$			0.513***	0.865***	0.180***	0.177***
			(12.969)	(8.991)	(23.866)	(22.558)
gdp	0.252***	0.104***	0.059***	0.066***	0.092***	0.085***
	(47.494)	(11.806)	(4.800)	(4.341)	(9.746)	(8.139)
wage	0.319***	0.096***	0.063***	0.054***	0.084***	0.075***
	(36.000)	(10.764)	(5.748)	(4.579)	(8.852)	(7.780)
perceived cost	-0.101***	-0.064***	-0.045***	-0.054***	-0.061***	-0.064***
	(-29.996)	(-13.136)	(-6.050)	(-6.304)	(-11.868)	(-11.802)
categorical grants	0.411***	0.288***	0.188***	0.282***	0.280***	0.285***
	(61.682)	(50.071)	(5.038)	(6.294)	(45.702)	(45.452)
block grants	0.069***	0.024***	0.017**	0.015**	0.022***	0.021***
	(16.232)	(8.421)	(2.528)	(2.127)	(7.469)	(6.945)
schooling	0.027**	0.006	-0.011	-0.020	-0.001	-0.016
	(1.981)	(0.364)	(-0.558)	(-0.931)	(-0.033)	(-0.938)
occupation	0.039***	0.017***	0.007	0.004	0.015***	0.010**
	(9.779)	(4.112)	(1.383)	(0.654)	(3.268)	(2.280)
men	-0.008***	-0.003	0.002	-0.003	-0.003	-0.004
	(-5.333)	(-1.033)	(0.360)	(-0.605)	(-0.842)	(-1.216)
population	-0.045***	0.098***	0.039	0.033	0.081***	0.066***
	(-11.941)	(4.921)	(1.593)	(1.116)	(3.797)	(2.894)
elderly	-0.017***	-0.050***	-0.024***	-0.017***	-0.040***	-0.021***
	(-11.525)	(-21.053)	(-7.168)	(-3.752)	(-15.872)	(-5.517)
young	-0.038***	-0.024***	-0.011***	-0.006***	-0.019***	-0.009***
	(-61.244)	(-15.498)	(-5.933)	(-2.635)	(-11.845)	(-4.466)
rural	0.002***	0.001***	0.001***	0.001***	0.001***	0.001***
	(36.617)	(8.724)	(4.744)	(5.958)	(8.086)	(8.266)
second cicle	-0.004***	-0.001***	-0.001***	-0.002***	-0.001***	-0.001***
	(-44.943)	(-5.185)	(-4.329)	(-6.229)	(-5.765)	(-7.045)
competition	0.028***	-0.003	0.003	0.002	-0.001	0.0001
	(4.291)	(-0.461)	(0.490)	(0.266)	(-0.225)	(-0.018)
incumbent's age	-0.022**	0.017**	0.014	0.024**	0.018**	0.018**
	(-2.358)	(2.032)	(1.340)	(2.154)	(2.081)	(2.036)
incumbents' education	-0,0002	0.009**	0.012***	0.010**	0.008**	0.009**
	(-0.063)	(2.561)	(2.983)	(2.283)	(2.335)	(2.481)
left	0.027***	0.004	0.006	0.002	0.004	0.003
	(5.474)	(1.083)	(1.223)	(0.319)	(0.970)	(0.720)
incumbent women	-0.035***	0.012**	0.010	0.008	0.012*	0.013*
	(-4.826)	(1.979)	(1.364)	(1.012)	(1.767)	(1.912)
aldermen's education	0.001***	0.0001	0.0001	0.00001	0.0001	0.0001
	(7.997)	(0.833)	(0.739)	(0.074)	(0.646)	(0.657)
aldermen's age	-0.155***	-0.002	0.030	0.017	0.007	0.013
	(-6.848)	(-0.097)	(1.068)	(0.572)	(0.295)	(0.529)
women in council	-0.001***	0.0001	0.00004	0.0002	0.00002	0.00003
	(-3.945)	(0.483)	(-0.201)	(-1.082)	(0.104)	(0.211)
competition for seats	0.005	0.010	0.005	0.013	0.008	0.011
	(0.876)	(1.481)	(0.649)	(1.443)	(1.101)	(1.500)
fragmentation	-0.001***	0.001**	0.0002	0.0002	0.0004**	0.0004*
	(-4.295)	(2.514)	(0.931)	(0.671)	(1.983)	(1.740)
majority of seats	-0.001	-0.005*	-0.002	-0.005	-0.005	-0.005*
	(-0.134)	(-1.767)	(-0.578)	(-1.336)	(-1.449)	(-1.696)
president's party	0.022***	0.018***	0.013**	0.012*	0.017***	0.016***
	(3.110)	(3.616)	(1.980)	(1.706)	(3.306)	(3.031)
governor's party	-0.003	-0.003	0.0002	-0.005	-0.003	-0.003

	OLS	WITHIN	GM	GM	ML	ML
	POLS	FE	SARFEGM	SDFEGM	SARFE	SDFE
	(-0.813)	(-0.871)	(0.048)	(-1.225)	(-0.828)	(-0.855)
lameduck	0.003	0.001	0.004	0.008**	0.002	0.003
	(0.769)	(0.317)	(1.278)	(2.154)	(0.668)	(0.888)
Wgdp				-0,078***		0,014
				(-3,120)		(0,893)
Wwage				-0,032		0,082***
				(-1,275)		(5,083)
Wperceived cost				0,047***		-0,004
				(3,439)		(-0,428)
Wcategorical grants				-0,240***		-0,073***
				(-5,690)		(-7,017)
Wblock grants				0,009		0,022***
				(0,730)		(4,149)
Wschooling				0,069		0,071**
				(1,619)		(2,275)
Woccupation				-0,010		0,020***
				(-1,053)		(2,789)
Wmen				0,003		-0,006
				(0,412)		(-1,004)
Wpopulation				-0,013		0,089***
				(-0,265)		(2,659)
Welderly				0,010		-0,030***
				(1,319)		(-6,354)
Wyoung				0,001		-0,018***
				(0,263)		(-6,366)
Wrural				-0,001***		-0,0004**
				(-4,565)		(-2,202)
Wsecond cicle				0,002***		0,001***
				(4,986)		(5,272)
Wcompetition				-0,016		-0,017*
				(-1,213)		(-1,664)
Wincumbent's age				-0,026		-0,033**
				(-1,366)		(-2,095)
Wincumbents' education				-0,011		-0,008
				(-1,405)		(-1,254)
Wleft				-0,002		-0,004
				(-0,182)		(-0,518)
Wincumbent women				0,000		0,010
				(-0,033)		(0,838)
Waldermen's education				0,000		0,0001
				(-0,827)		(0,446)
Waldermen's age				0,012		-0,051
				(0,215)		(-1,160)
Wwomen in council				0,001***		0,001***
				(2,606)		(3,629)
Wcompetition for seats				-0,018		-0,032**
				(-1,131)		(-2,563)
Wfragmentation				0,000		0,001
				(-0,151)		(1,475)
Wmajority of seats				-0,001		-0,006
				(-0,161)		(-0,962)
Wpresident's party				0,003		0,021**
				(0,281)		(2,365)
Wgovernor's party				0,015**		0,010*
				(2,326)		(1,953)
Wlameduck				-0,013*		-0,020***
				(-1,802)		(-3,723)
Spatial Fixed Effects	No	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Robust LM no Spatial Lag $\chi 2$	22530.3***	47.1***				
Robust LM no Spatial Error $\chi 2$	24993.1***	0.6				
Kleibergen-Paap $\chi 2$ (Underidentification)			882.3***	196.8***		
Kleibergen-Paap F (Weak Identification)			31.6a	8.4c		

	OLS	WITHIN	GM	GM	ML	ML
	POLS	FE	SARFEGM	SDFEGM	SARFE	SDFE
Hansen J statistics $\chi 2$ (Overidentification)			192.9***	24.2		
R-squared	0.389	0.929	0.631	0.601	0.931	0.932
N	25228	25228	25228	25228	25228	25228
log-likelihood			12573.8	11540.7	12725.1	12898.4

Notes: t-statistics in parenthesis. *** significant at 1%; ** significant at 5%; and * significant at 10%. a- significant at 5% IV maximal relative bias; c- significant at 20% IV maximal relative bias . Instruments are first and second order neighbors' characteristics for model SARFEGM, and only second order neighbors' characteristics for SDFEGM model.

Table A.1.2 – Full results of two regime models for determination of log education spending in Brazilian municipalities

	1	2	3	4	5
	d= dummy of "lame ducks"	d = dummy of "less than 50% of seats"	d= dummy of Prova Brasil 2007-2008	d = dummy of IDEB 2008	d = dummy of election years
λ_1 *on* dWy	0.163***	0.197***	0.166***	0.160***	0.154***
	(16.766)	(17.899)	(18.068)	(18.904)	(16.717)
λ_2 *on* $(1-d)Wy$	0.208***	0.146***	0.203***	0.264***	0.233***
	(12.439)	(10.741)	(14.760)	(14.608)	(17.277)
gdp	0,085***	0,085***	0,085***	0,085***	0,085***
	(8,784)	(8,764)	(8,789)	(8,758)	(8,714)
wage	0,075***	0,075***	0,074***	0,074***	0,073***
	(8,396)	(8,391)	(8,370)	(8,266)	(8,259)
perceived cost	-0,064***	-0,064***	-0,064***	-0,063***	-0,063***
	(-12,740)	(-12,797)	(-12,724)	(-12,635)	(-12,677)
categorical grants	0,285***	0,284***	0,284***	0,284***	0,284***
	(49,077)	(48,996)	(49,044)	(49,052)	(49,054)
block grants	0,021***	0,021***	0,021***	0,021***	0,021***
	(7,418)	(7,426)	(7,544)	(7,597)	(7,608)
schooling	-0,017	-0,016	-0,016	-0,017	-0,016
	(-1,035)	(-1,023)	(-1,019)	(-1,035)	(-1,004)
occupation	0,010**	0,010**	0,010**	0,010**	0,010**
	(2,451)	(2,451)	(2,471)	(2,504)	(2,525)
men	-0,004	-0,004	-0,004	-0,004	-0,004
	(-1,291)	(-1,310)	(-1,303)	(-1,231)	(-1,238)
population	0,066***	0,065***	0,065***	0,064***	0,065***
	(3,127)	(3,088)	(3,102)	(3,062)	(3,081)
elderly	-0,021***	-0,021***	-0,021***	-0,021***	-0,021***
	(-5,975)	(-5,916)	(-5,913)	(-5,882)	(-5,896)
young	-0,009***	-0,009***	-0,009***	-0,009***	-0,009***
	(-4,843)	(-4,791)	(-4,765)	(-4,711)	(-4,745)
rural	0,001***	0,001***	0,001***	0,001***	0,001***
	(8,935)	(8,952)	(8,932)	(8,929)	(8,884)
second cicle	-0,001***	-0,001***	-0,001***	-0,001***	-0,001***
	(-7,615)	(-7,622)	(-7,579)	(-7,571)	(-7,608)
competition	-0,0002	-0,0003	-0,0001	-0,0003	-0,0002
	(-0,037)	(-0,047)	(-0,023)	(-0,048)	(-0,034)
incumbent's age	0,018**	0,018**	0,018**	0,018**	0,018**
	(2,205)	(2,208)	(2,205)	(2,218)	(2,246)
incumbents' education	0,009***	0,009***	0,009***	0,009***	0,009***
	(2,669)	(2,692)	(2,689)	(2,698)	(2,723)
left	0,003	0,003	0,003	0,003	0,003
	(0,788)	(0,811)	(0,808)	(0,814)	(0,825)
incumbent women	0,013**	0,013**	0,013**	0,013**	0,013**
	(2,060)	(2,092)	(2,064)	(2,062)	(2,042)
aldermen's education	0,0001	0,0001	0,0001	0,0001	0,0001
	(0,706)	(0,711)	(0,713)	(0,697)	(0,692)
aldermen's age	0,013	0,013	0,012	0,012	0,012
	(0,590)	(0,584)	(0,554)	(0,543)	(0,561)
women in council	0,00004	0,00003	0,00004	0,00004	0,00004
	(0,219)	(0,219)	(0,234)	(0,252)	(0,251)
competition for seats	0,011	0,011	0,011	0,012*	0,011
	(1,611)	(1,576)	(1,623)	(1,647)	(1,581)
fragmentation	0,0004*	0,0004*	0,0004*	0,0004*	0,0004*
	(1,879)	(1,875)	(1,889)	(1,882)	(1,912)
majority of seats	-0,005*	0,006*	-0,005*	-0,005*	-0,005*
	(-1,827)	(1,865)	(-1,821)	(-1,814)	(-1,802)
president's party	0,016***	0,016***	0,016***	0,016***	0,016***
	(3,267)	(3,241)	(3,268)	(3,266)	(3,241)
governor's party	-0,003	-0,003	-0,003	-0,003	-0,003
	(-0,931)	(-0,874)	(-0,888)	(-0,905)	(-0,915)
lameduck	0,003	0,003	0,003	0,003	0,003
	(0,993)	(0,992)	(0,952)	(0,948)	(0,960)
Wgdp	0,014	0,014	0,014	0,014	0,014

	1	2	3	4	5
	d= dummy of "lame ducks"	d = dummy of "less than 50% of seats"	d= dummy of Prova Brasil 2007-2008	d = dummy of IDEB 2008	d = dummy of election years
	(0,966)	(1,013)	(1,008)	(1,001)	(0,963)
Wwage	0,082***	0,082***	0,081***	0,078***	0,078***
	(5,476)	(5,486)	(5,420)	(5,223)	(5,198)
Wperceived cost	-0,004	-0,004	-0,003	-0,002	-0,002
	(-0,493)	(-0,511)	(-0,440)	(-0,262)	(-0,325)
Wcategorical grants	-0,071***	-0,070***	-0,072***	-0,071***	-0,071***
	(-7,379)	(-7,228)	(-7,448)	(-7,350)	(-7,393)
Wblock grants	0,022***	0,022***	0,023***	0,023***	0,023***
	(4,433)	(4,474)	(4,530)	(4,577)	(4,603)
Wschooling	0,072**	0,071**	0,071**	0,069**	0,070**
	(2,466)	(2,439)	(2,447)	(2,396)	(2,429)
Woccupation	0,020***	0,020***	0,019***	0,019***	0,020***
	(3,022)	(3,019)	(2,994)	(2,992)	(3,027)
Wmen	-0,006	-0,006	-0,006	-0,005	-0,006
	(-1,120)	(-1,139)	(-1,075)	(-0,997)	(-1,027)
Wpopulation	0,089***	0,090***	0,088***	0,083***	0,087***
	(2,870)	(2,895)	(2,829)	(2,654)	(2,801)
Welderly	-0,030***	-0,030***	-0,029***	-0,027***	-0,029***
	(-6,878)	(-6,878)	(-6,553)	(-6,253)	(-6,528)
Wyoung	-0,018***	-0,018***	-0,017***	-0,016***	-0,017***
	(-6,895)	(-6,950)	(-6,623)	(-6,363)	(-6,579)
Wrural	-0,0004**	-0,0004**	-0,0004**	-0,0004**	-0,0004**
	(-2,386)	(-2,424)	(-2,368)	(-2,396)	(-2,547)
Wsecond cicle	0,001***	0,001***	0,001***	0,001***	0,001***
	(5,697)	(5,755)	(5,734)	(5,744)	(5,666)
Wcompetition	-0,017*	-0,017*	-0,017*	-0,017*	-0,017*
	(-1,801)	(-1,772)	(-1,803)	(-1,844)	(-1,824)
Wincumbent's age	-0,033**	-0,034**	-0,033**	-0,034**	-0,034**
	(-2,253)	(-2,276)	(-2,247)	(-2,272)	(-2,266)
Wincumbents' education	-0,008	-0,008	-0,008	-0,008	-0,008
	(-1,350)	(-1,310)	(-1,356)	(-1,389)	(-1,396)
Wleft	-0,004	-0,004	-0,004	-0,004	-0,004
	(-0,573)	(-0,561)	(-0,520)	(-0,538)	(-0,555)
Wincumbent women	0,010	0,010	0,010	0,010	0,010
	(0,877)	(0,940)	(0,915)	(0,951)	(0,934)
Waldermen's education	0,0001	0,0001	0,0001	0,0001	0,0001
	(0,476)	(0,425)	(0,504)	(0,502)	(0,470)
Waldermen's age	-0,050	-0,049	-0,052	-0,052	-0,051
	(-1,219)	(-1,200)	(-1,268)	(-1,275)	(-1,258)
Wwomen in council	0,001***	0,001***	0,001***	0,001***	0,001***
	(3,912)	(3,930)	(3,909)	(3,928)	(3,929)
Wcompetition for seats	-0,032***	-0,032***	-0,032***	-0,032***	-0,034***
	(-2,799)	(-2,788)	(-2,794)	(-2,787)	(-2,925)
Wfragmentation	0,001	0,001	0,001	0,001	0,001*
	(1,605)	(1,557)	(1,597)	(1,608)	(1,665)
Wmajority of seats	-0,006	0,006	-0,006	-0,006	-0,006
	(-1,049)	(1,038)	(-1,038)	(-1,055)	(-1,034)
Wpresident's party	0,021**	0,021***	0,021***	0,021***	0,021**
	(2,569)	(2,604)	(2,587)	(2,625)	(2,561)
Wgovernor's party	0,010**	0,010**	0,010**	0,010**	0,010**
	(2,098)	(2,088)	(2,145)	(2,081)	(2,062)
Wlameduck	-0,019***	-0,020***	-0,020***	-0,020***	-0,020***
	(-3,997)	(-4,016)	(-4,025)	(-4,024)	(-4,063)
Spatial Fixed Effects	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes
R-squared	0.9324	0.9324	0.9324	0.9324	0.9324
N	25228	25228	25228	25228	25228
log-likelihood	12899.917	12901.504	12899.984	12912.246	12909.956

Notes: t-statistics in parenthesis;
*** significant at 1%; ** significant at 5%; * significant at 10%.

Table A.1.3 – Full results of two regime models: varying the cut-offs of voting margin held by the incumbent at the city council

	2a	2b	2c	2d	2e	2f	2g
	d= dummy of "less than 45% of seats"	d= dummy of "less than 50% of seats"	d= dummy of "less than 55% of seats"	d= dummy of "less than 60% of seats"	d= dummy of "less than 65% of seats"	d= dummy of "less than 70% of seats	d= dummy of "less than 75% of seats"
$\lambda_1 \, on \, dWy$	0.189***	0.197***	0.196***	0.172***	0.172***	0.164***	0.162***
	(17.947)	(17.899)	(17.111)	(11.017)	(10.320)	(6.683)	(6.226)
$\lambda_2 \, on \, (1-d)Wy$	0.153***	0.146***	0.152***	0.178***	0.177***	0.178***	0.178***
	(10.594)	(10.741)	(11.745)	(17.612)	(18.121)	(20.513)	(20.755)
gdp	0,085***	0,085***	0,085***	0,085***	0,085***	0,085***	0,085***
	(8,738)	(8,764)	(8,762)	(8,780)	(8,773)	(8,729)	(8,732)
wage	0,074***	0,075***	0,075***	0,075***	0,075***	0,075***	0,075***
	(8,366)	(8,391)	(8,401)	(8,430)	(8,452)	(8,444)	(8,404)
perceived cost	-0,064***	-0,064***	-0,064***	-0,064***	-0,064***	-0,063***	-0,063***
	(-12,738)	(-12,797)	(-12,769)	(-12,716)	(-12,696)	(-12,663)	(-12,649)
categorical grants	0,284***	0,284***	0,284***	0,285***	0,285***	0,285***	0,285***
	(49,008)	(48,996)	(49,031)	(49,101)	(49,106)	(49,109)	(49,131)
block grants	0,021***	0,021***	0,021***	0,021***	0,021***	0,021***	0,021***
	(7,466)	(7,426)	(7,438)	(7,508)	(7,507)	(7,533)	(7,548)
schooling	-0,017	-0,016	-0,016	-0,016	-0,016	-0,016	-0,016
	(-1,037)	(-1,023)	(-0,982)	(-0,989)	(-0,972)	(-0,993)	(-1,011)
occupation	0,010**	0,010**	0,010**	0,010**	0,010**	0,010**	0,010**
	(2,458)	(2,451)	(2,460)	(2,482)	(2,502)	(2,480)	(2,486)
men	-0,004	-0,004	-0,004	-0,004	-0,004	-0,004	-0,004
	(-1,312)	(-1,310)	(-1,319)	(-1,315)	(-1,306)	(-1,303)	(-1,302)
population	0,066***	0,065***	0,065***	0,066***	0,066***	0,066***	0,066***
	(3,127)	(3,088)	(3,085)	(3,139)	(3,140)	(3,149)	(3,142)
elderly	-0,021***	-0,021***	-0,021***	-0,021***	-0,021***	-0,021***	-0,021***
	(-5,946)	(-5,916)	(-5,933)	(-5,973)	(-5,975)	(-6,001)	(-5,980)
young	-0,009***	-0,009***	-0,009***	-0,009***	-0,009***	-0,009***	-0,009***
	(-4,811)	(-4,791)	(-4,803)	(-4,813)	(-4,817)	(-4,851)	(-4,838)
rural	0,001***	0,001***	0,001***	0,001***	0,001***	0,001***	0,001***
	(8,922)	(8,952)	(8,939)	(8,920)	(8,906)	(8,868)	(8,877)
second cicle	-0,001***	-0,001***	-0,001***	-0,001***	-0,001***	-0,001***	-0,001***
	(-7,623)	(-7,622)	(-7,638)	(-7,621)	(-7,631)	(-7,605)	(-7,621)
competition	-0,0002	-0,0003	0,0004	0,001	0,002	0,002	0,003
	(-0,033)	(-0,047)	(0,071)	(0,213)	(0,321)	(0,446)	(0,575)
incumbent's age	0,018**	0,018**	0,018**	0,018**	0,018**	0,019**	0,019**
	(2,196)	(2,208)	(2,187)	(2,152)	(2,158)	(2,273)	(2,264)
incumbents' education	0,009***	0,009***	0,009***	0,009***	0,009***	0,008**	0,009***
	(2,659)	(2,692)	(2,678)	(2,689)	(2,647)	(2,526)	(2,641)
left	0,003	0,003	0,003	0,004	0,004	0,004	0,004
	(0,779)	(0,811)	(0,844)	(0,898)	(0,925)	(0,967)	(0,955)
incumbent women	0,013**	0,013**	0,013**	0,013**	0,013**	0,013**	0,013**
	(2,083)	(2,092)	(2,077)	(2,059)	(2,063)	(2,103)	(2,132)
aldermen's education	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001
	(0,707)	(0,711)	(0,690)	(0,684)	(0,659)	(0,674)	(0,652)
aldermen's age	0,013	0,013	0,012	0,012	0,012	0,012	0,011
	(0,604)	(0,584)	(0,548)	(0,535)	(0,536)	(0,543)	(0,517)
women in council	0,00004	0,00003	0,00004	0,00003	0,00003	0,00003	0,00003
	(0,243)	(0,219)	(0,221)	(0,202)	(0,202)	(0,196)	(0,173)
competition for seats	0,011	0,011	0,012*	0,012*	0,013*	0,012*	0,012*
	(1,495)	(1,576)	(1,657)	(1,706)	(1,783)	(1,676)	(1,745)
fragmentation	0,0004*	0,0004*	0,0004*	0,0004**	0,0004**	0,0005**	0,0005**
	(1,899)	(1,875)	(1,959)	(1,977)	(2,122)	(2,152)	(2,233)
majority of seats	0,006*	0,006*	0,003	0,001	-0,002	-0,005	-0,008
	(1,836)	(1,865)	(1,113)	(0,376)	(-0,551)	(-1,181)	(-1,597)
president's party	0,016***	0,016***	0,016***	0,016***	0,017***	0,016***	0,016***
	(3,248)	(3,241)	(3,296)	(3,347)	(3,388)	(3,362)	(3,332)
governor's party	-0,003	-0,003	-0,003	-0,003	-0,003	-0,003	-0,003
	(-0,910)	(-0,874)	(-0,920)	(-0,953)	(-0,967)	(-1,005)	(-0,988)
lameduck	0,002	0,003	0,002	0,002	0,001	0,001	0,001
	(0,908)	(0,992)	(0,808)	(0,614)	(0,388)	(0,360)	(0,318)

	2a	2b	2c	2d	2e	2f	2g
	d= dummy of "less than 45% of seats"	d= dummy of "less than 50% of seats"	d= dummy of "less than 55% of seats"	d= dummy of "less than 60% of seats"	d= dummy of "less than 65% of seats"	d= dummy of "less than 70% of seats	d= dummy of "less than 75% of seats"
Wgdp	0,014	0,014	0,014	0,014	0,015	0,016	0,016
	(0,982)	(1,013)	(1,022)	(1,006)	(1,032)	(1,097)	(1,096)
Wwage	0,082***	0,082***	0,083***	0,083***	0,083***	0,082***	0,083***
	(5,425)	(5,486)	(5,496)	(5,500)	(5,518)	(5,490)	(5,497)
Wperceived cost	-0,004	-0,004	-0,004	-0,004	-0,004	-0,005	-0,005
	(-0,486)	(-0,511)	(-0,526)	(-0,547)	(-0,555)	(-0,646)	(-0,673)
Wcategorical grants	-0,070***	-0,070***	-0,070***	-0,072***	-0,072***	-0,072***	-0,072***
	(-7,285)	(-7,228)	(-7,241)	(-7,492)	(-7,475)	(-7,500)	(-7,506)
Wblock grants	0,022***	0,022***	0,022***	0,022***	0,022***	0,022***	0,022***
	(4,475)	(4,474)	(4,488)	(4,480)	(4,472)	(4,420)	(4,420)
Wschooling	0,070**	0,071**	0,072**	0,072**	0,073**	0,072**	0,073**
	(2,402)	(2,439)	(2,471)	(2,469)	(2,500)	(2,483)	(2,531)
Woccupation	0,019***	0,020***	0,019***	0,020***	0,020***	0,019***	0,019***
	(2,983)	(3,019)	(2,992)	(3,006)	(3,027)	(2,984)	(2,969)
Wmen	-0,006	-0,006	-0,006	-0,006	-0,006	-0,006	-0,006
	(-1,142)	(-1,139)	(-1,112)	(-1,095)	(-1,114)	(-1,046)	(-1,059)
Wpopulation	0,090***	0,090***	0,088***	0,090***	0,090***	0,089***	0,090***
	(2,879)	(2,895)	(2,836)	(2,891)	(2,895)	(2,875)	(2,878)
Welderly	-0,030***	-0,030***	-0,030***	-0,030***	-0,030***	-0,030***	-0,030***
	(-6,879)	(-6,878)	(-6,849)	(-6,881)	(-6,864)	(-6,879)	(-6,898)
Wyoung	-0,018***	-0,018***	-0,018***	-0,018***	-0,018***	-0,018***	-0,018***
	(-6,919)	(-6,950)	(-6,949)	(-6,901)	(-6,910)	(-6,838)	(-6,856)
Wrural	-0,0004**	-0,0004**	-0,0004**	-0,0004**	-0,0004**	-0,0004**	-0,0004**
	(-2,418)	(-2,424)	(-2,418)	(-2,378)	(-2,376)	(-2,361)	(-2,419)
Wsecond cicle	0,001***	0,001***	0,001***	0,001***	0,001***	0,001***	0,001***
	(5,729)	(5,755)	(5,789)	(5,679)	(5,661)	(5,646)	(5,685)
Wcompetition	-0,018*	-0,017*	-0,018*	-0,016*	-0,016*	-0,018*	-0,019**
	(-1,897)	(-1,772)	(-1,900)	(-1,757)	(-1,699)	(-1,938)	(-2,077)
Wincumbent's age	-0,034**	-0,034**	-0,035**	-0,035**	-0,034**	-0,034**	-0,035**
	(-2,313)	(-2,276)	(-2,358)	(-2,353)	(-2,329)	(-2,331)	(-2,334)
Wincumbents' education	-0,008	-0,008	-0,008	-0,008	-0,007	-0,007	-0,007
	(-1,392)	(-1,310)	(-1,277)	(-1,275)	(-1,269)	(-1,142)	(-1,216)
Wleft	-0,004	-0,004	-0,004	-0,003	-0,003	-0,004	-0,003
	(-0,631)	(-0,561)	(-0,592)	(-0,468)	(-0,461)	(-0,523)	(-0,511)
Wincumbent women	0,010	0,010	0,010	0,010	0,010	0,009	0,009
	(0,927)	(0,940)	(0,905)	(0,885)	(0,935)	(0,847)	(0,832)
Waldermen's education	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0002
	(0,446)	(0,425)	(0,435)	(0,526)	(0,490)	(0,570)	(0,600)
Waldermen's age	-0,047	-0,049	-0,050	-0,052	-0,051	-0,055	-0,056
	(-1,157)	(-1,200)	(-1,230)	(-1,280)	(-1,239)	(-1,357)	(-1,370)
Wwomen in council	0,001***	0,001***	0,001***	0,001***	0,001***	0,001***	0,001***
	(3,929)	(3,930)	(3,953)	(3,895)	(3,934)	(3,951)	(3,918)
Wcompetition for seats	-0,033***	-0,032***	-0,031***	-0,031***	-0,031***	-0,034***	-0,032***
	(-2,869)	(-2,788)	(-2,665)	(-2,712)	(-2,657)	(-2,939)	(-2,813)
Wfragmentation	0,001	0,001	0,001	0,001	0,001	0,0004	0,0004
	(1,515)	(1,557)	(1,483)	(1,500)	(1,572)	(1,125)	(1,045)
Wmajority of seats	0,009*	0,006	0,009*	0,006	0,003	0,028***	0,031***
	(1,742)	(1,038)	(1,774)	(1,098)	(0,507)	(3,382)	(3,576)
Wpresident's party	0,020**	0,021***	0,021**	0,021***	0,021***	0,020**	0,020**
	(2,540)	(2,604)	(2,561)	(2,592)	(2,602)	(2,533)	(2,533)
Wgovernor's party	0,010**	0,010**	0,010**	0,010**	0,010**	0,010**	0,010**
	(2,100)	(2,088)	(2,059)	(2,079)	(2,047)	(2,062)	(2,042)
Wlameduck	-0,019***	-0,020***	-0,019***	-0,019***	-0,020***	-0,018***	-0,018***
	(-3,925)	(-4,016)	(-3,794)	(-3,940)	(-4,223)	(-3,783)	(-3,835)
Spatial Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.9324	0.9324	0.9324	0.9324	0.9324	0.9324	0.9324
N	25228	25228	25228	25228	25228	25228	25228
log-likelihood	12900.274	12901.504	12900.41	12895.754	12895.351	12901.532	12902.677

See notes on table A.1.2.

Table A.1.4 – Full results of two regime models: assigning year dummies as different regimes

	4a	4b	4c	4d	4e	4f	4g
	d= dummy of PNE (2002)	d= dummy of 2003	d= dummy of 2004	d= dummy of 2005	d= dummy of 2006	d= dummy of 2007	d= dummy of IDEB (2008)
$\lambda_1 \, on \, dWy$	0.153***	0.179***	0.174***	0.185***	0.194***	0.183***	0.160***
	(17.948)	(21.231)	(20.576)	(22.002)	(23.128)	(21.893)	(18.904)
$\lambda_2 \, on \, (1-d)Wy$	0.257***	0.159***	0.190***	0.088***	0.067***	0.116***	0.264***
	(13.849)	(7.990)	(9.662)	(4.188)	(3.192)	(5.853)	(14.608)
gdp	0,086***	0,086***	0,085***	0,085***	0,085***	0,085***	0,085***
	(8,828)	(8,806)	(8,783)	(8,722)	(8,748)	(8,780)	(8,758)
wage	0,075***	0,075***	0,075***	0,074***	0,074***	0,075***	0,074***
	(8,396)	(8,397)	(8,400)	(8,367)	(8,326)	(8,385)	(8,266)
perceived cost	-0,064***	-0,064***	-0,064***	-0,064***	-0,064***	-0,064***	-0,063***
	(-12,761)	(-12,751)	(-12,753)	(-12,720)	(-12,731)	(-12,722)	(-12,635)
categorical grants	0,285***	0,285***	0,285***	0,285***	0,283***	0,285***	0,284***
	(49,201)	(49,113)	(49,090)	(49,113)	(48,901)	(49,140)	(49,052)
block grants	0,020***	0,021***	0,021***	0,021***	0,021***	0,021***	0,021***
	(7,279)	(7,496)	(7,513)	(7,497)	(7,499)	(7,498)	(7,597)
schooling	-0,017	-0,016	-0,016	-0,017	-0,016	-0,016	-0,017
	(-1,038)	(-1,011)	(-1,007)	(-1,041)	(-0,998)	(-1,015)	(-1,035)
occupation	0,010**	0,010**	0,010**	0,010**	0,010**	0,010**	0,010**
	(2,371)	(2,474)	(2,472)	(2,433)	(2,408)	(2,481)	(2,504)
men	-0,004	-0,004	-0,004	-0,004	-0,004	-0,004	-0,004
	(-1,304)	(-1,313)	(-1,311)	(-1,292)	(-1,280)	(-1,279)	(-1,231)
population	0,065***	0,066***	0,066***	0,065***	0,065***	0,066***	0,064***
	(3,085)	(3,122)	(3,129)	(3,092)	(3,077)	(3,133)	(3,062)
elderly	-0,021***	-0,021***	-0,021***	-0,021***	-0,020***	-0,021***	-0,021***
	(-6,014)	(-5,960)	(-5,960)	(-5,960)	(-5,873)	(-5,991)	(-5,882)
young	-0,009***	-0,009***	-0,009***	-0,009***	-0,009***	-0,009***	-0,009***
	(-4,850)	(-4,824)	(-4,828)	(-4,805)	(-4,707)	(-4,858)	(-4,711)
rural	0,001***	0,001***	0,001***	0,001***	0,001***	0,001***	0,001***
	(8,921)	(8,928)	(8,918)	(8,938)	(8,854)	(8,921)	(8,929)
second cicle	-0,001***	-0,001***	-0,001***	-0,001***	-0,001***	-0,001***	-0,001***
	(-7,738)	(-7,618)	(-7,610)	(-7,623)	(-7,614)	(-7,629)	(-7,571)
competition	0,0000	-0,0001	-0,0001	-0,0002	0,0000	-0,0002	-0,0003
	(-0,006)	(-0,019)	(-0,019)	(-0,028)	(0,001)	(-0,034)	(-0,048)
incumbent's age	0,018**	0,018**	0,018**	0,018**	0,018**	0,018**	0,018**
	(2,191)	(2,200)	(2,204)	(2,209)	(2,238)	(2,197)	(2,218)
incumbents' education	0,009***	0,009***	0,009***	0,009***	0,009***	0,009***	0,009***
	(2,698)	(2,692)	(2,686)	(2,697)	(2,678)	(2,676)	(2,698)
left	0,003	0,003	0,003	0,003	0,003	0,003	0,003
	(0,690)	(0,770)	(0,782)	(0,815)	(0,808)	(0,748)	(0,814)
incumbent women	0,013**	0,013**	0,013**	0,013**	0,013**	0,013**	0,013**
	(2,046)	(2,062)	(2,062)	(2,039)	(2,066)	(2,068)	(2,062)
aldermen's education	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001
	(0,713)	(0,714)	(0,708)	(0,697)	(0,704)	(0,697)	(0,697)
aldermen's age	0,013	0,013	0,013	0,013	0,011	0,013	0,012
	(0,597)	(0,571)	(0,572)	(0,602)	(0,513)	(0,580)	(0,543)
women in council	0,00004	0,00004	0,00004	0,00004	0,00004	0,00004	0,00004
	(0,236)	(0,235)	(0,233)	(0,225)	(0,239)	(0,242)	(0,252)
competition for seats	0,012*	0,012	0,011	0,011	0,011	0,012	0,012*
	(1,647)	(1,623)	(1,606)	(1,599)	(1,566)	(1,629)	(1,647)
fragmentation	0,0004*	0,0004*	0,0004*	0,0004*	0,0004*	0,0004*	0,0004*
	(1,859)	(1,891)	(1,888)	(1,884)	(1,866)	(1,869)	(1,882)
majority of seats	-0,006*	-0,006*	-0,005*	-0,005*	-0,005*	-0,006*	-0,005*
	(-1,854)	(-1,837)	(-1,829)	(-1,827)	(-1,767)	(-1,842)	(-1,814)
president's party	0,016***	0,016***	0,016***	0,016***	0,016***	0,016***	0,016***
	(3,362)	(3,280)	(3,270)	(3,290)	(3,263)	(3,284)	(3,266)
governor's party	-0,003	-0,003	-0,003	-0,003	-0,003	-0,003	-0,003
	(-0,950)	(-0,914)	(-0,922)	(-0,917)	(-0,904)	(-0,969)	(-0,905)
lameduck	0,003	0,003	0,003	0,003	0,003	0,003	0,003
	(0,969)	(0,955)	(0,957)	(0,950)	(0,984)	(0,957)	(0,948)
Wgdp	0,012	0,014	0,014	0,012	0,012	0,013	0,014
	(0,850)	(1,010)	(0,976)	(0,831)	(0,869)	(0,950)	(1,001)

	4a	4b	4c	4d	4e	4f	4g
	d= dummy of PNE (2002)	d= dummy of 2003	d= dummy of 2004	d= dummy of 2005	d= dummy of 2006	d= dummy of 2007	d= dummy of IDEB (2008)
Wwage	0,084***	0,083***	0,082***	0,081***	0,080***	0,082***	0,078***
	(5,583)	(5,496)	(5,489)	(5,411)	(5,356)	(5,485)	(5,223)
Wperceived cost	-0,004	-0,004	-0,004	-0,003	-0,004	-0,003	-0,002
	(-0,475)	(-0,477)	(-0,483)	(-0,405)	(-0,476)	(-0,414)	(-0,262)
Wcategorical grants	-0,065***	-0,072***	-0,072***	-0,072***	-0,063***	-0,072***	-0,071***
	(-6,774)	(-7,495)	(-7,492)	(-7,416)	(-6,562)	(-7,477)	(-7,350)
Wblock grants	0,021***	0,022***	0,022***	0,022***	0,022***	0,022***	0,023***
	(4,123)	(4,478)	(4,499)	(4,442)	(4,417)	(4,472)	(4,577)
Wschooling	0,071**	0,072**	0,071**	0,071**	0,070**	0,071**	0,069**
	(2,435)	(2,467)	(2,463)	(2,431)	(2,400)	(2,440)	(2,396)
Woccupation	0,019***	0,020***	0,020***	0,019***	0,019***	0,020***	0,019***
	(2,982)	(3,031)	(3,030)	(2,962)	(2,950)	(3,059)	(2,992)
Wmen	-0,006	-0,006	-0,006	-0,006	-0,006	-0,006	-0,005
	(-1,153)	(-1,095)	(-1,089)	(-1,083)	(-1,093)	(-1,051)	(-0,997)
Wpopulation	0,085***	0,090***	0,090***	0,087***	0,086***	0,088***	0,083***
	(2,718)	(2,880)	(2,900)	(2,793)	(2,781)	(2,829)	(2,654)
Welderly	-0,031***	-0,030***	-0,030***	-0,030***	-0,028***	-0,031***	-0,027***
	(-7,072)	(-6,863)	(-6,903)	(-6,818)	(-6,500)	(-7,010)	(-6,253)
Wyoung	-0,018***	-0,018***	-0,018***	-0,018***	-0,017***	-0,018***	-0,016***
	(-7,099)	(-6,887)	(-6,908)	(-6,820)	(-6,561)	(-6,994)	(-6,363)
Wrural	-0,0004**	-0,0004**	-0,0004**	-0,0004**	-0,0004**	-0,0004**	-0,0004**
	(-2,354)	(-2,381)	(-2,398)	(-2,405)	(-2,476)	(-2,387)	(-2,396)
Wsecond cicle	0,001***	0,001***	0,001***	0,001***	0,001***	0,001***	0,001***
	(5,520)	(5,676)	(5,678)	(5,647)	(5,686)	(5,649)	(5,744)
Wcompetition	-0,017*	-0,017*	-0,017*	-0,017*	-0,017*	-0,017*	-0,017*
	(-1,785)	(-1,798)	(-1,797)	(-1,792)	(-1,794)	(-1,820)	(-1,844)
Wincumbent's age	-0,033**	-0,033**	-0,033**	-0,033**	-0,033**	-0,034**	-0,034**
	(-2,217)	(-2,256)	(-2,262)	(-2,234)	(-2,230)	(-2,298)	(-2,272)
Wincumbents' education	-0,008	-0,008	-0,008	-0,008	-0,008	-0,008	-0,008
	(-1,324)	(-1,345)	(-1,355)	(-1,365)	(-1,389)	(-1,369)	(-1,389)
Wleft	-0,003	-0,004	-0,004	-0,004	-0,003	-0,004	-0,004
	(-0,513)	(-0,558)	(-0,564)	(-0,570)	(-0,391)	(-0,621)	(-0,538)
Wincumbent women	0,010	0,010	0,010	0,010	0,010	0,010	0,010
	(0,924)	(0,918)	(0,907)	(0,880)	(0,909)	(0,924)	(0,951)
Waldermen's education	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001
	(0,480)	(0,490)	(0,480)	(0,453)	(0,512)	(0,465)	(0,502)
Waldermen's age	-0,053	-0,052	-0,051	-0,049	-0,053	-0,051	-0,052
	(-1,292)	(-1,273)	(-1,254)	(-1,198)	(-1,293)	(-1,248)	(-1,275)
Wwomen in council	0,001***	0,001***	0,001***	0,001***	0,001***	0,001***	0,001***
	(3,937)	(3,919)	(3,921)	(3,925)	(3,911)	(3,947)	(3,928)
Wcompetition for seats	-0,031***	-0,032***	-0,032***	-0,034***	-0,033***	-0,032***	-0,032***
	(-2,684)	(-2,760)	(-2,801)	(-2,905)	(-2,867)	(-2,742)	(-2,787)
Wfragmentation	0,001	0,001	0,001	0,001	0,001	0,001	0,001
	(1,575)	(1,621)	(1,611)	(1,548)	(1,579)	(1,608)	(1,608)
Wmajority of seats	-0,005	-0,006	-0,006	-0,005	-0,005	-0,006	-0,006
	(-1,007)	(-1,040)	(-1,037)	(-1,011)	(-1,007)	(-1,054)	(-1,055)
Wpresident's party	0,021**	0,021**	0,021**	0,021**	0,020**	0,021**	0,021***
	(2,548)	(2,565)	(2,551)	(2,565)	(2,522)	(2,556)	(2,625)
Wgovernor's party	0,010**	0,010**	0,010**	0,010**	0,010**	0,010**	0,010**
	(2,162)	(2,120)	(2,103)	(2,150)	(2,123)	(2,024)	(2,081)
Wlameduck	-0,020***	-0,020***	-0,020***	-0,019***	-0,020***	-0,020***	-0,020***
	(-4,025)	(-4,037)	(-4,034)	(-3,990)	(-4,056)	(-4,026)	(-4,024)
Spatial Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.9324	0.9323	0.9323	0.9324	0.9325	0.9324	0.9324
N	25228	25228	25228	25228	25228	25228	25228
log-likelihood	12914.594	12897.732	12897.523	12905.047	12897.523	12901.902	12912.246

See notes on table A.1.2.

Table A.1.5 – School inputs as dependent variables (full results)

	Computer to pupil ratio		TV to pupil ratio		Log average school-day length		Log teacher to pupil ratio		Log average class size	
	6	7	8	9	10	11	12	13	14	15
	d= dummy of Prova Brasil 2007-2008	d = dummy of IDEB 2008	d= dummy of Prova Brasil 2007-2008	d = dummy of IDEB 2008	d= dummy of Prova Brasil 2007-2008	d = dummy of IDEB 2008	d= dummy of Prova Brasil 2007-2008	d = dummy of IDEB 2008	d= dummy of Prova Brasil 2007-2008	d = dummy of IDEB 2008
$\lambda_1 \, on \, dWy$	0.153***	0.143***	0.104***	0.142***	0.054***	0.062***	0.087***	0.097***	0.108***	0.109***
	(16.357)	(16.565)	(10.902)	(16.463)	(5.494)	(6.965)	(8.969)	(11.016)	(11.263)	(12.356)
$\lambda_2 \, on \, (1-d)Wy$	0.284***	0.389***	0.275***	0.267***	0.095***	0.093***	0.162***	0.180***	0.114***	0.118***
	(21.003)	(22.775)	(20.145)	(14.159)	(6.219)	(4.308)	(11.100)	(8.939)	(7.552)	(5.542)
gdp	0,062	0,066	0,010	0,011	0,001	0,001	-0,027***	-0,027***	0,001	0,001
	(0,933)	(0,993)	(0,471)	(0,479)	(0,479)	(0,477)	(-2,914)	(-2,922)	(0,098)	(0,102)
wage	-0,168***	-0,157***	0,068***	0,069***	-0,006***	-0,006***	-0,018**	-0,018**	0,007	0,007
	(-2,810)	(-2,631)	(3,384)	(3,398)	(-3,112)	(-3,116)	(-2,146)	(-2,164)	(0,900)	(0,901)
perceived cost	-0,028	-0,032	-0,027**	-0,026**	-0,0002	-0,0002	0,009*	0,009*	-0,009**	-0,009**
	(-0,837)	(-0,956)	(-2,369)	(-2,280)	(-0,202)	(-0,201)	(1,829)	(1,858)	(-2,064)	(-2,064)
categorical grants	0,027	0,026	-0,010	-0,008	0,001	0,001	0,057***	0,057***	-0,019***	-0,019***
	(0,686)	(0,652)	(-0,744)	(-0,624)	(0,829)	(0,829)	(10,264)	(10,307)	(-3,510)	(-3,511)
block grants	0,010	0,009	0,004	0,004	-0,0002	-0,0002	-0,003	-0,003	0,004*	0,004*
	(0,536)	(0,512)	(0,657)	(0,676)	(-0,330)	(-0,331)	(-1,027)	(-1,031)	(1,709)	(1,708)
schooling	-0,177	-0,181*	0,021	0,023	0,002	0,002	0,048***	0,048***	-0,014	-0,014
	(-1,645)	(-1,683)	(0,587)	(0,644)	(0,706)	(0,703)	(3,163)	(3,163)	(-0,978)	(-0,976)
occupation	-0,006	-0,008	-0,016*	-0,016*	0,0002	0,0002	0,013***	0,013***	-0,001	-0,001
	(-0,227)	(-0,295)	(-1,684)	(-1,671)	(0,188)	(0,179)	(3,348)	(3,357)	(-0,239)	(-0,241)
men	-0,133***	-0,132***	0,033***	0,034***	0,002**	0,002**	0,006*	0,006*	-0,005	-0,005
	(-5,676)	(-5,651)	(4,206)	(4,293)	(2,236)	(2,236)	(1,770)	(1,802)	(-1,490)	(-1,488)
population	-0,223	-0,225	-0,188***	-0,186***	0,004	0,004	-0,059***	-0,059***	0,056***	0,056***
	(-1,584)	(-1,599)	(-3,962)	(-3,915)	(0,853)	(0,851)	(-2,971)	(-2,989)	(2,905)	(2,911)
elderly	0,146***	0,143***	-0,058***	-0,058***	0,001	0,001	0,002	0,002	0,003	0,003
	(6,232)	(6,125)	(-7,287)	(-7,311)	(1,033)	(1,021)	(0,528)	(0,542)	(0,936)	(0,934)
young	-0,010	-0,010	-0,030***	-0,030***	0,001**	0,001**	-0,009***	-0,009***	0,007***	0,007***
	(-0,813)	(-0,759)	(-6,915)	(-6,952)	(2,491)	(2,484)	(-4,833)	(-4,830)	(3,841)	(3,836)
rural	-0,003***	-0,003***	0,001***	0,001***	-0,00001	-0,00001	0,001***	0,001***	-0,002***	-0,002***
	(-4,946)	(-4,949)	(6,518)	(6,526)	(-0,433)	(-0,435)	(10,287)	(10,294)	(-21,674)	(-21,675)
second cicle	-0,002*	-0,002*	-0,001***	-0,001***	0,0001**	0,0001**	0,0002	0,0002	0,002***	0,002***
	(-1,696)	(-1,755)	(-3,127)	(-3,135)	(2,048)	(2,052)	(1,037)	(1,032)	(14,671)	(14,673)
competition	-0,030	-0,028	0,012	0,011	-0,001	-0,001	0,0002	0,0002	-0,008*	-0,008*
	(-0,851)	(-0,804)	(1,024)	(0,961)	(-1,264)	(-1,260)	(0,044)	(0,045)	(-1,745)	(-1,746)
incumbent's age	0,115**	0,112**	0,039**	0,038**	-0,003*	-0,003*	0,001	0,001	-0,018**	-0,018**
	(2,109)	(2,067)	(2,159)	(2,096)	(-1,923)	(-1,923)	(0,139)	(0,144)	(-2,480)	(-2,478)

	Computer to pupil ratio		TV to pupil ratio		Log average school-day length		Log teacher to pupil ratio		Log average class size	
	6	7	8	9	10	11	12	13	14	15
	d= dummy of Prova Brasil 2007-2008	d = dummy of IDEB 2008	d= dummy of Prova Brasil 2007-2008	d = dummy of IDEB 2008	d= dummy of Prova Brasil 2007-2008	d = dummy of IDEB 2008	d= dummy of Prova Brasil 2007-2008	d = dummy of IDEB 2008	d= dummy of Prova Brasil 2007-2008	d = dummy of IDEB 2008
incumbents' education	0,046**	0,047**	-0,005	-0,005	-0,002**	-0,002**	0,008***	0,008***	0,002	0,002
	(2,113)	(2,142)	(-0,662)	(-0,685)	(-2,231)	(-2,230)	(2,612)	(2,615)	(0,596)	(0,596)
left	0,020	0,020	0,001	0,001	0,001	0,001	0,008**	0,008**	-0,015***	-0,015***
	(0,745)	(0,740)	(0,121)	(0,128)	(0,673)	(0,673)	(2,216)	(2,223)	(-4,088)	(-4,088)
incumbent women	-0,048	-0,048	0,006	0,006	-0,002	-0,002	-0,005	-0,005	-0,009*	-0,009*
	(-1,177)	(-1,169)	(0,421)	(0,457)	(-1,268)	(-1,271)	(-0,787)	(-0,783)	(-1,691)	(-1,692)
aldermen's education	-0,001	-0,001	-0,001**	-0,001**	0,00002	0,00002	0,0001	0,0001	-0,00004	-0,00004
	(-0,886)	(-0,849)	(-2,248)	(-2,283)	(0,787)	(0,798)	(1,083)	(1,069)	(-0,331)	(-0,330)
aldermen's age	0,033	0,040	-0,052	-0,052	-0,004	-0,004	-0,006	-0,006	-0,043**	-0,043**
	(0,224)	(0,269)	(-1,043)	(-1,035)	(-0,874)	(-0,871)	(-0,272)	(-0,282)	(-2,166)	(-2,166)
women in council	0,002	0,002	0,0004	0,0004	-0,0001	-0,0001*	-0,0002	-0,0002	-0,0005***	-0,0005***
	(1,602)	(1,636)	(1,105)	(1,104)	(-1,640)	(-1,650)	(-1,152)	(-1,162)	(-3,401)	(-3,403)
competition for seats	-0,263***	-0,266***	-0,039**	-0,037**	0,002	0,002	-0,0005	-0,0005	0,003	0,003
	(-5,553)	(-5,636)	(-2,421)	(-2,347)	(1,111)	(1,102)	(-0,074)	(-0,078)	(0,486)	(0,486)
fragmentation	0,003*	0,003*	0,001***	0,001***	0,00003	0,00003	0,001***	0,001***	-0,0002	-0,0002
	(1,890)	(1,937)	(2,596)	(2,622)	(0,717)	(0,716)	(4,570)	(4,551)	(-1,035)	(-1,035)
majority of seats	0,064***	0,064***	-0,011	-0,011	-0,001	-0,001	-0,011***	-0,011***	0,008***	0,008***
	(3,189)	(3,217)	(-1,624)	(-1,598)	(-1,114)	(-1,118)	(-3,879)	(-3,877)	(3,124)	(3,123)
president's party	0,010	0,010	0,032***	0,032***	-0,0005	-0,0005	-0,006	-0,007	-0,002	-0,002
	(0,296)	(0,317)	(2,905)	(2,873)	(-0,484)	(-0,491)	(-1,414)	(-1,423)	(-0,376)	(-0,377)
governor's party	0,016	0,017	-0,005	-0,005	0,0004	0,0004	-0,003	-0,003	0,004	0,004
	(0,854)	(0,911)	(-0,720)	(-0,811)	(0,612)	(0,621)	(-1,222)	(-1,214)	(1,349)	(1,351)
lameduck	-0,051***	-0,052***	0,019***	0,019***	0,0003	0,0003	-0,002	-0,002	0,007***	0,007***
	(-2,869)	(-2,896)	(3,141)	(3,166)	(0,511)	(0,519)	(-0,617)	(-0,622)	(2,811)	(2,810)
Wgdp	-0,162*	-0,157*	0,070**	0,073**	-0,007**	-0,007**	0,023*	0,023*	-0,013	-0,012
	(-1,689)	(-1,646)	(2,174)	(2,272)	(-2,303)	(-2,294)	(1,714)	(1,713)	(-0,965)	(-0,955)
Wwage	-0,602***	-0,579***	0,121***	0,124***	0,006*	0,005*	0,003	0,002	-0,019	-0,019
	(-5,882)	(-5,667)	(3,504)	(3,603)	(1,720)	(1,703)	(0,194)	(0,147)	(-1,384)	(-1,384)
Wperceived cost	-0,084	-0,101*	-0,043**	-0,041**	0,007***	0,007***	-0,003	-0,002	0,008	0,008
	(-1,594)	(-1,928)	(-2,443)	(-2,325)	(4,270)	(4,262)	(-0,377)	(-0,294)	(1,122)	(1,117)
Wcategorical grants	-0,184***	-0,188***	-0,012	-0,005	0,002	0,002	0,025***	0,025***	-0,001	-0,001
	(-2,842)	(-2,906)	(-0,557)	(-0,249)	(1,074)	(1,062)	(2,707)	(2,788)	(-0,073)	(-0,079)
Wblock grants	0,019	0,018	-0,007	-0,006	-0,0002	-0,0002	-0,010**	-0,010**	0,011**	0,011**
	(0,566)	(0,532)	(-0,594)	(-0,572)	(-0,223)	(-0,220)	(-2,042)	(-2,037)	(2,319)	(2,318)
Wschooling	-0,922***	-0,921***	-0,057	-0,048	-0,012*	-0,012*	-0,022	-0,022	-0,003	-0,003
	(-4,670)	(-4,676)	(-0,864)	(-0,726)	(-1,906)	(-1,920)	(-0,789)	(-0,779)	(-0,126)	(-0,129)

	Computer to pupil ratio		TV to pupil ratio		Log average school-day length		Log teacher to pupil ratio		Log average class size	
	6	7	8	9	10	11	12	13	14	15
	d= dummy of Prova Brasil 2007-2008	d = dummy of IDEB 2008	d= dummy of Prova Brasil 2007-2008	d = dummy of IDEB 2008	d= dummy of Prova Brasil 2007-2008	d = dummy of IDEB 2008	d= dummy of Prova Brasil 2007-2008	d = dummy of IDEB 2008	d= dummy of Prova Brasil 2007-2008	d = dummy of IDEB 2008
Woccupation	-0,140***	-0,141***	-0,006	-0,005	-0,001	-0,001	0,039***	0,039***	-0,016***	-0,016***
	(-3,108)	(-3,133)	(-0,396)	(-0,363)	(-0,355)	(-0,367)	(6,163)	(6,145)	(-2,656)	(-2,656)
Wmen	-0,049	-0,046	0,043***	0,045***	-0,002*	-0,002*	0,017***	0,017***	-0,0002	-0,0002
	(-1,243)	(-1,169)	(3,271)	(3,402)	(-1,787)	(-1,799)	(3,108)	(3,152)	(-0,042)	(-0,035)
Wpopulation	-0,420*	-0,434**	-0,157**	-0,147**	0,009	0,009	0,010	0,008	0,032	0,032
	(-1,894)	(-1,963)	(-2,099)	(-1,962)	(1,334)	(1,325)	(0,309)	(0,265)	(1,078)	(1,081)
Welderly	0,134***	0,125***	-0,069***	-0,072***	-0,003***	-0,003***	-0,025***	-0,025***	-0,003	-0,003
	(4,509)	(4,210)	(-6,866)	(-7,203)	(-3,725)	(-3,764)	(-5,981)	(-6,049)	(-0,843)	(-0,842)
Wyoung	0,040**	0,039**	-0,027***	-0,029***	-0,002***	-0,002***	-0,019***	-0,020***	0,006**	0,006**
	(2,252)	(2,198)	(-4,589)	(-4,916)	(-2,857)	(-2,872)	(-7,787)	(-7,933)	(2,316)	(2,324)
Wrural	-0,002	-0,001	-0,001***	-0,001**	-0,0001*	-0,0001*	-0,001***	-0,001***	0,001***	0,001***
	(-1,448)	(-1,367)	(-2,586)	(-2,567)	(-1,861)	(-1,862)	(-6,918)	(-6,918)	(4,037)	(4,033)
Wsecond cicle	0,001	0,001	0,001**	0,001**	0,0001	0,0001	0,0005**	0,0005**	-0,001***	-0,001***
	(0,621)	(0,567)	(2,145)	(2,184)	(1,552)	(1,542)	(2,024)	(2,000)	(-4,531)	(-4,528)
Wcompetition	0,189***	0,188***	-0,034	-0,037*	-0,001	-0,001	0,010	0,010	0,003	0,003
	(2,956)	(2,955)	(-1,563)	(-1,702)	(-0,585)	(-0,567)	(1,101)	(1,107)	(0,376)	(0,375)
Wincumbent's age	0,193*	0,193*	-0,015	-0,017	-0,008**	-0,008**	0,017	0,016	0,020	0,020
	(1,911)	(1,916)	(-0,443)	(-0,502)	(-2,428)	(-2,434)	(1,170)	(1,158)	(1,427)	(1,428)
Wincumbents' education	-0,004	-0,004	-0,012	-0,012	0,001	0,001	-0,001	-0,001	-0,003	-0,003
	(-0,108)	(-0,092)	(-0,858)	(-0,875)	(0,614)	(0,597)	(-0,121)	(-0,103)	(-0,594)	(-0,595)
Wleft	-0,138***	-0,138***	-0,058***	-0,058***	-0,004***	-0,004***	-0,009	-0,009	0,014**	0,014**
	(-2,993)	(-3,005)	(-3,742)	(-3,737)	(-2,817)	(-2,827)	(-1,325)	(-1,334)	(2,268)	(2,268)
Wincumbent women	0,032	0,028	-0,003	-0,002	0,003	0,003	0,027**	0,027**	-0,015	-0,015
	(0,415)	(0,370)	(-0,099)	(-0,081)	(1,233)	(1,217)	(2,516)	(2,525)	(-1,467)	(-1,468)
Waldermen's education	0,0005	0,0006	0,001**	0,001**	-0,0001	-0,0001	0,0001	0,0001	-0,0003	-0,0003
	(0,273)	(0,325)	(2,210)	(2,211)	(-1,358)	(-1,342)	(0,433)	(0,419)	(-1,146)	(-1,144)
Waldermen's age	0,208	0,235	-0,179*	-0,177*	-0,004	-0,004	-0,052	-0,053	0,091**	0,091**
	(0,746)	(0,843)	(-1,907)	(-1,880)	(-0,412)	(-0,403)	(-1,336)	(-1,352)	(2,400)	(2,399)
Wwomen in council	0,001	0,001	0,0004	0,0004	-0,0001	-0,0001	0,0001	0,0001	0,0001	0,0001
	(0,585)	(0,604)	(0,667)	(0,591)	(-1,160)	(-1,168)	(0,284)	(0,270)	(0,303)	(0,305)
Wcompetition for seats	-0,272***	-0,279***	-0,140***	-0,135***	0,004*	0,004*	-0,011	-0,011	0,006	0,006
	(-3,433)	(-3,535)	(-5,251)	(-5,068)	(1,781)	(1,776)	(-0,977)	(-0,983)	(0,528)	(0,528)
Wfragmentation	-0,004	-0,004	-0,002*	-0,002*	0,000**	0,000**	0,001***	0,001***	-0,001**	-0,001**
	(-1,590)	(-1,582)	(-1,769)	(-1,758)	(-2,210)	(-2,207)	(3,822)	(3,853)	(-2,310)	(-2,311)
Wmajority of seats	0,088**	0,090**	0,024*	0,024*	-0,004***	-0,004***	-0,001	-0,001	0,003	0,003

	Computer to pupil ratio		TV to pupil ratio		Log average school-day length		Log teacher to pupil ratio		Log average class size	
	6	7	8	9	10	11	12	13	14	15
	d= dummy of Prova Brasil 2007-2008	d = dummy of IDEB 2008	d= dummy of Prova Brasil 2007-2008	d = dummy of IDEB 2008	d= dummy of Prova Brasil 2007-2008	d = dummy of IDEB 2008	d= dummy of Prova Brasil 2007-2008	d = dummy of IDEB 2008	d= dummy of Prova Brasil 2007-2008	d = dummy of IDEB 2008
	(2,383)	(2,427)	(1,948)	(1,941)	(-3,092)	(-3,105)	(-0,134)	(-0,120)	(0,538)	(0,536)
Wpresident's party	0,125**	0,128**	0,028	0,028	0,002	0,002	-0,005	-0,005	-0,012	-0,012
	(2,262)	(2,325)	(1,530)	(1,522)	(1,096)	(1,089)	(-0,667)	(-0,671)	(-1,543)	(-1,544)
Wgovernor's party	0,037	0,038	-0,006	-0,007	0,001	0,001	-0,010**	-0,010**	0,014***	0,014***
	(1,118)	(1,159)	(-0,543)	(-0,649)	(1,005)	(1,020)	(-2,103)	(-2,103)	(3,035)	(3,037)
Wlameduck	-0,057*	-0,058*	-0,048***	-0,048***	-0,001	-0,001	0,001	0,001	0,014***	0,014***
	(-1,689)	(-1,710)	(-4,262)	(-4,232)	(-0,724)	(-0,715)	(0,169)	(0,171)	(3,056)	(3,053)
Spatial Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.7508	0.752	0.7922	0.7916	0.8549	0.8549	0.8319	0.8319	0.8922	0.8922
N	26334	26334	26334	26334	26334	26334	26334	26334	26334	26334
log-likelihood	-37053.149	-36988.687	-8328.6402	-8360.1332	54247.274	54245.59	14716.983	14715.353	15680.834	15680.883

See notes on table A.1.2.

Table A.1.6 – Full results of two regime models: assigning year dummies as different regimes and computer to pupil ratio as dependent variable

	7a	7b	7c	7d	7e	7f	7g
	d= dummy of PNE (2002)	d= dummy of year 2003	d= dummy of year 2004	d= dummy of year 2005	d= dummy of year 2006	d= dummy of year 2007	d= dummy of IDEB (2008)
$\lambda_1 \, on \, dWy$	0.191***	0.216***	0.224***	0.225***	0.223***	0.229***	0.143***
	(22.657)	(25.880)	(26.966)	(27.063)	(26.723)	(27.692)	(16.565)
$\lambda_2 \, on \, (1-d)Wy$	0.299***	0.152***	0.064***	0.053**	0.091***	0.097***	0.389***
	(15.844)	(7.340)	(2.971)	(2.412)	(4.210)	(4.631)	(22.775)
gdp	0,055	0,059	0,060	0,063	0,061	0,064	0,066
	(0,834)	(0,886)	(0,903)	(0,956)	(0,915)	(0,964)	(0,993)
wage	-0,170***	-0,170***	-0,172***	-0,170***	-0,169***	-0,167***	-0,157***
	(-2,834)	(-2,841)	(-2,870)	(-2,833)	(-2,828)	(-2,787)	(-2,631)
perceived cost	-0,019	-0,023	-0,022	-0,023	-0,025	-0,023	-0,032
	(-0,571)	(-0,684)	(-0,655)	(-0,671)	(-0,738)	(-0,677)	(-0,956)
categorical grants	0,027	0,026	0,029	0,026	0,027	0,026	0,026
	(0,674)	(0,659)	(0,732)	(0,666)	(0,684)	(0,657)	(0,652)
block grants	0,011	0,010	0,010	0,010	0,010	0,010	0,009
	(0,583)	(0,565)	(0,552)	(0,555)	(0,551)	(0,551)	(0,512)
schooling	-0,162	-0,171	-0,167	-0,167	-0,171	-0,169	-0,181*
	(-1,505)	(-1,587)	(-1,555)	(-1,550)	(-1,589)	(-1,573)	(-1,683)
occupation	-0,002	-0,004	-0,004	-0,004	-0,005	-0,005	-0,008
	(-0,085)	(-0,159)	(-0,160)	(-0,138)	(-0,179)	(-0,180)	(-0,295)
men	-0,135***	-0,135***	-0,134***	-0,134***	-0,134***	-0,135***	-0,132***
	(-5,730)	(-5,739)	(-5,708)	(-5,726)	(-5,708)	(-5,761)	(-5,651)
population	-0,208	-0,216	-0,213	-0,209	-0,216	-0,209	-0,225
	(-1,475)	(-1,526)	(-1,510)	(-1,482)	(-1,530)	(-1,484)	(-1,599)
elderly	0,151***	0,150***	0,150***	0,149***	0,148***	0,150***	0,143***
	(6,420)	(6,381)	(6,389)	(6,361)	(6,299)	(6,400)	(6,125)
young	-0,009	-0,010	-0,009	-0,010	-0,010	-0,009	-0,010
	(-0,734)	(-0,751)	(-0,733)	(-0,760)	(-0,792)	(-0,687)	(-0,759)
rural	-0,003***	-0,003***	-0,003***	-0,003***	-0,003***	-0,003***	-0,003***
	(-5,052)	(-4,985)	(-5,085)	(-4,973)	(-5,003)	(-5,034)	(-4,949)
second cicle	-0,002	-0,002	-0,002	-0,002	-0,002*	-0,002	-0,002*
	(-1,573)	(-1,610)	(-1,617)	(-1,610)	(-1,649)	(-1,602)	(-1,755)
competition	-0,034	-0,033	-0,034	-0,032	-0,032	-0,034	-0,028
	(-0,970)	(-0,931)	(-0,957)	(-0,911)	(-0,902)	(-0,951)	(-0,804)
incumbent's age	0,113**	0,115**	0,116**	0,113**	0,112**	0,113**	0,112**
	(2,085)	(2,122)	(2,128)	(2,074)	(2,071)	(2,090)	(2,067)
incumbents' education	0,047**	0,047**	0,046**	0,047**	0,047**	0,047**	0,047**
	(2,145)	(2,134)	(2,118)	(2,129)	(2,133)	(2,153)	(2,142)
left	0,022	0,022	0,021	0,022	0,021	0,022	0,020
	(0,814)	(0,794)	(0,763)	(0,808)	(0,776)	(0,810)	(0,740)
incumbent women	-0,046	-0,047	-0,046	-0,047	-0,047	-0,046	-0,048
	(-1,121)	(-1,149)	(-1,124)	(-1,140)	(-1,152)	(-1,121)	(-1,169)
aldermen's education	-0,001	-0,001	-0,001	-0,001	-0,001	-0,001	-0,001
	(-0,889)	(-0,891)	(-0,860)	(-0,898)	(-0,891)	(-0,866)	(-0,849)
aldermen's age	0,028	0,033	0,033	0,026	0,031	0,036	0,040
	(0,191)	(0,221)	(0,226)	(0,178)	(0,211)	(0,240)	(0,269)
women in council	0,002	0,002	0,002	0,002	0,002	0,002	0,002
	(1,555)	(1,567)	(1,568)	(1,544)	(1,582)	(1,556)	(1,636)
competition for seats	-0,254***	-0,257***	-0,256***	-0,256***	-0,258***	-0,255***	-0,266***
	(-5,363)	(-5,425)	(-5,416)	(-5,410)	(-5,461)	(-5,387)	(-5,636)
fragmentation	0,003*	0,003*	0,003**	0,003*	0,003*	0,003**	0,003*
	(1,951)	(1,928)	(1,975)	(1,914)	(1,926)	(1,993)	(1,937)
majority of seats	0,064***	0,064***	0,064***	0,063***	0,064***	0,065***	0,064***
	(3,205)	(3,228)	(3,208)	(3,173)	(3,187)	(3,241)	(3,217)
president's party	0,004	0,008	0,008	0,008	0,008	0,009	0,010
	(0,125)	(0,237)	(0,230)	(0,233)	(0,237)	(0,262)	(0,317)
governor's party	0,010	0,013	0,013	0,013	0,014	0,013	0,017
	(0,497)	(0,662)	(0,651)	(0,683)	(0,730)	(0,651)	(0,911)
lameduck	-0,052***	-0,052***	-0,052***	-0,051***	-0,051***	-0,052***	-0,052***
	(-2,883)	(-2,897)	(-2,894)	(-2,861)	(-2,861)	(-2,911)	(-2,896)

	7a	7b	7c	7d	7e	7f	7g
	d= dummy of PNE (2002)	d= dummy of year 2003	d= dummy of year 2004	d= dummy of year 2005	d= dummy of year 2006	d= dummy of year 2007	d= dummy of IDEB (2008)
Wgdp	-0,167*	-0,162*	-0,156	-0,144	-0,156	-0,141	-0,157*
	(-1,747)	(-1,687)	(-1,628)	(-1,502)	(-1,631)	(-1,468)	(-1,646)
Wwage	-0,614***	-0,616***	-0,620***	-0,607***	-0,611***	-0,615***	-0,579***
	(-5,992)	(-6,011)	(-6,053)	(-5,930)	(-5,970)	(-6,007)	(-5,667)
Wperceived cost	-0,055	-0,068	-0,065	-0,067	-0,071	-0,070	-0,101*
	(-1,047)	(-1,301)	(-1,235)	(-1,270)	(-1,358)	(-1,338)	(-1,928)
Wcategorical grants	-0,184***	-0,187***	-0,179***	-0,180***	-0,181***	-0,184***	-0,188***
	(-2,842)	(-2,887)	(-2,764)	(-2,787)	(-2,794)	(-2,839)	(-2,906)
Wblock grants	0,018	0,019	0,019	0,018	0,019	0,018	0,018
	(0,545)	(0,561)	(0,555)	(0,549)	(0,559)	(0,539)	(0,532)
Wschooling	-0,863***	-0,899***	-0,884***	-0,885***	-0,898***	-0,885***	-0,921***
	(-4,371)	(-4,551)	(-4,476)	(-4,480)	(-4,545)	(-4,484)	(-4,676)
Woccupation	-0,130***	-0,136***	-0,135***	-0,134***	-0,137***	-0,136***	-0,141***
	(-2,890)	(-3,032)	(-2,998)	(-2,977)	(-3,048)	(-3,035)	(-3,133)
Wmen	-0,054	-0,054	-0,053	-0,053	-0,051	-0,055	-0,046
	(-1,371)	(-1,366)	(-1,344)	(-1,341)	(-1,300)	(-1,393)	(-1,169)
Wpopulation	-0,370*	-0,391*	-0,379*	-0,370*	-0,400*	-0,372*	-0,434**
	(-1,670)	(-1,762)	(-1,711)	(-1,668)	(-1,802)	(-1,679)	(-1,963)
Welderly	0,156***	0,152***	0,151***	0,149***	0,145***	0,157***	0,125***
	(5,286)	(5,144)	(5,095)	(5,041)	(4,909)	(5,322)	(4,210)
Wyoung	0,045**	0,044**	0,044**	0,043**	0,043**	0,045***	0,039**
	(2,557)	(2,473)	(2,485)	(2,445)	(2,420)	(2,581)	(2,198)
Wrural	-0,002*	-0,002	-0,002*	-0,002	-0,002	-0,002*	-0,001
	(-1,719)	(-1,578)	(-1,805)	(-1,548)	(-1,558)	(-1,659)	(-1,367)
Wsecond cicle	0,001	0,001	0,001	0,001	0,001	0,001	0,001
	(0,873)	(0,770)	(0,775)	(0,738)	(0,716)	(0,781)	(0,567)
Wcompetition	0,180***	0,184***	0,181***	0,182***	0,185***	0,179***	0,188***
	(2,813)	(2,878)	(2,824)	(2,846)	(2,886)	(2,803)	(2,955)
Wincumbent's age	0,188*	0,196*	0,195*	0,187*	0,187*	0,195*	0,193*
	(1,853)	(1,931)	(1,928)	(1,844)	(1,852)	(1,923)	(1,916)
Wincumbents' education	-0,003	-0,002	-0,003	-0,005	-0,004	-0,002	-0,004
	(-0,070)	(-0,056)	(-0,083)	(-0,125)	(-0,092)	(-0,049)	(-0,092)
Wleft	-0,131***	-0,134***	-0,135***	-0,133***	-0,135***	-0,133***	-0,138***
	(-2,837)	(-2,916)	(-2,923)	(-2,883)	(-2,923)	(-2,889)	(-3,005)
Wincumbent women	0,042	0,037	0,039	0,039	0,036	0,039	0,028
	(0,549)	(0,482)	(0,514)	(0,508)	(0,475)	(0,506)	(0,370)
Waldermen's education	0,0004	0,0004	0,0004	0,0005	0,0005	0,0005	0,0006
	(0,239)	(0,236)	(0,248)	(0,282)	(0,299)	(0,287)	(0,325)
Waldermen's age	0,203	0,199	0,204	0,209	0,208	0,213	0,235
	(0,728)	(0,713)	(0,731)	(0,749)	(0,747)	(0,763)	(0,843)
Wwomen in council	0,001	0,001	0,001	0,001	0,001	0,001	0,001
	(0,512)	(0,568)	(0,578)	(0,460)	(0,540)	(0,539)	(0,604)
Wcompetition for seats	-0,245***	-0,263***	-0,261***	-0,242***	-0,257***	-0,256***	-0,279***
	(-3,097)	(-3,318)	(-3,291)	(-3,052)	(-3,249)	(-3,232)	(-3,535)
Wfragmentation	-0,004	-0,004	-0,004	-0,004	-0,004	-0,004	-0,004
	(-1,503)	(-1,526)	(-1,510)	(-1,535)	(-1,522)	(-1,462)	(-1,582)
Wmajority of seats	0,089**	0,090**	0,090**	0,087**	0,088**	0,091**	0,090**
	(2,410)	(2,431)	(2,429)	(2,351)	(2,358)	(2,440)	(2,427)
Wpresident's party	0,107*	0,119**	0,119**	0,118**	0,119**	0,123**	0,128**
	(1,949)	(2,165)	(2,154)	(2,137)	(2,156)	(2,230)	(2,325)
Wgovernor's party	0,018	0,028	0,028	0,028	0,031	0,028	0,038
	(0,538)	(0,844)	(0,833)	(0,845)	(0,924)	(0,840)	(1,159)
Wlameduck	-0,057*	-0,059*	-0,058*	-0,057*	-0,057*	-0,059*	-0,058*
	(-1,703)	(-1,735)	(-1,722)	(-1,675)	(-1,678)	(-1,750)	(-1,710)
Spatial Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.7507	0.7504	0.7507	0.7508	0.7506	0.7509	0.752
N	26334	26334	26334	26334	26334	26334	26334
log-likelihood	-37073.812	-37083.102	-37068.961	-37067.236	-37074.181	-37068.195	-36988.687

See notes on table A.1.2.

Table A.1.7 – Full results of two regime models: assigning year dummies as different regimes and TV to pupil ratio as dependent variable

	9a	9b	9c	9d	9e	9f	9g
	d= dummy of PNE (2002)	d= dummy of year 2003	d= dummy of year 2004	d= dummy of year 2005	d= dummy of year 2006	d= dummy of year 2007	d= dummy of IDEB (2008)
λ_1 *on* dWy	0.191***	0.177***	0.173***	0.166***	0.164***	0.142***	0.142***
	(22.584)	(20.760)	(20.308)	(19.363)	(19.121)	(16.520)	(16.463)
λ_2 *on* $(1-d)Wy$	-0.007	0.086***	0.096***	0.159***	0.171***	0.275***	0.267***
	(-0.311)	(4.013)	(4.504)	(7.636)	(8.282)	(14.565)	(14.159)
gdp	0,013	0,012	0,013	0,012	0,012	0,013	0,011
	(0,565)	(0,528)	(0,577)	(0,546)	(0,551)	(0,561)	(0,479)
wage	0,070***	0,070***	0,070***	0,070***	0,070***	0,070***	0,069***
	(3,470)	(3,462)	(3,482)	(3,459)	(3,465)	(3,466)	(3,398)
perceived cost	-0,025**	-0,026**	-0,026**	-0,026**	-0,026**	-0,027**	-0,026**
	(-2,233)	(-2,297)	(-2,299)	(-2,300)	(-2,295)	(-2,376)	(-2,280)
categorical grants	-0,010	-0,009	-0,009	-0,009	-0,009	-0,010	-0,008
	(-0,749)	(-0,677)	(-0,652)	(-0,670)	(-0,669)	(-0,778)	(-0,624)
block grants	0,004	0,004	0,004	0,004	0,004	0,004	0,004
	(0,654)	(0,669)	(0,691)	(0,681)	(0,681)	(0,667)	(0,676)
schooling	0,025	0,025	0,026	0,025	0,025	0,024	0,023
	(0,702)	(0,690)	(0,703)	(0,698)	(0,702)	(0,670)	(0,644)
occupation	-0,016*	-0,016*	-0,016*	-0,016*	-0,016*	-0,016*	-0,016*
	(-1,652)	(-1,694)	(-1,694)	(-1,712)	(-1,708)	(-1,733)	(-1,671)
men	0,034***	0,034***	0,034***	0,034***	0,034***	0,034***	0,034***
	(4,269)	(4,336)	(4,347)	(4,353)	(4,354)	(4,302)	(4,293)
population	-0,186***	-0,185***	-0,185***	-0,185***	-0,185***	-0,187***	-0,186***
	(-3,922)	(-3,901)	(-3,879)	(-3,897)	(-3,894)	(-3,928)	(-3,915)
elderly	-0,058***	-0,058***	-0,058***	-0,058***	-0,058***	-0,058***	-0,058***
	(-7,353)	(-7,347)	(-7,340)	(-7,354)	(-7,354)	(-7,348)	(-7,311)
young	-0,030***	-0,030***	-0,030***	-0,030***	-0,030***	-0,030***	-0,030***
	(-6,982)	(-6,977)	(-6,970)	(-6,985)	(-6,986)	(-6,967)	(-6,952)
rural	0,001***	0,001***	0,001***	0,001***	0,001***	0,001***	0,001***
	(6,455)	(6,492)	(6,526)	(6,495)	(6,495)	(6,480)	(6,526)
second cicle	-0,001***	-0,001***	-0,001***	-0,001***	-0,001***	-0,001***	-0,001***
	(-2,987)	(-3,095)	(-3,150)	(-3,120)	(-3,116)	(-3,106)	(-3,135)
competition	0,011	0,011	0,011	0,011	0,011	0,012	0,011
	(0,955)	(0,916)	(0,940)	(0,946)	(0,940)	(0,986)	(0,961)
incumbent's age	0,038**	0,038**	0,038**	0,038**	0,038**	0,039**	0,038**
	(2,105)	(2,052)	(2,056)	(2,072)	(2,067)	(2,110)	(2,096)
incumbents' education	-0,005	-0,005	-0,005	-0,005	-0,005	-0,005	-0,005
	(-0,681)	(-0,689)	(-0,690)	(-0,689)	(-0,690)	(-0,673)	(-0,685)
left	0,001	0,001	0,001	0,001	0,001	0,001	0,001
	(0,139)	(0,137)	(0,131)	(0,141)	(0,141)	(0,139)	(0,128)
incumbent women	0,006	0,007	0,007	0,007	0,007	0,006	0,006
	(0,467)	(0,470)	(0,494)	(0,472)	(0,476)	(0,450)	(0,457)
aldermen's education	-0,001**	-0,001**	-0,001**	-0,001**	-0,001**	-0,001**	-0,001**
	(-2,256)	(-2,307)	(-2,288)	(-2,295)	(-2,296)	(-2,271)	(-2,283)
aldermen's age	-0,054	-0,053	-0,052	-0,052	-0,052	-0,052	-0,052
	(-1,093)	(-1,054)	(-1,042)	(-1,035)	(-1,039)	(-1,044)	(-1,035)
women in council	0,0004	0,0004	0,0004	0,0004	0,0004	0,0004	0,0004
	(1,095)	(1,088)	(1,090)	(1,089)	(1,089)	(1,084)	(1,104)
competition for seats	-0,036**	-0,037**	-0,037**	-0,037**	-0,037**	-0,038**	-0,037**
	(-2,279)	(-2,327)	(-2,297)	(-2,314)	(-2,308)	(-2,358)	(-2,347)
fragmentation	0,001***	0,001***	0,001***	0,001***	0,001***	0,001***	0,001***
	(2,637)	(2,642)	(2,644)	(2,630)	(2,633)	(2,614)	(2,622)
majority of seats	-0,011	-0,011	-0,011	-0,011	-0,011	-0,011	-0,011
	(-1,574)	(-1,593)	(-1,592)	(-1,597)	(-1,595)	(-1,614)	(-1,598)
president's party	0,032***	0,031***	0,031***	0,031***	0,031***	0,031***	0,032***
	(2,956)	(2,817)	(2,859)	(2,844)	(2,844)	(2,862)	(2,873)
governor's party	-0,005	-0,006	-0,005	-0,005	-0,005	-0,005	-0,005
	(-0,771)	(-0,851)	(-0,826)	(-0,843)	(-0,844)	(-0,783)	(-0,811)
lameduck	0,019***	0,019***	0,019***	0,019***	0,019***	0,019***	0,019***
	(3,169)	(3,165)	(3,160)	(3,180)	(3,178)	(3,162)	(3,166)
Wgdp	0,080**	0,078**	0,080**	0,078**	0,079**	0,078**	0,073**

	9a	9b	9c	9d	9e	9f	9g
	d= dummy of PNE (2002)	d= dummy of year 2003	d= dummy of year 2004	d= dummy of year 2005	d= dummy of year 2006	d= dummy of year 2007	d= dummy of IDEB (2008)
	(2,468)	(2,423)	(2,489)	(2,426)	(2,442)	(2,405)	(2,272)
Wwage	0,128***	0,130***	0,131***	0,130***	0,130***	0,129***	0,124***
	(3,720)	(3,772)	(3,793)	(3,762)	(3,774)	(3,733)	(3,603)
Wperceived cost	-0,040**	-0,043**	-0,043**	-0,042**	-0,042**	-0,044**	-0,041**
	(-2,292)	(-2,407)	(-2,403)	(-2,402)	(-2,396)	(-2,517)	(-2,325)
Wcategorical grants	-0,010	-0,011	-0,008	-0,009	-0,009	-0,015	-0,005
	(-0,477)	(-0,486)	(-0,364)	(-0,396)	(-0,395)	(-0,684)	(-0,249)
Wblock grants	-0,005	-0,007	-0,006	-0,007	-0,006	-0,007	-0,006
	(-0,481)	(-0,605)	(-0,571)	(-0,577)	(-0,575)	(-0,595)	(-0,572)
Wschooling	-0,040	-0,042	-0,041	-0,042	-0,041	-0,047	-0,048
	(-0,599)	(-0,633)	(-0,618)	(-0,630)	(-0,619)	(-0,705)	(-0,726)
Woccupation	-0,006	-0,005	-0,005	-0,006	-0,006	-0,006	-0,005
	(-0,389)	(-0,349)	(-0,359)	(-0,394)	(-0,387)	(-0,426)	(-0,363)
Wmen	0,045***	0,046***	0,046***	0,047***	0,047***	0,046***	0,045***
	(3,413)	(3,475)	(3,503)	(3,519)	(3,520)	(3,450)	(3,402)
Wpopulation	-0,155**	-0,145*	-0,142*	-0,146*	-0,145*	-0,153**	-0,147**
	(-2,070)	(-1,936)	(-1,902)	(-1,946)	(-1,939)	(-2,044)	(-1,962)
Welderly	-0,071***	-0,074***	-0,074***	-0,075***	-0,075***	-0,073***	-0,072***
	(-7,164)	(-7,397)	(-7,437)	(-7,516)	(-7,514)	(-7,334)	(-7,203)
Wyoung	-0,030***	-0,030***	-0,030***	-0,031***	-0,031***	-0,029***	-0,029***
	(-4,993)	(-5,096)	(-5,097)	(-5,146)	(-5,154)	(-4,961)	(-4,916)
Wrural	-0,001***	-0,001***	-0,001**	-0,001***	-0,001***	-0,001***	-0,001**
	(-2,684)	(-2,623)	(-2,521)	(-2,615)	(-2,611)	(-2,641)	(-2,567)
Wsecond cicle	0,001**	0,001**	0,001**	0,001**	0,001**	0,001**	0,001**
	(2,346)	(2,303)	(2,263)	(2,262)	(2,273)	(2,258)	(2,184)
Wcompetition	-0,037*	-0,039*	-0,039*	-0,038*	-0,038*	-0,036*	-0,037*
	(-1,728)	(-1,788)	(-1,793)	(-1,760)	(-1,772)	(-1,676)	(-1,702)
Wincumbent's age	-0,016	-0,019	-0,019	-0,018	-0,018	-0,017	-0,017
	(-0,458)	(-0,557)	(-0,550)	(-0,526)	(-0,531)	(-0,490)	(-0,502)
Wincumbents' education	-0,011	-0,012	-0,012	-0,012	-0,012	-0,012	-0,012
	(-0,819)	(-0,880)	(-0,873)	(-0,874)	(-0,873)	(-0,859)	(-0,875)
Wleft	-0,058***	-0,057***	-0,057***	-0,058***	-0,058***	-0,057***	-0,058***
	(-3,758)	(-3,680)	(-3,706)	(-3,709)	(-3,707)	(-3,703)	(-3,737)
Wincumbent women	-0,001	-0,002	-0,001	-0,002	-0,002	-0,002	-0,002
	(-0,034)	(-0,074)	(-0,057)	(-0,078)	(-0,074)	(-0,089)	(-0,081)
Waldermen's education	0,001**	0,001**	0,001**	0,001**	0,001**	0,001**	0,001**
	(2,237)	(2,216)	(2,215)	(2,229)	(2,228)	(2,232)	(2,211)
Waldermen's age	-0,184**	-0,179*	-0,177*	-0,176*	-0,177*	-0,178*	-0,177*
	(-1,963)	(-1,902)	(-1,878)	(-1,875)	(-1,879)	(-1,895)	(-1,880)
Wwomen in council	0,0004	0,0004	0,0004	0,0004	0,0004	0,0004	0,0004
	(0,537)	(0,542)	(0,560)	(0,541)	(0,538)	(0,584)	(0,591)
Wcompetition for seats	-0,135***	-0,132***	-0,132***	-0,133***	-0,133***	-0,136***	-0,135***
	(-5,055)	(-4,966)	(-4,948)	(-4,995)	(-4,981)	(-5,107)	(-5,068)
Wfragmentation	-0,002*	-0,001*	-0,002*	-0,002*	-0,002*	-0,002*	-0,002*
	(-1,761)	(-1,750)	(-1,752)	(-1,793)	(-1,787)	(-1,807)	(-1,758)
Wmajority of seats	0,025**	0,024*	0,025**	0,024*	0,024*	0,024*	0,024*
	(1,964)	(1,937)	(1,963)	(1,947)	(1,948)	(1,956)	(1,941)
Wpresident's party	0,033*	0,026	0,028	0,028	0,028	0,028	0,028
	(1,805)	(1,416)	(1,482)	(1,492)	(1,494)	(1,492)	(1,522)
Wgovernor's party	-0,008	-0,008	-0,007	-0,008	-0,008	-0,007	-0,007
	(-0,697)	(-0,703)	(-0,659)	(-0,688)	(-0,692)	(-0,619)	(-0,649)
Wlameduck	-0,049***	-0,048***	-0,048***	-0,048***	-0,048***	-0,049***	-0,048***
	(-4,293)	(-4,252)	(-4,240)	(-4,241)	(-4,243)	(-4,270)	(-4,232)
Spatial Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.792	0.7914	0.7913	0.7912	0.7912	0.7916	0.7916
N	26334	26334	26334	26334	26334	26334	26334
log-likelihood	-8346.6284	-8371.7517	-8374.364	-8378.4992	-8378.4895	-8359.2063	-8360.1332

See notes on table A.1.2.

Table A.1.8 – Full results of two regime models: assigning year dummies as different regimes and log average school-day length as dependent variable

	11a	11b	11c	11d	11e	11f	11g
	d= dummy of PNE (2002)	d= dummy of year 2003	d= dummy of year 2004	d= dummy of year 2005	d= dummy of year 2006	d= dummy of year 2007	d= dummy of IDEB (2008)
λ_1 *on* dWy	0.059***	0.071***	0.076***	0.070***	0.070***	0.061***	0.062***
	(6.645)	(7.922)	(8.503)	(7.868)	(7.867)	(6.878)	(6.965)
λ_2 *on* $(1-d)Wy$	0.108***	0.047**	0.008	0.045**	0.047**	0.097***	0.093***
	(5.014)	(2.138)	(0.363)	(2.056)	(2.119)	(4.492)	(4.308)
gdp	0,001	0,001	0,001	0,001	0,001	0,001	0,001
	(0,476)	(0,472)	(0,466)	(0,465)	(0,469)	(0,463)	(0,477)
wage	-0,006***	-0,006***	-0,006***	-0,006***	-0,006***	-0,006***	-0,006***
	(-3,129)	(-3,117)	(-3,125)	(-3,114)	(-3,118)	(-3,112)	(-3,116)
perceived cost	-0,0002	-0,0002	-0,0002	-0,0002	-0,0002	-0,0002	-0,0002
	(-0,194)	(-0,191)	(-0,203)	(-0,197)	(-0,196)	(-0,193)	(-0,201)
categorical grants	0,001	0,001	0,001	0,001	0,001	0,001	0,001
	(0,834)	(0,832)	(0,846)	(0,843)	(0,828)	(0,839)	(0,829)
block grants	-0,0002	-0,0002	-0,0002	-0,0002	-0,0002	-0,0002	-0,0002
	(-0,333)	(-0,331)	(-0,336)	(-0,329)	(-0,333)	(-0,332)	(-0,331)
schooling	0,002	0,002	0,002	0,002	0,002	0,002	0,002
	(0,696)	(0,697)	(0,698)	(0,698)	(0,698)	(0,696)	(0,703)
occupation	0,0002	0,0002	0,0001	0,0002	0,0002	0,0002	0,0002
	(0,172)	(0,181)	(0,167)	(0,190)	(0,188)	(0,195)	(0,179)
men	0,002**	0,002**	0,002**	0,002**	0,002**	0,002**	0,002**
	(2,237)	(2,240)	(2,225)	(2,239)	(2,235)	(2,237)	(2,236)
population	0,004	0,004	0,004	0,004	0,004	0,004	0,004
	(0,825)	(0,839)	(0,831)	(0,841)	(0,849)	(0,842)	(0,851)
elderly	0,001	0,001	0,001	0,001	0,001	0,001	0,001
	(1,010)	(1,016)	(1,015)	(1,011)	(1,018)	(1,019)	(1,021)
young	0,001**	0,001**	0,001**	0,001**	0,001**	0,001**	0,001**
	(2,473)	(2,480)	(2,484)	(2,477)	(2,482)	(2,483)	(2,484)
rural	-0,00001	-0,00001	-0,00001	-0,00001	-0,00001	-0,00001	-0,00001
	(-0,432)	(-0,432)	(-0,435)	(-0,431)	(-0,443)	(-0,436)	(-0,435)
second cicle	0,0001**	0,0001**	0,0001**	0,0001**	0,0001**	0,0001**	0,0001**
	(2,058)	(2,055)	(2,065)	(2,047)	(2,056)	(2,053)	(2,052)
competition	-0,001	-0,001	-0,001	-0,001	-0,001	-0,001	-0,001
	(-1,254)	(-1,259)	(-1,252)	(-1,261)	(-1,259)	(-1,262)	(-1,260)
incumbent's age	-0,003*	-0,003*	-0,003*	-0,003*	-0,003*	-0,003*	-0,003*
	(-1,926)	(-1,922)	(-1,938)	(-1,921)	(-1,923)	(-1,923)	(-1,923)
incumbents' education	-0,002**	-0,002**	-0,002**	-0,002**	-0,002**	-0,002**	-0,002**
	(-2,234)	(-2,232)	(-2,228)	(-2,234)	(-2,227)	(-2,230)	(-2,230)
left	0,001	0,001	0,001	0,001	0,001	0,001	0,001
	(0,682)	(0,672)	(0,672)	(0,677)	(0,674)	(0,673)	(0,673)
incumbent women	-0,002	-0,002	-0,002	-0,002	-0,002	-0,002	-0,002
	(-1,284)	(-1,270)	(-1,280)	(-1,277)	(-1,272)	(-1,271)	(-1,271)
aldermen's education	0,00003	0,00002	0,00003	0,00003	0,00002	0,00002	0,00002
	(0,801)	(0,797)	(0,815)	(0,800)	(0,798)	(0,796)	(0,798)
aldermen's age	-0,004	-0,004	-0,004	-0,004	-0,004	-0,004	-0,004
	(-0,856)	(-0,861)	(-0,872)	(-0,874)	(-0,868)	(-0,871)	(-0,871)
women in council	-0,0001*	-0,0001*	-0,000	-0,0001*	-0,0001*	-0,0001*	-0,0001*
	(-1,647)	(-1,656)	(-1,643)	(-1,656)	(-1,647)	(-1,649)	(-1,650)
competition for seats	0,002	0,002	0,002	0,002	0,002	0,002	0,002
	(1,093)	(1,098)	(1,102)	(1,097)	(1,099)	(1,102)	(1,102)
fragmentation	0,00003	0,00003	0,00003	0,00003	0,00003	0,00003	0,00003
	(0,732)	(0,716)	(0,725)	(0,718)	(0,717)	(0,716)	(0,716)
majority of seats	-0,001	-0,001	-0,001	-0,001	-0,001	-0,001	-0,001
	(-1,109)	(-1,116)	(-1,122)	(-1,118)	(-1,117)	(-1,117)	(-1,118)
president's party	-0,0005	-0,0005	-0,0005	-0,0005	-0,0005	-0,0005	-0,0005
	(-0,487)	(-0,491)	(-0,496)	(-0,488)	(-0,491)	(-0,489)	(-0,491)
governor's party	0,0004	0,0004	0,0004	0,0004	0,0004	0,0004	0,0004
	(0,645)	(0,629)	(0,618)	(0,622)	(0,630)	(0,619)	(0,621)
lameduck	0,0003	0,0003	0,0003	0,0003	0,0003	0,0003	0,0003
	(0,531)	(0,524)	(0,537)	(0,520)	(0,519)	(0,519)	(0,519)
Wgdp	-0,007**	-0,007**	-0,007**	-0,007**	-0,007**	-0,007**	-0,007**

	11a	11b	11c	11d	11e	11f	11g
	d= dummy of PNE (2002)	d= dummy of year 2003	d= dummy of year 2004	d= dummy of year 2005	d= dummy of year 2006	d= dummy of year 2007	d= dummy of IDEB (2008)
	(-2,299)	(-2,306)	(-2,286)	(-2,321)	(-2,309)	(-2,326)	(-2,294)
Wwage	0,005*	0,005*	0,005*	0,005*	0,005*	0,005*	0,005*
	(1,673)	(1,695)	(1,692)	(1,688)	(1,703)	(1,705)	(1,703)
Wperceived cost	0,007***	0,007***	0,007***	0,007***	0,007***	0,007***	0,007***
	(4,297)	(4,274)	(4,248)	(4,283)	(4,278)	(4,280)	(4,262)
Wcategorical grants	0,002	0,002	0,002	0,002	0,002	0,002	0,002
	(1,089)	(1,078)	(1,075)	(1,086)	(1,083)	(1,098)	(1,062)
Wblock grants	-0,0003	-0,0002	-0,0002	-0,0002	-0,0002	-0,0002	-0,0002
	(-0,239)	(-0,222)	(-0,232)	(-0,225)	(-0,223)	(-0,224)	(-0,220)
Wschooling	-0,012*	-0,012*	-0,012*	-0,012*	-0,012*	-0,012*	-0,012*
	(-1,946)	(-1,914)	(-1,945)	(-1,924)	(-1,923)	(-1,911)	(-1,920)
Woccupation	-0,001	-0,001	-0,001	-0,001	-0,001	0,000	-0,001
	(-0,395)	(-0,373)	(-0,379)	(-0,360)	(-0,365)	(-0,353)	(-0,367)
Wmen	-0,002*	-0,002*	-0,002*	-0,002*	-0,002*	-0,002*	-0,002*
	(-1,787)	(-1,798)	(-1,788)	(-1,802)	(-1,805)	(-1,798)	(-1,799)
Wpopulation	0,009	0,009	0,009	0,009	0,009	0,009	0,009
	(1,304)	(1,330)	(1,314)	(1,328)	(1,332)	(1,342)	(1,325)
Welderly	-0,003***	-0,003***	-0,003***	-0,003***	-0,003***	-0,003***	-0,003***
	(-3,789)	(-3,783)	(-3,782)	(-3,770)	(-3,770)	(-3,758)	(-3,764)
Wyoung	-0,002***	-0,002***	-0,002***	-0,002***	-0,002***	-0,002***	-0,002***
	(-2,881)	(-2,873)	(-2,885)	(-2,873)	(-2,875)	(-2,867)	(-2,872)
Wrural	-0,0001*	-0,0001*	-0,0001*	-0,0001*	-0,0001*	-0,0001*	-0,0001*
	(-1,850)	(-1,863)	(-1,881)	(-1,848)	(-1,860)	(-1,860)	(-1,862)
Wsecond cicle	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001
	(1,517)	(1,543)	(1,523)	(1,532)	(1,540)	(1,544)	(1,542)
Wcompetition	-0,001	-0,001	-0,001	-0,001	-0,001	-0,001	-0,001
	(-0,540)	(-0,555)	(-0,536)	(-0,566)	(-0,567)	(-0,570)	(-0,567)
Wincumbent's age	-0,008**	-0,008**	-0,008**	-0,008**	-0,008**	-0,008**	-0,008**
	(-2,433)	(-2,432)	(-2,464)	(-2,433)	(-2,433)	(-2,434)	(-2,434)
Wincumbents' education	0,001	0,001	0,001	0,001	0,001	0,001	0,001
	(0,590)	(0,588)	(0,573)	(0,602)	(0,595)	(0,599)	(0,597)
Wleft	-0,004***	-0,004***	-0,004***	-0,004***	-0,004***	-0,004***	-0,004***
	(-2,819)	(-2,820)	(-2,861)	(-2,826)	(-2,826)	(-2,826)	(-2,827)
Wincumbent women	0,003	0,003	0,003	0,003	0,003	0,003	0,003
	(1,191)	(1,214)	(1,176)	(1,214)	(1,213)	(1,219)	(1,217)
Waldermen's education	-0,0001	-0,0001	-0,0001	-0,0001	-0,0001	-0,0001	-0,0001
	(-1,334)	(-1,331)	(-1,341)	(-1,343)	(-1,341)	(-1,346)	(-1,342)
Waldermen's age	-0,004	-0,003	-0,004	-0,003	-0,004	-0,004	-0,004
	(-0,424)	(-0,399)	(-0,416)	(-0,399)	(-0,404)	(-0,401)	(-0,403)
Wwomen in council	-0,0001	-0,0001	-0,0001	-0,0001	-0,0001	-0,0001	-0,0001
	(-1,157)	(-1,161)	(-1,173)	(-1,168)	(-1,170)	(-1,166)	(-1,168)
Wcompetition for seats	0,004*	0,004*	0,004*	0,004*	0,004*	0,004*	0,004*
	(1,763)	(1,775)	(1,776)	(1,766)	(1,771)	(1,774)	(1,776)
Wfragmentation	0,000**	0,000**	0,000**	0,000**	0,000**	0,000**	0,000**
	(-2,205)	(-2,203)	(-2,203)	(-2,204)	(-2,212)	(-2,207)	(-2,207)
Wmajority of seats	-0,004***	-0,004***	-0,004***	-0,004***	-0,004***	-0,004***	-0,004***
	(-3,095)	(-3,101)	(-3,115)	(-3,107)	(-3,107)	(-3,103)	(-3,105)
Wpresident's party	0,002	0,002	0,002	0,002	0,002	0,002	0,002
	(1,075)	(1,093)	(1,075)	(1,091)	(1,078)	(0,463)	(1,089)
Wgovernor's party	0,001	0,001	0,001	0,001	0,001	0,001	0,001
	(1,055)	(1,026)	(1,019)	(1,029)	(1,035)	(1,019)	(1,020)
Wlameduck	-0,001	-0,001	-0,001	-0,001	-0,001	-0,001	-0,001
	(-0,732)	(-0,717)	(-0,715)	(-0,711)	(-0,718)	(-0,716)	(-0,715)
Spatial Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.8549	0.8549	0.8549	0.8549	0.8549	0.8549	0.8549
N	26334	26334	26334	26334	26334	26334	26334
log-likelihood	54246.897	54245.172	54248.187	54245.145	54245.112	54245.877	54245.59

See notes on table A.1.2.

Table A.1.9 – Full results of two regime models: assigning year dummies as different regimes and log teacher to pupil ratio as dependent variable

	13a	13b	13c	13d	13e	13f	13g
	d= dummy of PNE (2002)	d= dummy of year 2003	d= dummy of year 2004	d= dummy of year 2005	d= dummy of year 2006	d= dummy of year 2007	d= dummy of IDEB (2008)
λ_1 on dWy	0.110***	0.117***	0.120***	0.118***	0.115***	0.107***	0.097***
	(12.589)	(13.337)	(13.777)	(13.542)	(13.160)	(12.284)	(11.016)
λ_2 on $(1-d)Wy$	0.121***	0.081***	0.061***	0.061***	0.090***	0.138***	0.180***
	(5.782)	(3.781)	(2.829)	(2.785)	(4.152)	(6.721)	(8.939)
gdp	-0,028***	-0,027***	-0,027***	-0,028***	-0,028***	-0,028***	-0,027***
	(-2,966)	(-2,950)	(-2,951)	(-2,974)	(-2,963)	(-2,962)	(-2,922)
wage	-0,018**	-0,018**	-0,018**	-0,018**	-0,018**	-0,018**	-0,018**
	(-2,120)	(-2,130)	(-2,107)	(-2,122)	(-2,126)	(-2,115)	(-2,164)
perceived cost	0,009*	0,009*	0,009*	0,009*	0,009*	0,009*	0,009*
	(1,881)	(1,877)	(1,868)	(1,880)	(1,873)	(1,867)	(1,858)
categorical grants	0,057***	0,057***	0,057***	0,057***	0,057***	0,057***	0,057***
	(10,343)	(10,349)	(10,309)	(10,336)	(10,331)	(10,321)	(10,307)
block grants	-0,003	-0,003	-0,003	-0,003	-0,003	-0,003	-0,003
	(-1,027)	(-1,034)	(-1,021)	(-1,021)	(-1,028)	(-1,029)	(-1,031)
schooling	0,047***	0,047***	0,047***	0,047***	0,047***	0,047***	0,048***
	(3,119)	(3,121)	(3,131)	(3,123)	(3,125)	(3,123)	(3,163)
occupation	0,013***	0,013***	0,013***	0,013***	0,013***	0,013***	0,013***
	(3,366)	(3,365)	(3,374)	(3,346)	(3,365)	(3,369)	(3,357)
men	0,006*	0,006*	0,006*	0,006*	0,006*	0,006*	0,006*
	(1,839)	(1,831)	(1,829)	(1,827)	(1,831)	(1,823)	(1,802)
population	-0,059***	-0,059***	-0,059***	-0,059***	-0,059***	-0,059***	-0,059***
	(-2,959)	(-2,952)	(-2,956)	(-2,968)	(-2,965)	(-2,950)	(-2,989)
elderly	0,002	0,002	0,002	0,002	0,002	0,002	0,002
	(0,460)	(0,472)	(0,472)	(0,464)	(0,467)	(0,459)	(0,542)
young	-0,009***	-0,009***	-0,009***	-0,009***	-0,009***	-0,009***	-0,009***
	(-4,934)	(-4,926)	(-4,909)	(-4,922)	(-4,921)	(-4,929)	(-4,830)
rural	0,001***	0,001***	0,001***	0,001***	0,001***	0,001***	0,001***
	(10,303)	(10,295)	(10,299)	(10,309)	(10,302)	(10,297)	(10,294)
second cicle	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0002
	(0,992)	(1,012)	(0,970)	(0,992)	(1,002)	(1,000)	(1,032)
competition	0,0002	0,0002	0,0003	0,0002	0,0002	0,0002	0,0002
	(0,046)	(0,046)	(0,051)	(0,034)	(0,048)	(0,048)	(0,045)
incumbent's age	0,001	0,001	0,001	0,001	0,001	0,001	0,001
	(0,140)	(0,140)	(0,141)	(0,133)	(0,143)	(0,137)	(0,144)
incumbents' education	0,008***	0,008***	0,008***	0,008***	0,008***	0,008***	0,008***
	(2,624)	(2,625)	(2,635)	(2,615)	(2,619)	(2,621)	(2,615)
left	0,008**	0,008**	0,008**	0,008**	0,008**	0,008**	0,008**
	(2,205)	(2,206)	(2,206)	(2,208)	(2,207)	(2,203)	(2,223)
incumbent women	-0,005	-0,004	-0,005	-0,005	-0,005	-0,005	-0,005
	(-0,784)	(-0,774)	(-0,797)	(-0,790)	(-0,784)	(-0,782)	(-0,783)
aldermen's education	0,0001	0,0001	0,0002	0,0001	0,0001	0,0001	0,0001
	(1,075)	(1,071)	(1,091)	(1,076)	(1,073)	(1,078)	(1,069)
aldermen's age	-0,006	-0,006	-0,006	-0,005	-0,006	-0,006	-0,006
	(-0,272)	(-0,280)	(-0,277)	(-0,251)	(-0,274)	(-0,270)	(-0,282)
women in council	-0,0002	-0,0002	-0,0002	-0,0002	-0,0002	-0,0002	-0,0002
	(-1,127)	(-1,127)	(-1,116)	(-1,145)	(-1,132)	(-1,128)	(-1,162)
competition for seats	-0,0004	-0,0003	-0,0005	-0,0005	-0,0004	-0,0004	-0,0005
	(-0,059)	(-0,049)	(-0,068)	(-0,068)	(-0,062)	(-0,056)	(-0,078)
fragmentation	0,001***	0,001***	0,001***	0,001***	0,001***	0,001***	0,001***
	(4,527)	(4,538)	(4,532)	(4,526)	(4,532)	(4,539)	(4,551)
majority of seats	-0,011***	-0,011***	-0,011***	-0,011***	-0,011***	-0,011***	-0,011***
	(-3,884)	(-3,887)	(-3,884)	(-3,884)	(-3,881)	(-3,882)	(-3,877)
president's party	-0,006	-0,006	-0,006	-0,006	-0,007	-0,007	-0,007
	(-1,417)	(-1,412)	(-1,416)	(-1,414)	(-1,421)	(-1,419)	(-1,423)
governor's party	-0,003	-0,003	-0,003	-0,003	-0,003	-0,003	-0,003
	(-1,209)	(-1,219)	(-1,198)	(-1,200)	(-1,215)	(-1,215)	(-1,214)
lameduck	-0,002	-0,002	-0,002	-0,002	-0,002	-0,002	-0,002
	(-0,617)	(-0,612)	(-0,628)	(-0,615)	(-0,616)	(-0,612)	(-0,622)
Wgdp	0,023*	0,023*	0,024*	0,023*	0,023*	0,023*	0,023*

	13a	13b	13c	13d	13e	13f	13g
	d= dummy of PNE (2002)	d= dummy of year 2003	d= dummy of year 2004	d= dummy of year 2005	d= dummy of year 2006	d= dummy of year 2007	d= dummy of IDEB (2008)
	(1,737)	(1,741)	(1,753)	(1,695)	(1,740)	(1,732)	(1,713)
Wwage	0,003	0,003	0,004	0,003	0,003	0,003	0,002
	(0,215)	(0,205)	(0,247)	(0,203)	(0,208)	(0,223)	(0,147)
Wperceived cost	-0,003	-0,002	-0,003	-0,003	-0,003	-0,003	-0,002
	(-0,341)	(-0,339)	(-0,357)	(-0,345)	(-0,347)	(-0,367)	(-0,294)
Wcategorical grants	0,025***	0,025***	0,025***	0,026***	0,025***	0,025***	0,025***
	(2,796)	(2,796)	(2,766)	(2,799)	(2,778)	(2,755)	(2,788)
Wblock grants	-0,010**	-0,010**	-0,010**	-0,010**	-0,010**	-0,010**	-0,010**
	(-2,052)	(-2,070)	(-2,044)	(-2,036)	(-2,046)	(-2,056)	(-2,037)
Wschooling	-0,022	-0,021	-0,022	-0,022	-0,022	-0,021	-0,022
	(-0,775)	(-0,767)	(-0,780)	(-0,785)	(-0,779)	(-0,774)	(-0,779)
Woccupation	0,039***	0,039***	0,039***	0,039***	0,039***	0,039***	0,039***
	(6,142)	(6,160)	(6,132)	(6,126)	(6,149)	(6,162)	(6,145)
Wmen	0,018***	0,018***	0,018***	0,018***	0,018***	0,018***	0,017***
	(3,201)	(3,191)	(3,197)	(3,181)	(3,186)	(3,183)	(3,152)
Wpopulation	0,011	0,011	0,011	0,011	0,010	0,011	0,008
	(0,350)	(0,341)	(0,367)	(0,346)	(0,336)	(0,358)	(0,265)
Welderly	-0,026***	-0,025***	-0,025***	-0,025***	-0,025***	-0,025***	-0,025***
	(-6,156)	(-6,135)	(-6,127)	(-6,131)	(-6,138)	(-6,117)	(-6,049)
Wyoung	-0,020***	-0,020***	-0,020***	-0,020***	-0,020***	-0,020***	-0,020***
	(-8,147)	(-8,126)	(-8,097)	(-8,089)	(-8,098)	(-8,071)	(-7,933)
Wrural	-0,001***	-0,001***	-0,001***	-0,001***	-0,001***	-0,001***	-0,001***
	(-6,872)	(-6,895)	(-6,847)	(-6,880)	(-6,877)	(-6,884)	(-6,918)
Wsecond cicle	0,0005*	0,0005**	0,0004*	0,0005*	0,0005*	0,0005*	0,0005**
	(1,913)	(1,968)	(1,827)	(1,928)	(1,942)	(1,951)	(2,000)
Wcompetition	0,010	0,010	0,010	0,010	0,010	0,010	0,010
	(1,139)	(1,143)	(1,133)	(1,106)	(1,140)	(1,137)	(1,107)
Wincumbent's age	0,016	0,016	0,016	0,017	0,016	0,016	0,016
	(1,144)	(1,140)	(1,138)	(1,166)	(1,148)	(1,149)	(1,158)
Wincumbents' education	-0,001	-0,001	-0,001	-0,001	-0,001	-0,001	-0,001
	(-0,119)	(-0,117)	(-0,111)	(-0,129)	(-0,120)	(-0,122)	(-0,103)
Wleft	-0,009	-0,009	-0,009	-0,009	-0,009	-0,009	-0,009
	(-1,327)	(-1,327)	(-1,314)	(-1,333)	(-1,328)	(-1,315)	(-1,334)
Wincumbent women	0,027**	0,027**	0,027**	0,027**	0,027**	0,027**	0,027**
	(2,495)	(2,488)	(2,503)	(2,512)	(2,497)	(2,493)	(2,525)
Waldermen's education	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001
	(0,457)	(0,474)	(0,465)	(0,428)	(0,446)	(0,460)	(0,419)
Waldermen's age	-0,053	-0,053	-0,052	-0,052	-0,053	-0,052	-0,053
	(-1,342)	(-1,359)	(-1,331)	(-1,325)	(-1,340)	(-1,336)	(-1,352)
Wwomen in council	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001
	(0,252)	(0,253)	(0,258)	(0,262)	(0,256)	(0,254)	(0,270)
Wcompetition for seats	-0,011	-0,011	-0,011	-0,011	-0,011	-0,011	-0,011
	(-1,012)	(-1,010)	(-1,005)	(-1,010)	(-1,005)	(-1,004)	(-0,983)
Wfragmentation	0,001***	0,001***	0,001***	0,001***	0,001***	0,001***	0,001***
	(3,838)	(3,852)	(3,856)	(3,803)	(3,830)	(3,833)	(3,853)
Wmajority of seats	-0,001	-0,001	-0,001	-0,001	-0,001	-0,001	-0,001
	(-0,104)	(-0,104)	(-0,098)	(-0,112)	(-0,113)	(-0,120)	(-0,120)
Wpresident's party	-0,005	-0,005	-0,005	-0,005	-0,005	-0,005	-0,005
	(-0,669)	(-0,661)	(-0,652)	(-0,667)	(-0,682)	(-0,690)	(-0,671)
Wgovernor's party	-0,010**	-0,010**	-0,010**	-0,010**	-0,010**	-0,010**	-0,010**
	(-2,068)	(-2,091)	(-2,053)	(-2,062)	(-2,073)	(-2,072)	(-2,103)
Wlameduck	0,001	0,001	0,001	0,001	0,001	0,001	0,001
	(0,165)	(0,163)	(0,148)	(0,178)	(0,169)	(0,170)	(0,171)
Spatial Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.8318	0.8318	0.8319	0.8318	0.8318	0.8318	0.8319
N	26334	26334	26334	26334	26334	26334	26334
log-likelihood	14707.186	14708.107	14710.151	14709.444	14707.559	14708.014	14715.353

See notes on table A.1.2.

Table A.1.10 – Two regime models: assigning year dummies as different regimes and log average class size as dependent variable

	15a	15b	15c	15d	15e	15f	15g
	d= dummy of PNE (2002)	d= dummy of year 2003	d= dummy of year 2004	d= dummy of year 2005	d= dummy of year 2006	d= dummy of year 2007	d= dummy of IDEB (2008)
λ_1 *on* dWy	0.103***	0.112***	0.113***	0.116***	0.110***	0.111***	0.109***
	(11.663)	(12.789)	(12.881)	(13.205)	(12.528)	(12.608)	(12.356)
λ_2 *on* $(1-d)Wy$	0.154***	0.098***	0.092***	0.065***	0.114***	0.109***	0.118***
	(7.358)	(4.575)	(4.285)	(2.990)	(5.314)	(5.141)	(5.542)
gdp	0,001	0,001	0,001	0,001	0,001	0,001	0,001
	(0,085)	(0,098)	(0,094)	(0,103)	(0,098)	(0,098)	(0,102)
wage	0,007	0,007	0,007	0,007	0,007	0,007	0,007
	(0,898)	(0,905)	(0,897)	(0,897)	(0,903)	(0,902)	(0,901)
perceived cost	-0,009**	-0,009**	-0,009**	-0,009**	-0,009**	-0,009**	-0,009**
	(-2,040)	(-2,064)	(-2,055)	(-2,055)	(-2,059)	(-2,060)	(-2,064)
categorical grants	-0,019***	-0,019***	-0,019***	-0,019***	-0,019***	-0,019***	-0,019***
	(-3,531)	(-3,514)	(-3,510)	(-3,509)	(-3,510)	(-3,511)	(-3,511)
block grants	0,004*	0,004*	0,004*	0,004*	0,004*	0,004*	0,004*
	(1,668)	(1,705)	(1,705)	(1,700)	(1,707)	(1,706)	(1,708)
schooling	-0,014	-0,014	-0,014	-0,014	-0,014	-0,014	-0,014
	(-0,962)	(-0,977)	(-0,972)	(-0,981)	(-0,974)	(-0,974)	(-0,976)
occupation	-0,001	-0,001	-0,001	-0,001	-0,001	-0,001	-0,001
	(-0,227)	(-0,234)	(-0,236)	(-0,245)	(-0,236)	(-0,237)	(-0,241)
men	-0,005	-0,005	-0,005	-0,005	-0,005	-0,005	-0,005
	(-1,500)	(-1,490)	(-1,492)	(-1,493)	(-1,492)	(-1,492)	(-1,488)
population	0,055***	0,055***	0,056***	0,055***	0,055***	0,055***	0,056***
	(2,886)	(2,903)	(2,904)	(2,899)	(2,902)	(2,903)	(2,911)
elderly	0,003	0,003	0,003	0,003	0,003	0,003	0,003
	(0,940)	(0,939)	(0,936)	(0,933)	(0,941)	(0,940)	(0,934)
young	0,007***	0,007***	0,007***	0,007***	0,007***	0,007***	0,007***
	(3,844)	(3,846)	(3,842)	(3,833)	(3,848)	(3,846)	(3,836)
rural	-0,002***	-0,002***	-0,002***	-0,002***	-0,002***	-0,002***	-0,002***
	(-21,674)	(-21,672)	(-21,679)	(-21,673)	(-21,676)	(-21,675)	(-21,675)
second cicle	0,002***	0,002***	0,002***	0,002***	0,002***	0,002***	0,002***
	(14,677)	(14,675)	(14,663)	(14,688)	(14,675)	(14,674)	(14,673)
competition	-0,008*	-0,008*	-0,008*	-0,008*	-0,008*	-0,008*	-0,008*
	(-1,741)	(-1,745)	(-1,752)	(-1,729)	(-1,747)	(-1,747)	(-1,746)
incumbent's age	-0,018**	-0,018**	-0,018**	-0,018**	-0,018**	-0,018**	-0,018**
	(-2,481)	(-2,481)	(-2,480)	(-2,478)	(-2,484)	(-2,483)	(-2,478)
incumbents' education	0,002	0,002	0,002	0,002	0,002	0,002	0,002
	(0,599)	(0,596)	(0,596)	(0,593)	(0,598)	(0,598)	(0,596)
left	-0,015***	-0,015***	-0,015***	-0,015***	-0,015***	-0,015***	-0,015***
	(-4,096)	(-4,087)	(-4,089)	(-4,099)	(-4,087)	(-4,088)	(-4,088)
incumbent women	-0,009*	-0,009*	-0,009*	-0,009*	-0,009*	-0,009*	-0,009*
	(-1,691)	(-1,691)	(-1,691)	(-1,688)	(-1,690)	(-1,690)	(-1,692)
aldermen's education	-0,00004	-0,00004	-0,00004	-0,00004	-0,00004	-0,00004	-0,00004
	(-0,323)	(-0,330)	(-0,328)	(-0,335)	(-0,330)	(-0,330)	(-0,330)
aldermen's age	-0,044**	-0,043**	-0,044**	-0,044**	-0,044**	-0,044**	-0,043**
	(-2,180)	(-2,164)	(-2,171)	(-2,171)	(-2,168)	(-2,168)	(-2,166)
women in council	-0,0005***	-0,0005***	-0,0005***	-0,0005***	-0,0005***	-0,0005***	-0,0005***
	(-3,406)	(-3,400)	(-3,403)	(-3,396)	(-3,400)	(-3,401)	(-3,403)
competition for seats	0,003	0,003	0,003	0,003	0,003	0,003	0,003
	(0,501)	(0,490)	(0,495)	(0,479)	(0,490)	(0,489)	(0,486)
fragmentation	-0,0002	-0,0002	-0,0002	-0,0002	-0,0002	-0,0002	-0,0002
	(-1,031)	(-1,035)	(-1,036)	(-1,034)	(-1,034)	(-1,034)	(-1,035)
majority of seats	0,008***	0,008***	0,008***	0,008***	0,008***	0,008***	0,008***
	(3,120)	(3,122)	(3,119)	(3,135)	(3,122)	(3,122)	(3,123)
president's party	-0,002	-0,002	-0,002	-0,002	-0,002	-0,002	-0,002
	(-0,362)	(-0,377)	(-0,374)	(-0,372)	(-0,376)	(-0,376)	(-0,377)
governor's party	0,003	0,004	0,003	0,003	0,004	0,004	0,004
	(1,315)	(1,348)	(1,341)	(1,337)	(1,346)	(1,347)	(1,351)
lameduck	0,007***	0,007***	0,007***	0,007***	0,007***	0,007***	0,007***
	(2,821)	(2,820)	(2,810)	(2,798)	(2,814)	(2,813)	(2,810)
Wgdp	-0,013	-0,013	-0,012	-0,012	-0,013	-0,013	-0,012

	15a	15b	15c	15d	15e	15f	15g
	d= dummy of PNE (2002)	d= dummy of year 2003	d= dummy of year 2004	d= dummy of year 2005	d= dummy of year 2006	d= dummy of year 2007	d= dummy of IDEB (2008)
	(-0,964)	(-0,966)	(-0,961)	(-0,954)	(-0,972)	(-0,971)	(-0,955)
Wwage	-0,020	-0,019	-0,019	-0,019	-0,019	-0,019	-0,019
	(-1,413)	(-1,382)	(-1,391)	(-1,381)	(-1,376)	(-1,378)	(-1,384)
Wperceived cost	0,008	0,008	0,008	0,008	0,008	0,008	0,008
	(1,174)	(1,126)	(1,131)	(1,157)	(1,132)	(1,129)	(1,117)
Wcategorical grants	-0,001	-0,001	-0,001	-0,001	-0,001	-0,001	-0,001
	(-0,100)	(-0,066)	(-0,085)	(-0,087)	(-0,066)	(-0,068)	(-0,079)
Wblock grants	0,010**	0,011**	0,011**	0,010**	0,011**	0,011**	0,011**
	(2,299)	(2,319)	(2,320)	(2,310)	(2,317)	(2,316)	(2,318)
Wschooling	-0,002	-0,003	-0,003	-0,004	-0,003	-0,003	-0,003
	(-0,086)	(-0,121)	(-0,111)	(-0,138)	(-0,122)	(-0,123)	(-0,129)
Woccupation	-0,016***	-0,016***	-0,016***	-0,016***	-0,016***	-0,016***	-0,016***
	(-2,639)	(-2,652)	(-2,645)	(-2,664)	(-2,647)	(-2,649)	(-2,656)
Wmen	-0,0003	-0,0002	-0,0002	-0,0003	-0,0003	-0,0003	-0,0002
	(-0,056)	(-0,045)	(-0,044)	(-0,048)	(-0,050)	(-0,048)	(-0,035)
Wpopulation	0,031	0,032	0,032	0,032	0,032	0,032	0,032
	(1,036)	(1,075)	(1,072)	(1,065)	(1,071)	(1,071)	(1,081)
Welderly	-0,003	-0,003	-0,003	-0,003	-0,003	-0,003	-0,003
	(-0,875)	(-0,838)	(-0,841)	(-0,844)	(-0,841)	(-0,845)	(-0,842)
Wyoung	0,005**	0,006**	0,006**	0,005**	0,006**	0,006**	0,006**
	(2,305)	(2,334)	(2,327)	(2,295)	(2,333)	(2,328)	(2,324)
Wrural	0,001***	0,001***	0,001***	0,001***	0,001***	0,001***	0,001***
	(4,037)	(4,039)	(3,995)	(4,078)	(4,036)	(4,037)	(4,033)
Wsecond cicle	-0,001***	-0,001***	-0,001***	-0,001***	-0,001***	-0,001***	-0,001***
	(-4,586)	(-4,531)	(-4,546)	(-4,521)	(-4,531)	(-4,532)	(-4,528)
Wcompetition	0,003	0,003	0,003	0,003	0,003	0,003	0,003
	(0,386)	(0,375)	(0,371)	(0,399)	(0,375)	(0,375)	(0,375)
Wincumbent's age	0,020	0,020	0,020	0,019	0,020	0,020	0,020
	(1,434)	(1,430)	(1,429)	(1,407)	(1,426)	(1,427)	(1,428)
Wincumbents' education	-0,003	-0,003	-0,003	-0,003	-0,003	-0,003	-0,003
	(-0,601)	(-0,592)	(-0,592)	(-0,610)	(-0,594)	(-0,594)	(-0,595)
Wleft	0,014**	0,014**	0,014**	0,014**	0,014**	0,014**	0,014**
	(2,265)	(2,269)	(2,264)	(2,273)	(2,270)	(2,270)	(2,268)
Wincumbent women	-0,015	-0,015	-0,015	-0,015	-0,015	-0,015	-0,015
	(-1,483)	(-1,472)	(-1,470)	(-1,461)	(-1,469)	(-1,468)	(-1,468)
Waldermen's education	-0,0003	-0,0003	-0,0003	-0,0003	-0,0003	-0,0003	-0,0003
	(-1,150)	(-1,147)	(-1,147)	(-1,144)	(-1,145)	(-1,145)	(-1,144)
Waldermen's age	0,091**	0,091**	0,090**	0,091**	0,091**	0,091**	0,091**
	(2,409)	(2,399)	(2,393)	(2,416)	(2,399)	(2,400)	(2,399)
Wwomen in council	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001
	(0,305)	(0,301)	(0,307)	(0,303)	(0,306)	(0,305)	(0,305)
Wcompetition for seats	0,006	0,006	0,006	0,006	0,006	0,006	0,006
	(0,543)	(0,535)	(0,537)	(0,527)	(0,535)	(0,532)	(0,528)
Wfragmentation	-0,001**	-0,001**	-0,001**	-0,001**	-0,001**	-0,001**	-0,001**
	(-2,295)	(-2,313)	(-2,298)	(-2,317)	(-2,309)	(-2,309)	(-2,311)
Wmajority of seats	0,003	0,003	0,003	0,003	0,003	0,003	0,003
	(0,526)	(0,538)	(0,536)	(0,520)	(0,537)	(0,538)	(0,536)
Wpresident's party	-0,011	-0,012	-0,011	-0,011	-0,012	-0,012	-0,012
	(-1,522)	(-1,544)	(-1,539)	(-1,534)	(-1,542)	(-1,542)	(-1,544)
Wgovernor's party	0,013***	0,014***	0,014***	0,013***	0,014***	0,014***	0,014***
	(2,987)	(3,036)	(3,024)	(3,011)	(3,032)	(3,032)	(3,037)
Wlameduck	0,014***	0,014***	0,014***	0,014***	0,014***	0,014***	0,014***
	(3,055)	(3,063)	(3,063)	(3,032)	(3,060)	(3,058)	(3,053)
Spatial Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.8922	0.8922	0.8922	0.8922	0.8922	0.8922	0.8922
N	26334	26334	26334	26334	26334	26334	26334
log-likelihood	15683.445	15680.946	15681.132	15682.621	15680.784	15680.775	15680.883

See notes on table A.1.2.

A.2 Appendix to Chapter 2: Tables with full results

Table A.2.1 – Tobit marginal effects estimates on the proportion of beneficiaries among the poor Median voter above the poverty line (data from the 2000 Census)

	I	II	III	IV	V
Population density	0.034**				
	(0.014)				
Urban density		0.002*			
		(0.001)			
Area			-0.003		
			(0.002)		
Isolated poor				-0.018**	
				(0.007)	
Prob. poor meets non poor					0.026***
					(0.009)
Income	-0.898*	-0.826*	-0.806	-0.951*	-1.150**
	(0.500)	(0.496)	(0.498)	(0.503)	(0.519)
Inequaity/Proxy for tax price	-3.910***	-3.745**	-3.783**	-3.795**	-3.855**
	(1.509)	(1.501)	(1.501)	(1.501)	(1.500)
Size of the program	2.295***	2.297***	2.295***	2.297***	2.301***
	(0.052)	(0.052)	(0.052)	(0.052)	(0.053)
Population	0.001	0.001	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Schooling	0.687**	0.690**	0.693**	0.571**	0.544*
	(0.291)	(0.291)	(0.291)	(0.290)	(0.288)
Family members less than 15 years old	-1.854	-1.820	-1.830	-1.187	-0.887
	(1.656)	(1.658)	(1.654)	(1.704)	(1.707)
School attendance	0.107***	0.106***	0.103***	0.104***	0.101***
	(0.034)	(0.034)	(0.035)	(0.034)	(0.035)
Nonwhite	0.014	0.015	0.016	0.014	0.015
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
Elderly	0.168	0.156	0.151	0.202*	0.230**
	(0.113)	(0.112)	(0.112)	(0.113)	(0.115)
Young	0.152	0.150	0.150	0.133	0.123
	(0.094)	(0.093)	(0.094)	(0.095)	(0.095)
Men head of the family	-0.057	-0.061	-0.060	-0.042	-0.039
	(0.055)	(0.055)	(0.055)	(0.055)	(0.055)
Couple	0.045*	0.047*	0.046*	0.055**	0.055**
	(0.026)	(0.026)	(0.026)	(0.026)	(0.026)
Gender	-0.103	-0.096	-0.105	-0.082	-0.073
	(0.157)	(0.156)	(0.157)	(0.159)	(0.160)
slum	0.508*	0.543*	0.536*	0.466	0.465
	(0.283)	(0.283)	(0.283)	(0.284)	(0.284)
tenements	-0.115	-0.122	-0.085	-0.098	-0.074
	(0.313)	(0.314)	(0.313)	(0.312)	(0.311)
Illegal land occupation	0.441	0.447	0.445	0.472*	0.465*
	(0.274)	(0.273)	(0.273)	(0.274)	(0.273)
capitals	-0.526	-0.139	-0.240	0.073	0.314
	(1.026)	(1.081)	(1.082)	(1.088)	(1.098)
latitude	0.128	0.121	0.126	0.112	0.109
	(0.096)	(0.096)	(0.096)	(0.096)	(0.096)
longitude	0.280**	0.285**	0.289**	0.261**	0.257**
	(0.112)	(0.112)	(0.113)	(0.112)	(0.112)
Distance to the federal capital	0.052	0.054	0.061	0.082	0.089
	(0.093)	(0.093)	(0.093)	(0.093)	(0.092)
Distance to the state capital	-0.122	-0.138	-0.119	-0.138	-0.127
	(0.119)	(0.119)	(0.120)	(0.118)	(0.118)
Distance to portugal	-1.388	-1.526	-1.400	-1.856	-1.830

	I	II	III	IV	V
	(4.102)	(4.101)	(4.102)	(4.106)	(4.076)
altitude	0.000	0.000	0.000	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Rainfall (100mm)	0.045	0.045	0.045	0.049	0.051
	(0.034)	(0.034)	(0.034)	(0.034)	(0.034)
Type of soil 1	-0.442	-0.453	-0.450	-0.448	-0.440
	(0.449)	(0.448)	(0.449)	(0.449)	(0.448)
Type of soil 2	-0.312	-0.320	-0.325	-0.316	-0.302
	(0.562)	(0.562)	(0.562)	(0.559)	(0.560)
Type of soil 3	-1.376	-1.377	-1.399	-1.440	-1.415
	(1.103)	(1.106)	(1.104)	(1.100)	(1.100)
Type of soil 4	-1.964	-1.982	-2.011	-2.038	-2.003
	(1.702)	(1.701)	(1.701)	(1.691)	(1.689)
Type of soil 5	1.068	1.111	1.104	1.083	1.099
	(1.462)	(1.461)	(1.462)	(1.456)	(1.456)
Type of soil 6	-0.494	-0.497	-0.505	-0.524	-0.519
	(0.448)	(0.448)	(0.448)	(0.448)	(0.447)
Type of soil 7	-0.293	-0.310	-0.316	-0.334	-0.331
	(0.648)	(0.647)	(0.647)	(0.646)	(0.645)
Type of soil 8	-0.353	-0.351	-0.355	-0.350	-0.328
	(0.527)	(0.526)	(0.526)	(0.525)	(0.526)
Type of soil 9	-0.735	-0.697	-0.747	-0.744	-0.698
	(0.879)	(0.878)	(0.878)	(0.884)	(0.890)
Type of soil 10	-0.042	-0.032	-0.055	-0.094	-0.073
	(0.673)	(0.674)	(0.672)	(0.669)	(0.669)
Type of soil 11	-0.208	-0.180	-0.184	-0.163	-0.176
	(0.630)	(0.629)	(0.629)	(0.631)	(0.628)
Cycle of sugar cane	0.172	0.200	0.181	0.256	0.203
	(0.840)	(0.834)	(0.834)	(0.838)	(0.837)
Cycle of gold	1.046	1.045	1.114	1.087	1.002
	(1.024)	(1.023)	(1.028)	(1.025)	(1.018)
Age of municipality município	0.021***	0.020***	0.021***	0.020***	0.020**
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
STATE11	-12.143***	-12.354***	-12.422***	-12.003***	-11.858***
	(2.977)	(2.975)	(2.979)	(2.974)	(2.974)
STATE12	-9.799***	-10.882***	-10.177***	-9.807***	-9.766***
	(3.725)	(3.786)	(3.738)	(3.703)	(3.704)
STATE13	-10.931***	-11.203***	-10.922***	-11.315***	-11.397***
	(3.463)	(3.464)	(3.415)	(3.435)	(3.437)
STATE14	-4.452	-4.622	-4.551	-4.370	-4.415
	(6.204)	(6.203)	(6.153)	(6.066)	(6.042)
STATE15	-6.223***	-6.285***	-6.227***	-6.364***	-6.372***
	(2.079)	(2.078)	(2.072)	(2.071)	(2.066)
STATE16	-6.104**	-6.286**	-6.206**	-6.454**	-6.536**
	(2.814)	(2.817)	(2.831)	(2.833)	(2.820)
STATE17	-4.481***	-5.146***	-4.558***	-4.757***	-4.611***
	(1.637)	(1.760)	(1.635)	(1.639)	(1.636)
STATE21	-5.041***	-5.092***	-5.156***	-5.305***	-5.285***
	(1.804)	(1.804)	(1.804)	(1.798)	(1.793)
STATE22	-4.605***	-4.640***	-4.685***	-4.811***	-4.703***
	(1.547)	(1.545)	(1.545)	(1.545)	(1.544)
STATE23	-2.562	-2.537	-2.592	-2.985*	-2.947*
	(1.663)	(1.663)	(1.661)	(1.654)	(1.650)
STATE24	-2.423	-2.415	-2.463	-3.011*	-3.067*
	(1.709)	(1.711)	(1.708)	(1.703)	(1.701)
STATE25	-2.142	-2.116	-2.162	-2.627	-2.553
	(1.644)	(1.644)	(1.643)	(1.633)	(1.632)
STATE26	-0.500	-0.515	-0.580	-0.930	-0.909
	(1.543)	(1.542)	(1.541)	(1.531)	(1.530)
STATE27	-0.821	-0.865	-0.915	-1.361	-1.333
	(1.523)	(1.522)	(1.521)	(1.516)	(1.511)
STATE28	-0.688	-0.740	-0.746	-0.874	-0.917
	(1.402)	(1.401)	(1.400)	(1.393)	(1.392)
STATE29	-2.137*	-2.181*	-2.189*	-2.280**	-2.271**

	I	II	III	IV	V
	(1.125)	(1.122)	(1.122)	(1.118)	(1.117)
STATE31	-2.779***	-2.863***	-2.857***	-3.011***	-3.091***
	(0.760)	(0.754)	(0.754)	(0.761)	(0.762)
STATE32	1.134	1.010	1.047	1.088	1.133
	(1.061)	(1.058)	(1.058)	(1.060)	(1.060)
STATE35	-2.862***	-2.921***	-2.961***	-3.148***	-3.222***
	(0.839)	(0.835)	(0.838)	(0.839)	(0.839)
STATE41	-3.070***	-3.212***	-3.257***	-3.247***	-3.257***
	(1.139)	(1.134)	(1.138)	(1.130)	(1.129)
STATE42	-3.027**	-3.216***	-3.243***	-3.134**	-3.050**
	(1.232)	(1.225)	(1.229)	(1.222)	(1.223)
STATE43	-3.715**	-3.884***	-3.919***	-3.790***	-3.703**
	(1.444)	(1.438)	(1.442)	(1.435)	(1.438)
STATE50	2.826	2.646	2.710	2.590	2.520
	(1.913)	(1.907)	(1.909)	(1.892)	(1.892)
STATE51	-5.305***	-5.480***	-5.432***	-5.284***	-5.309***
	(1.913)	(1.911)	(1.913)	(1.904)	(1.900)
STATE52	5.121***	4.998***	5.035***	4.916***	4.865***
	(1.479)	(1.474)	(1.475)	(1.472)	(1.469)
Constant	-20.813**	-21.113**	-20.637**	-21.399**	-23.768**
	(10.152)	(10.100)	(10.157)	(10.201)	(10.333)
Fixed Effects Variables	yes	yes	yes	yes	yes
sigma	6.091***	6.089***	6.090***	6.076***	6.073***
	(0.265)	(0.265)	(0.265)	(0.264)	(0.263)
Pseudo_R2	0.239	0.239	0.239	0.240	0.240
bic	13973.518	13973.359	13974.969	13968.017	13966.011
N	4135.000	4134.000	4135.000	4135.000	4135.000

Note: Robust standard errors in parenthesis. * p<0.10, ** p<0.05, *** p<0.01.

Table A.2.2 – Tobit marginal effects estimates on the proportion of beneficiaries among the poor for the samples with the 50% richest and poorest municipalities Median voter above the poverty line (data from the 2000 Census)

	I		II		III		IV		V	
	50% richest	50% poorest	50% richest	50% poorest	50% richest	50% poorest	50% richest	50% poorest	50% richest	50% poorest
Population density	0.044***	0.020								
	(0.017)	(0.049)								
Urban density			0.002	0.001						
			(0.006)	(0.001)						
Area					-0.007	-0.001				
					(0.005)	(0.002)				
Isolated poor							-0.020*	-0.018**		
							(0.012)	(0.008)		
Prob. poor meets non poor									0.028*	0.033**
									(0.015)	(0.013)
Income	-1.288	2.014	-1.224	1.974	-1.195	2.067	-1.348	1.765	-1.510*	1.220
	(0.846)	(1.410)	(0.843)	(1.415)	(0.846)	(1.413)	(0.854)	(1.434)	(0.865)	(1.507)
Inequaity/Proxy for tax price	-6.452**	-0.327	-6.148**	-0.284	-6.206**	-0.351	-6.115**	-0.300	-6.123**	-0.316
	(2.865)	(1.260)	(2.845)	(1.257)	(2.846)	(1.257)	(2.850)	(1.242)	(2.848)	(1.237)
Size of the program	3.899***	2.039***	3.900***	2.040***	3.898***	2.039***	3.900***	2.040***	3.903***	2.043***
	(0.249)	(0.040)	(0.249)	(0.040)	(0.249)	(0.040)	(0.249)	(0.040)	(0.249)	(0.041)
Population	0.000	0.023***	0.001	0.024***	0.001	0.024***	0.001	0.024***	0.001	0.024***
	(0.000)	(0.005)	(0.001)	(0.005)	(0.001)	(0.005)	(0.001)	(0.005)	(0.001)	(0.005)
Schooling	1.330**	-0.232	1.350**	-0.234	1.377**	-0.236	1.267**	-0.358	1.247**	-0.406
	(0.602)	(0.283)	(0.603)	(0.284)	(0.602)	(0.284)	(0.596)	(0.277)	(0.595)	(0.276)
Family members less than 15 years old	0.277	-1.328	-0.218	-1.324	0.431	-1.322	0.632	-0.787	1.375	-0.467
	(5.316)	(1.523)	(5.317)	(1.524)	(5.446)	(1.522)	(5.355)	(1.560)	(5.385)	(1.591)
School attendance	0.179**	0.064**	0.174**	0.065**	0.165*	0.063**	0.165*	0.065**	0.162*	0.061**
	(0.084)	(0.028)	(0.084)	(0.028)	(0.085)	(0.028)	(0.085)	(0.028)	(0.086)	(0.028)
Nonwhite	0.011	0.016	0.014	0.016	0.015	0.017	0.012	0.016	0.012	0.015
	(0.026)	(0.011)	(0.026)	(0.011)	(0.026)	(0.011)	(0.026)	(0.011)	(0.026)	(0.011)
Elderly	0.114	0.062	0.084	0.062	0.082	0.060	0.151	0.085	0.182	0.115
	(0.190)	(0.118)	(0.189)	(0.118)	(0.189)	(0.118)	(0.188)	(0.119)	(0.189)	(0.121)
Young	0.173	0.056	0.178	0.057	0.158	0.056	0.154	0.040	0.131	0.028
	(0.207)	(0.090)	(0.208)	(0.090)	(0.211)	(0.090)	(0.209)	(0.091)	(0.210)	(0.092)
Men head of the family	-0.190	-0.057	-0.198	-0.057	-0.195	-0.057	-0.175	-0.042	-0.172	-0.037
	(0.122)	(0.047)	(0.122)	(0.047)	(0.121)	(0.047)	(0.121)	(0.047)	(0.121)	(0.047)
Couple	0.154**	0.012	0.159**	0.013	0.152**	0.011	0.170**	0.018	0.174**	0.018

	I		II		III		IV		V	
	50% richest	50% poorest	50% richest	50% poorest	50% richest	50% poorest	50% richest	50% poorest	50% richest	50% poorest
	(0.075)	(0.021)	(0.076)	(0.021)	(0.076)	(0.021)	(0.076)	(0.021)	(0.076)	(0.021)
Gender	0.054	0.034	0.045	0.048	0.061	0.035	0.074	0.055	0.086	0.061
	(0.278)	(0.158)	(0.279)	(0.158)	(0.282)	(0.158)	(0.281)	(0.162)	(0.282)	(0.163)
slum	0.444	0.198	0.494	0.203	0.504	0.201	0.435	0.128	0.443	0.116
	(0.464)	(0.267)	(0.465)	(0.267)	(0.465)	(0.267)	(0.465)	(0.266)	(0.464)	(0.267)
tenements	-0.150	-0.178	-0.100	-0.209	-0.087	-0.165	-0.116	-0.169	-0.091	-0.159
	(0.470)	(0.303)	(0.470)	(0.299)	(0.470)	(0.302)	(0.467)	(0.303)	(0.466)	(0.302)
Illegal land occupation	0.419	0.087	0.417	0.094	0.422	0.087	0.459	0.107	0.457	0.097
	(0.466)	(0.242)	(0.466)	(0.242)	(0.465)	(0.242)	(0.467)	(0.242)	(0.467)	(0.241)
capitals	0.480		0.881		0.720		1.200		1.460	
	(1.630)		(1.728)		(1.740)		(1.737)		(1.750)	
latitude	-0.267	0.120	-0.274	0.117	-0.259	0.120	-0.257	0.108	-0.249	0.094
	(0.243)	(0.096)	(0.244)	(0.097)	(0.245)	(0.096)	(0.245)	(0.097)	(0.244)	(0.096)
longitude	0.152	0.306**	0.162	0.308**	0.170	0.315**	0.131	0.292**	0.128	0.301**
	(0.192)	(0.126)	(0.192)	(0.126)	(0.193)	(0.128)	(0.196)	(0.124)	(0.196)	(0.124)
Distance to the federal capital	-0.103	-0.018	-0.090	-0.025	-0.088	-0.012	-0.027	-0.008	-0.005	-0.013
	(0.205)	(0.091)	(0.205)	(0.091)	(0.206)	(0.092)	(0.210)	(0.090)	(0.211)	(0.090)
Distance to the state capital	0.015	-0.099	-0.018	-0.114	0.000	-0.093	-0.019	-0.130	-0.000	-0.135
	(0.243)	(0.113)	(0.242)	(0.113)	(0.245)	(0.114)	(0.242)	(0.113)	(0.243)	(0.113)
Distance to portugal	1.622	-9.270	1.231	-9.269	1.326	-9.145	0.414	-8.586	0.498	-8.904
	(5.029)	(7.228)	(5.030)	(7.218)	(5.026)	(7.236)	(5.007)	(7.316)	(4.973)	(7.253)
altitude	-0.000	-0.001	-0.000	-0.001	-0.000	-0.001	0.000	-0.000	0.000	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Rainfall (100mm)	0.019	0.047	0.027	0.046	0.026	0.046	0.038	0.042	0.041	0.039
	(0.055)	(0.036)	(0.055)	(0.036)	(0.055)	(0.036)	(0.056)	(0.036)	(0.056)	(0.037)
Type of soil 1	-0.185	-0.242	-0.207	-0.239	-0.203	-0.246	-0.186	-0.236	-0.170	-0.238
	(0.768)	(0.360)	(0.769)	(0.361)	(0.767)	(0.361)	(0.765)	(0.364)	(0.765)	(0.365)
Type of soil 2	-1.165	0.279	-1.196	0.294	-1.193	0.271	-1.193	0.295	-1.182	0.312
	(1.185)	(0.384)	(1.191)	(0.385)	(1.184)	(0.385)	(1.180)	(0.383)	(1.182)	(0.385)
Type of soil 3	-1.390	-0.224	-1.446	-0.190	-1.460	-0.228	-1.526	-0.229	-1.519	-0.190
	(1.959)	(1.265)	(1.973)	(1.268)	(1.970)	(1.264)	(1.966)	(1.237)	(1.956)	(1.239)
Type of soil 4	-3.368	-1.057	-3.411	-1.051	-3.407	-1.085	-3.552	-1.076	-3.514	-1.045
	(4.241)	(1.045)	(4.236)	(1.047)	(4.240)	(1.047)	(4.199)	(1.048)	(4.190)	(1.051)
Type of soil 5	1.626	-0.685	1.681	-0.685	1.683	-0.701	1.691	-0.828	1.698	-0.857
	(1.859)	(0.957)	(1.856)	(0.954)	(1.855)	(0.967)	(1.852)	(0.920)	(1.853)	(0.881)
Type of soil 6	-0.382	-0.115	-0.406	-0.101	-0.427	-0.117	-0.442	-0.114	-0.433	-0.119
	(0.783)	(0.353)	(0.783)	(0.353)	(0.782)	(0.353)	(0.777)	(0.355)	(0.777)	(0.357)
Type of soil 7	0.164	-0.479	0.115	-0.469	0.097	-0.463	0.104	-0.467	0.115	-0.465
	(0.901)	(0.769)	(0.900)	(0.768)	(0.898)	(0.768)	(0.896)	(0.762)	(0.895)	(0.764)
Type of soil 8	0.107	-0.366	0.106	-0.360	0.088	-0.368	0.119	-0.374	0.138	-0.356

	I		II		III		IV		V	
	50% richest	50% poorest	50% richest	50% poorest	50% richest	50% poorest	50% richest	50% poorest	50% richest	50% poorest
	(0.861)	(0.405)	(0.860)	(0.405)	(0.857)	(0.405)	(0.855)	(0.406)	(0.856)	(0.408)
Type of soil 9	2.459	-1.105	2.404	-1.072	2.364	-1.102	2.413	-1.124	2.513	-1.125
	(1.621)	(0.720)	(1.640)	(0.724)	(1.620)	(0.720)	(1.621)	(0.726)	(1.636)	(0.731)
Type of soil 10	-0.249	0.006	-0.249	0.026	-0.283	-0.001	-0.335	0.008	-0.316	0.053
	(0.950)	(0.684)	(0.948)	(0.686)	(0.948)	(0.683)	(0.940)	(0.682)	(0.940)	(0.685)
Type of soil 11	-0.036	0.291	0.008	0.306	-0.005	0.294	0.022	0.334	-0.014	0.359
	(0.986)	(0.544)	(0.984)	(0.545)	(0.983)	(0.544)	(0.983)	(0.550)	(0.977)	(0.550)
Cycle of sugar cane	-2.460	0.080	-2.354	0.083	-2.333	0.060	-2.355	0.161	-2.454	0.125
	(1.919)	(0.631)	(1.887)	(0.630)	(1.882)	(0.631)	(1.940)	(0.609)	(1.915)	(0.611)
Cycle of gold	1.507	0.735	1.452	0.739	1.455	0.789	1.324	0.923	1.286	0.817
	(2.182)	(0.810)	(2.200)	(0.809)	(2.196)	(0.809)	(2.173)	(0.825)	(2.180)	(0.807)
Age of municipality município	0.035**	0.014**	0.033**	0.013**	0.034**	0.014**	0.031**	0.015**	0.031**	0.016**
	(0.015)	(0.007)	(0.015)	(0.007)	(0.015)	(0.007)	(0.015)	(0.007)	(0.015)	(0.007)
STATE11	-4.561	-11.667***	-4.906	-11.614***	-5.027	-11.882***	-4.987	-11.823***	-5.199	-11.613***
	(5.307)	(3.281)	(5.322)	(3.279)	(5.333)	(3.334)	(5.334)	(3.269)	(5.318)	(3.252)
STATE12		-10.307***		-10.800***		-10.630***		-10.419***		-10.376***
		(3.831)		(3.848)		(3.925)		(3.790)		(3.772)
STATE13	-2.094	-10.783***	-3.158	-10.574***	-2.691	-10.806***	-3.977	-11.002***	-4.262	-11.052***
	(7.342)	(3.501)	(7.310)	(3.497)	(7.264)	(3.494)	(7.320)	(3.465)	(7.287)	(3.461)
STATE14		-5.761		-5.653		-5.894		-5.645		-5.398
		(5.137)		(5.154)		(5.125)		(5.064)		(5.056)
STATE15	2.977	-8.147***	2.915	-8.047***	2.953	-8.166***	2.174	-8.309***	1.892	-8.190***
	(4.764)	(2.118)	(4.773)	(2.122)	(4.801)	(2.122)	(4.808)	(2.144)	(4.799)	(2.132)
STATE16	0.988	-7.360***	0.083	-7.268***	-0.034	-7.399***	-0.962	-7.621***	-1.348	-7.558***
	(6.886)	(2.634)	(6.937)	(2.636)	(6.965)	(2.647)	(6.982)	(2.669)	(6.969)	(2.645)
STATE17	-4.496	-5.939***	-6.141	-6.278***	-4.775	-5.965***	-4.882	-6.433***	-4.817	-6.358***
	(3.057)	(1.848)	(6.761)	(1.905)	(3.066)	(1.852)	(3.088)	(1.913)	(3.084)	(1.901)
STATE21	0.692	-6.589***	0.105	-6.511***	-0.194	-6.639***	-0.778	-6.986***	-1.019	-6.959***
	(5.794)	(1.837)	(5.846)	(1.842)	(5.876)	(1.842)	(5.906)	(1.879)	(5.891)	(1.868)
STATE22	-0.123	-6.161***	-0.811	-6.076***	-0.877	-6.171***	-1.744	-6.499***	-1.921	-6.349***
	(4.856)	(1.699)	(4.915)	(1.706)	(4.928)	(1.701)	(4.968)	(1.748)	(4.957)	(1.738)
STATE23	-0.435	-4.608***	1.340	-4.494***	1.145	-4.608***	-0.213	-5.088***	-0.632	-4.947***
	(5.844)	(1.717)	(5.791)	(1.725)	(5.807)	(1.718)	(5.919)	(1.763)	(5.922)	(1.754)
STATE24	6.516	-3.875**	6.765	-3.757**	6.590	-3.858**	5.193	-4.446**	4.850	-4.387**
	(5.390)	(1.729)	(5.382)	(1.740)	(5.394)	(1.731)	(5.521)	(1.775)	(5.521)	(1.769)
STATE25	4.250	-3.976**	4.389	-3.841**	4.175	-3.943**	2.959	-4.456**	2.751	-4.240**
	(5.186)	(1.714)	(5.199)	(1.724)	(5.204)	(1.716)	(5.336)	(1.756)	(5.306)	(1.749)
STATE26	3.983	-2.395	3.827	-2.258	3.582	-2.374	2.641	-2.826	2.390	-2.693
	(5.778)	(1.695)	(5.793)	(1.706)	(5.831)	(1.698)	(5.940)	(1.736)	(5.922)	(1.732)
STATE27	2.830	-2.942*	2.539	-2.841*	2.415	-2.918*	1.124	-3.529**	0.941	-3.462**

	I		II		III		IV		V	
	50% richest	50% poorest	50% richest	50% poorest	50% richest	50% poorest	50% richest	50% poorest	50% richest	50% poorest
	(4.414)	(1.663)	(4.460)	(1.672)	(4.464)	(1.665)	(4.605)	(1.712)	(4.597)	(1.704)
STATE28	-0.849	-2.803*	-0.595	-2.735*	-0.659	-2.775*	-1.481	-3.165*	-1.624	-3.223**
	(3.737)	(1.600)	(3.768)	(1.609)	(3.771)	(1.603)	(3.848)	(1.644)	(3.848)	(1.642)
STATE29	2.559	-4.441***	2.532	-4.379***	2.359	-4.427***	2.129	-4.781***	2.256	-4.801***
	(2.807)	(1.484)	(2.811)	(1.492)	(2.824)	(1.486)	(2.824)	(1.540)	(2.804)	(1.536)
STATE31	-2.958***	-2.803**	-2.993***	-2.770**	-3.008***	-2.802**	-3.162***	-3.234**	-3.315***	-3.377**
	(1.136)	(1.373)	(1.134)	(1.381)	(1.134)	(1.375)	(1.136)	(1.451)	(1.137)	(1.454)
STATE32	0.562	-0.410	0.469	-0.397	0.468	-0.406	0.434	-0.634	0.426	-0.602
	(1.314)	(1.742)	(1.314)	(1.748)	(1.315)	(1.745)	(1.320)	(1.788)	(1.320)	(1.784)
STATE35	-2.644**	-3.521**	-2.645**	-3.497**	-2.680**	-3.600**	-2.875**	-3.913**	-3.007**	-4.021**
	(1.259)	(1.708)	(1.256)	(1.714)	(1.257)	(1.721)	(1.258)	(1.754)	(1.257)	(1.750)
STATE41	-3.146*	-2.937*	-3.308**	-2.919	-3.302**	-3.045*	-3.354**	-3.262*	-3.458**	-3.329*
	(1.662)	(1.781)	(1.665)	(1.786)	(1.666)	(1.799)	(1.666)	(1.817)	(1.664)	(1.806)
STATE42	-5.049***	-2.535	-5.237***	-2.508	-5.196***	-2.648	-5.211***	-2.872	-5.260***	-2.860
	(1.767)	(2.101)	(1.768)	(2.108)	(1.771)	(2.115)	(1.770)	(2.135)	(1.772)	(2.130)
STATE43	-5.311***	-3.106	-5.547***	-3.083	-5.464***	-3.256	-5.535***	-3.158	-5.565***	-3.074
	(2.056)	(2.144)	(2.052)	(2.148)	(2.059)	(2.178)	(2.054)	(2.166)	(2.056)	(2.161)
STATE50	4.044	0.508	3.839	0.507	4.089	0.374	3.827	0.022	3.729	-0.250
	(2.824)	(2.466)	(2.822)	(2.469)	(2.866)	(2.497)	(2.817)	(2.463)	(2.809)	(2.459)
STATE51	-0.457	-5.981**	-0.697	-5.969**	-0.602	-6.072**	-0.760	-6.138**	-0.974	-6.183**
	(3.269)	(2.526)	(3.275)	(2.529)	(3.287)	(2.536)	(3.290)	(2.517)	(3.280)	(2.494)
STATE52	4.611**	-0.088	4.473*	-0.099	4.485*	-0.103	4.437*	-0.535	4.403*	-0.770
	(2.324)	(1.930)	(2.324)	(1.935)	(2.325)	(1.932)	(2.326)	(1.974)	(2.326)	(1.980)
Constant	-42.642**	-10.487	-41.574**	-11.346	-41.406**	-11.008	-41.857**	-11.431	-44.767**	-13.701
	(19.599)	(10.133)	(19.600)	(10.082)	(19.596)	(10.217)	(19.674)	(10.218)	(19.697)	(10.411)
Fixed Effects Variables	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
sigma	7.129***	3.820***	7.130***	3.819***	7.130***	3.820***	7.115***	3.801***	7.110***	3.799***
	(0.382)	(0.231)	(0.382)	(0.231)	(0.382)	(0.231)	(0.382)	(0.229)	(0.382)	(0.229)
Pseudo R^2	0.204	0.348	0.204	0.348	0.204	0.348	0.204	0.348	0.205	0.349
Bic	6901.810	6673.950	6896.116	6672.030	6903.439	6673.702	6892.952	6666.065	6891.879	6663.222
N	2177.000	1958.000	2176.000	1958.000	2177.000	1958.000	2177.000	1958.000	2177.000	1958.000

See notes on table A.2.1.

Table A.2.3 – Tobit marginal effects estimates on the proportion of beneficiaries among the poor for the samples with the 50% most and least populated municipalities Median voter above the poverty line (data from the 2000 Census)

	I		II		III		IV		V	
	50% most pop	50% least pop	50% most pop	50% least pop	50% most pop	50% least pop	50% most pop	50% least pop	50% most pop	50% least pop
Population density	0.014	-0.233								
	(0.010)	(0.412)								
Urban density			-0.002	0.003						
			(0.001)	(0.002)						
Area					-0.002	-0.014				
					(0.002)	(0.019)				
Isolated poor							-0.005	-0.029**		
							(0.005)	(0.013)		
Prob. poor meets non poor									0.208	4.341***
									(0.728)	(1.656)
Income	-0.986**	-1.855*	-0.954**	-1.878*	-0.919**	-1.784	-0.973**	-2.058*	-0.969**	-2.399**
	(0.383)	(1.106)	(0.381)	(1.105)	(0.381)	(1.112)	(0.389)	(1.115)	(0.398)	(1.156)
Inequaity/Proxy for tax price	-0.911	-4.632*	-0.762	-4.752*	-0.795	-4.832*	-0.808	-4.554*	-0.774	-4.631*
	(1.293)	(2.555)	(1.272)	(2.557)	(1.271)	(2.561)	(1.274)	(2.561)	(1.277)	(2.559)
Size of the program	2.014***	2.571***	2.014***	2.572***	2.014***	2.570***	2.015***	2.572***	2.014***	2.577***
	(0.052)	(0.082)	(0.052)	(0.082)	(0.052)	(0.082)	(0.052)	(0.083)	(0.052)	(0.083)
Population	0.000	0.476***	0.000	0.456***	0.000	0.480***	0.000	0.476***	0.000	0.463***
	(0.000)	(0.134)	(0.000)	(0.135)	(0.000)	(0.135)	(0.000)	(0.134)	(0.000)	(0.134)
Schooling	0.215	1.211*	0.207	1.185*	0.209	1.190*	0.184	0.947	0.199	0.858
	(0.208)	(0.651)	(0.208)	(0.651)	(0.207)	(0.651)	(0.207)	(0.647)	(0.209)	(0.643)
Family members less than 15 years old	-0.447	-5.153*	-0.534	-5.024	-0.444	-5.170*	-0.250	-4.310	-0.370	-3.755
	(1.329)	(3.131)	(1.336)	(3.137)	(1.328)	(3.131)	(1.336)	(3.187)	(1.361)	(3.192)
School attendance	0.068***	0.182***	0.069***	0.183***	0.064**	0.176***	0.066**	0.180***	0.066**	0.178***
	(0.026)	(0.067)	(0.026)	(0.067)	(0.026)	(0.068)	(0.026)	(0.067)	(0.026)	(0.067)
Nonwhite	0.017	0.009	0.018	0.009	0.019*	0.009	0.018*	0.008	0.018*	0.008
	(0.011)	(0.023)	(0.011)	(0.023)	(0.011)	(0.023)	(0.011)	(0.023)	(0.011)	(0.023)
Elderly	-0.073	0.597***	-0.089	0.599***	-0.089	0.592***	-0.067	0.659***	-0.078	0.690***
	(0.095)	(0.207)	(0.094)	(0.207)	(0.094)	(0.206)	(0.098)	(0.206)	(0.100)	(0.208)
Young	-0.053	0.416**	-0.051	0.413**	-0.055	0.419**	-0.058	0.391**	-0.056	0.374**
	(0.078)	(0.172)	(0.078)	(0.172)	(0.078)	(0.172)	(0.078)	(0.174)	(0.078)	(0.174)
Men head of the family	0.011	-0.099	0.006	-0.097	0.007	-0.095	0.012	-0.073	0.009	-0.066
	(0.046)	(0.096)	(0.046)	(0.096)	(0.046)	(0.096)	(0.047)	(0.095)	(0.047)	(0.096)
Couple	0.011	0.083	0.012	0.084	0.011	0.079	0.014	0.098*	0.012	0.101*
	(0.018)	(0.052)	(0.018)	(0.053)	(0.018)	(0.053)	(0.018)	(0.053)	(0.018)	(0.053)
Gender	-0.190	0.184	-0.202*	0.200	-0.192	0.202	-0.185	0.219	-0.194	0.235

	(0.123)	(0.263)	(0.123)	(0.263)	(0.123)	(0.265)	(0.123)	(0.267)	(0.122)	(0.269)
slum	0.506**	-0.696	0.513**	-0.693	0.513**	-0.717	0.499**	-0.849	0.511**	-0.893
	(0.227)	(0.787)	(0.227)	(0.787)	(0.227)	(0.789)	(0.226)	(0.784)	(0.227)	(0.784)
tenements	-0.224	0.312	-0.205	0.347	-0.212	0.432	-0.218	0.271	-0.216	0.390
	(0.228)	(1.180)	(0.228)	(1.180)	(0.228)	(1.183)	(0.228)	(1.172)	(0.228)	(1.171)
Illegal land occupation	0.336*	0.126	0.329	0.125	0.339*	0.122	0.344*	0.156	0.337*	0.155
	(0.203)	(0.582)	(0.203)	(0.581)	(0.203)	(0.582)	(0.204)	(0.581)	(0.204)	(0.580)
capitals	0.833		0.966		0.958		1.046		1.017	
	(0.879)		(0.934)		(0.931)		(0.938)		(0.940)	
latitude	0.007	0.295	0.002	0.292	0.006	0.301	-0.001	0.280	0.001	0.278
	(0.074)	(0.211)	(0.073)	(0.211)	(0.073)	(0.211)	(0.074)	(0.211)	(0.074)	(0.210)
longitude	0.111	0.601**	0.114	0.607***	0.123	0.603**	0.107	0.578**	0.111	0.570**
	(0.087)	(0.235)	(0.086)	(0.235)	(0.087)	(0.236)	(0.086)	(0.234)	(0.086)	(0.233)
Distance to the federal capital	0.045	0.042	0.050	0.033	0.055	0.026	0.056	0.078	0.051	0.097
	(0.072)	(0.193)	(0.072)	(0.194)	(0.073)	(0.195)	(0.073)	(0.192)	(0.073)	(0.192)
Distance to the state capital	0.005	-0.435*	0.000	-0.441*	0.010	-0.402	-0.000	-0.451*	0.001	-0.441*
	(0.092)	(0.257)	(0.092)	(0.257)	(0.093)	(0.257)	(0.092)	(0.256)	(0.092)	(0.255)
Distance to portugal	-4.180	5.354	-4.243	5.444	-4.152	5.563	-4.394	4.929	-4.316	5.539
	(4.062)	(8.293)	(4.062)	(8.295)	(4.058)	(8.291)	(4.073)	(8.430)	(4.090)	(8.179)
altitude	0.000	0.001	0.000	0.001	0.000	0.001	0.000	0.001	0.000	0.001
	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)
Rainfall (100mm)	-0.013	0.103	-0.010	0.100	-0.012	0.097	-0.010	0.107*	-0.011	0.109*
	(0.029)	(0.063)	(0.029)	(0.063)	(0.029)	(0.063)	(0.029)	(0.063)	(0.029)	(0.063)
Type of soil 1	0.052	-1.303	0.058	-1.316	0.050	-1.351	0.048	-1.326	0.051	-1.357
	(0.341)	(1.033)	(0.340)	(1.035)	(0.341)	(1.039)	(0.340)	(1.037)	(0.341)	(1.035)
Type of soil 2	0.334	-0.815	0.352	-0.810	0.327	-0.853	0.343	-0.866	0.338	-0.864
	(0.421)	(1.232)	(0.420)	(1.234)	(0.420)	(1.238)	(0.420)	(1.226)	(0.421)	(1.225)
Type of soil 3	-1.173	-1.569	-1.182	-1.544	-1.189	-1.652	-1.177	-1.714	-1.182	-1.647
	(0.959)	(2.035)	(0.965)	(2.037)	(0.962)	(2.038)	(0.970)	(2.002)	(0.964)	(2.014)
Type of soil 4	0.326	-51.853	0.322	-51.331	0.286	-51.891	0.306	-51.743	0.318	-51.679
	(0.856)	(.)	(0.857)	(.)	(0.861)	(.)	(0.852)	(.)	(0.855)	(.)
Type of soil 5	-0.755	3.173	-0.729	3.184	-0.724	3.116	-0.737	3.090	-0.729	3.058
	(0.652)	(2.990)	(0.654)	(2.989)	(0.655)	(2.996)	(0.652)	(2.977)	(0.653)	(2.974)
Type of soil 6	-0.251	-0.841	-0.256	-0.833	-0.258	-0.891	-0.260	-0.904	-0.256	-0.925
	(0.333)	(1.023)	(0.333)	(1.026)	(0.333)	(1.031)	(0.333)	(1.025)	(0.333)	(1.023)
Type of soil 7	0.098	-1.389	0.093	-1.362	0.086	-1.463	0.074	-1.400	0.081	-1.419
	(0.474)	(1.933)	(0.473)	(1.933)	(0.473)	(1.939)	(0.474)	(1.924)	(0.474)	(1.927)
Type of soil 8	-0.086	-0.597	-0.087	-0.590	-0.089	-0.643	-0.084	-0.631	-0.085	-0.605
	(0.374)	(1.253)	(0.374)	(1.254)	(0.374)	(1.259)	(0.374)	(1.250)	(0.375)	(1.249)
Type of soil 9	0.595	-2.928	0.625	-2.697	0.586	-2.926	0.590	-2.979	0.589	-2.912

	(0.610)	(2.167)	(0.610)	(2.193)	(0.609)	(2.162)	(0.609)	(2.192)	(0.608)	(2.212)
Type of soil 10	0.494	-1.437	0.501	-1.373	0.490	-1.481	0.483	-1.561	0.493	-1.569
	(0.502)	(1.604)	(0.502)	(1.607)	(0.501)	(1.606)	(0.501)	(1.592)	(0.502)	(1.591)
Type of soil 11	-0.057	0.173	-0.042	0.163	-0.039	0.118	-0.043	0.215	-0.043	0.138
	(0.479)	(1.527)	(0.478)	(1.526)	(0.478)	(1.527)	(0.478)	(1.539)	(0.478)	(1.526)
Cycle of sugar cane	0.124		0.129		0.116		0.131		0.125	
	(0.556)		(0.553)		(0.554)		(0.554)		(0.553)	
Cycle of gold	0.284	4.580	0.274	4.602	0.340	4.609	0.266	5.075*	0.272	4.737*
	(0.763)	(2.860)	(0.764)	(2.863)	(0.766)	(2.869)	(0.756)	(2.891)	(0.760)	(2.822)
Age of municipality município	0.008	-0.009	0.008	-0.008	0.009	-0.007	0.008	-0.010	0.008	-0.008
	(0.006)	(0.019)	(0.006)	(0.019)	(0.006)	(0.019)	(0.006)	(0.019)	(0.006)	(0.019)
STATE11	-5.343**	-22.057***	-5.478**	-22.064***	-5.672***	-21.604***	-5.328**	-21.768***	-5.408**	-21.679***
	(2.140)	(7.072)	(2.133)	(7.076)	(2.139)	(7.079)	(2.147)	(7.061)	(2.150)	(7.056)
STATE12	-3.771	-18.810**	-2.564	-18.838**	-4.241	-18.378**	-3.818	-18.786**	-3.873	-19.111**
	(2.823)	(8.756)	(2.789)	(8.764)	(2.836)	(8.803)	(2.821)	(8.692)	(2.826)	(8.701)
STATE13	-4.148*	-61.107	-4.299*	-61.304	-4.293*	-60.731	-4.319*	-61.608	-4.313*	-62.432
	(2.428)	(.)	(2.427)	(.)	(2.408)	(.)	(2.418)	(.)	(2.423)	(.)
STATE14		-10.606		-10.592		-8.975		-10.188		-10.547
		(10.558)		(10.584)		(10.924)		(10.418)		(10.376)
STATE15	-2.250	-14.391**	-2.254	-14.329**	-2.313	-14.282**	-2.300	-14.215**	-2.284	-14.596***
	(1.496)	(5.584)	(1.493)	(5.593)	(1.490)	(5.606)	(1.491)	(5.581)	(1.491)	(5.573)
STATE16	-1.477	-8.691	-1.676	-8.658	-1.780	-7.255	-1.702	-8.703	-1.663	-9.234
	(1.826)	(6.711)	(1.848)	(6.721)	(1.843)	(6.994)	(1.842)	(6.712)	(1.853)	(6.704)
STATE17	-0.333	-7.367*	1.023	-7.910*	-0.401	-7.222	-0.392	-7.639*	-0.356	-7.593*
	(1.218)	(4.469)	(1.317)	(4.534)	(1.217)	(4.482)	(1.212)	(4.478)	(1.216)	(4.482)
STATE21	-2.523*	-9.262*	-2.531*	-9.349*	-2.621**	-9.334*	-2.582**	-9.494*	-2.548**	-9.766*
	(1.293)	(5.187)	(1.291)	(5.191)	(1.291)	(5.199)	(1.287)	(5.193)	(1.287)	(5.195)
STATE22	-2.286**	-5.771	-2.286**	-5.748	-2.348**	-5.732	-2.328**	-5.949	-2.303**	-5.976
	(1.138)	(4.369)	(1.137)	(4.376)	(1.137)	(4.378)	(1.135)	(4.375)	(1.139)	(4.380)
STATE23	-1.878	-2.848	-1.842	-2.771	-1.890*	-2.827	-1.958*	-3.378	-1.887*	-3.467
	(1.149)	(4.877)	(1.148)	(4.891)	(1.148)	(4.890)	(1.143)	(4.878)	(1.140)	(4.879)
STATE24	-1.919	-0.677	-1.889	-0.618	-1.920	-0.644	-2.022	-1.532	-1.948	-1.812
	(1.259)	(4.669)	(1.259)	(4.683)	(1.260)	(4.682)	(1.252)	(4.666)	(1.248)	(4.669)
STATE25	-1.835	0.215	-1.813	0.274	-1.822	0.236	-1.939*	-0.456	-1.856	-0.526
	(1.175)	(4.559)	(1.174)	(4.572)	(1.176)	(4.573)	(1.171)	(4.552)	(1.167)	(4.554)
STATE26	-0.828	4.269	-0.823	4.313	-0.857	4.187	-0.929	3.594	-0.870	3.512
	(1.073)	(4.481)	(1.073)	(4.494)	(1.073)	(4.492)	(1.068)	(4.481)	(1.065)	(4.477)
STATE27	-0.888	0.393	-0.894	0.348	-0.925	0.283	-1.017	-0.458	-0.945	-0.506
	(1.044)	(4.720)	(1.044)	(4.731)	(1.043)	(4.721)	(1.040)	(4.716)	(1.034)	(4.730)
STATE28	-0.713	2.214	-0.688	2.141	-0.733	2.103	-0.749	1.984	-0.738	1.675

	(0.975)	(4.433)	(0.975)	(4.440)	(0.974)	(4.443)	(0.971)	(4.424)	(0.970)	(4.433)
STATE29	-1.812**	-3.461	-1.795**	-3.439	-1.827**	-3.538	-1.839**	-3.612	-1.829**	-3.631
	(0.817)	(3.836)	(0.816)	(3.846)	(0.816)	(3.845)	(0.815)	(3.838)	(0.814)	(3.842)
STATE31	-0.839	-3.360	-0.854	-3.427	-0.872	-3.426	-0.905	-3.538	-0.883	-3.802
	(0.560)	(3.295)	(0.557)	(3.304)	(0.557)	(3.305)	(0.558)	(3.306)	(0.557)	(3.317)
STATE32	0.599	3.263	0.584	3.247	0.585	3.232	0.590	3.444	0.583	3.392
	(0.709)	(4.083)	(0.708)	(4.086)	(0.709)	(4.088)	(0.711)	(4.077)	(0.712)	(4.074)
STATE35	-0.745	-3.693	-0.761	-3.759	-0.817	-3.794	-0.819	-4.077	-0.781	-4.385
	(0.604)	(3.551)	(0.602)	(3.560)	(0.603)	(3.564)	(0.602)	(3.561)	(0.603)	(3.570)
STATE41	-1.790**	-4.085	-1.882**	-4.139	-1.950**	-4.078	-1.877**	-4.103	-1.865**	-4.295
	(0.829)	(3.890)	(0.823)	(3.898)	(0.830)	(3.903)	(0.822)	(3.887)	(0.823)	(3.893)
STATE42	-0.832	-4.611	-0.955	-4.674	-1.018	-4.549	-0.944	-4.357	-0.932	-4.312
	(0.940)	(3.961)	(0.932)	(3.971)	(0.938)	(3.976)	(0.931)	(3.959)	(0.931)	(3.968)
STATE43	-1.363	-6.276	-1.494	-6.298	-1.563	-6.112	-1.485	-5.917	-1.464	-5.868
	(1.125)	(4.205)	(1.118)	(4.214)	(1.127)	(4.223)	(1.118)	(4.200)	(1.117)	(4.211)
STATE50	3.657**	1.562	3.572**	1.504	3.556**	1.865	3.571**	1.366	3.580**	1.033
	(1.684)	(4.974)	(1.678)	(4.982)	(1.674)	(4.999)	(1.675)	(4.950)	(1.676)	(4.957)
STATE51	-1.333	-10.460**	-1.409	-10.501**	-1.482	-9.965**	-1.365	-10.161**	-1.390	-10.431**
	(1.552)	(4.996)	(1.548)	(5.003)	(1.548)	(5.061)	(1.554)	(4.985)	(1.553)	(4.980)
STATE52	5.606***	4.145	5.566***	4.060	5.556***	4.138	5.569***	3.924	5.563***	3.682
	(1.200)	(4.165)	(1.196)	(4.173)	(1.196)	(4.176)	(1.197)	(4.172)	(1.196)	(4.178)
Constant	2.110	-72.025***	2.655	-73.261***	2.083	-72.385***	1.962	-73.525***	2.360	-77.798***
	(7.880)	(19.623)	(7.846)	(19.555)	(7.841)	(19.564)	(7.886)	(19.698)	(7.908)	(19.947)
Fixed Effects Variables	yes	yes	yes	yes			yes	yes	yes	yes
sigma	3.286***	8.696***	3.286***	8.693***	3.285***	8.695***	3.284***	8.664***	3.286***	8.656***
	(0.156)	(0.432)	(0.156)	(0.432)	(0.156)	(0.433)	(0.155)	(0.431)	(0.155)	(0.430)
Pseudo R^2	0.295	0.236	0.295	0.236	0.295	0.236	0.295	0.237	0.295	0.237
Bic	6936.170	6631.914	6936.429	6630.993	6936.544	6631.525	6936.568	6627.011	6937.260	6625.001
N	1952.000	2183.000	1952.000	2182.000	1952.000	2183.000	1952.000	2183.000	1952.000	2183.000

See notes on table A.2.1.

Table A.2.4 – Tobit Marginal Effect estimates on the proportion of beneficiaries among the poor using municipality dummies to capture the fixed effect
Median voter above the poverty line (PNAD data from 2001 to 2007)

	Tobit FE-I	Tobit FE-II
Time commuting poor	-3.158**	
	(1.394)	
Time commuting non poor	3.946	
	(4.779)	
Isolated poor		-0.009
		(0.024)
Income	7.051***	4.275***
	(1.406)	(1.466)
Inequality/Proxy for tax price	-8.596*	-0.284
	(4.512)	(4.919)
Size of the program	1.842***	1.986***
	(0.045)	(0.051)
Population	-0.000	0.011
	(0.012)	(0.015)
Schooling	-0.487	0.079
	(0.920)	(1.000)
Nonwhite	0.001	0.047
	(0.052)	(0.057)
School Attendance	-0.030	0.065
	(0.112)	(0.124)
Family members less than 15 years old	1.273	-2.097
	(5.100)	(5.690)
Young	0.191	0.381
	(0.213)	(0.235)
Elderly	0.404*	0.616***
	(0.218)	(0.232)
Men head of the family	-0.083	0.050
	(0.072)	(0.080)
Couple	-0.167**	-0.053
	(0.081)	(0.089)
Gender	-0.046	0.155
	(0.157)	(0.171)
Year_2002	10.261***	8.716***
	(1.767)	(1.977)
Year_2003	10.625***	10.774***
	(1.459)	(1.642)
Year_2004	14.609***	13.679***
	(1.617)	(1.811)
Year_2005	12.851***	12.568***
	(1.631)	(1.819)
Year_2006	14.326***	13.241***
	(1.944)	(2.134)
Year_2007	17.039***	15.140***
	(1.995)	(2.177)
Constant	-11.069	-163.001
	(133.351)	(160.015)
Pseudo R^2	0.164	0.143
Bic	31907.350	36930.058
N	3928.000	4790.000

See notes on table A.2.1.

Table A.2.5 –Tobit marginal effects estimates on the proportion of non-poor beneficiaries (leakage)
Median voter above the poverty line (Census 2000)

	I	II	III	IV	V
Population density	0.000				
	(0.002)				
Urban density		0.000			
		(0.000)			
Area			-0.000		
			(0.001)		
Isolated poor				0.002	
				(0.001)	
Prob. poor meets non poor					0.001
					(0.002)
Income	-0.098	-0.098	-0.094	-0.062	-0.084
	(0.081)	(0.081)	(0.081)	(0.085)	(0.088)
Inequality/Proxy for tax price	-0.106	-0.111	-0.110	-0.105	-0.117
	(0.287)	(0.285)	(0.285)	(0.285)	(0.285)
Size of the program	0.565***	0.565***	0.565***	0.565***	0.565***
	(0.017)	(0.016)	(0.017)	(0.017)	(0.017)
Population	0.000**	0.000*	0.000*	0.000*	0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Schooling	0.194***	0.194***	0.194***	0.203***	0.185***
	(0.058)	(0.058)	(0.058)	(0.057)	(0.056)
Family members less than 15 years old	0.222	0.225	0.228	0.158	0.268
	(0.440)	(0.440)	(0.440)	(0.454)	(0.459)
School attendance	-0.012*	-0.012*	-0.013*	-0.012	-0.013*
	(0.007)	(0.007)	(0.008)	(0.008)	(0.008)
Nonwhite	0.001	0.001	0.001	0.001	0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Elderly	-0.065***	-0.065***	-0.065***	-0.068***	-0.060***
	(0.021)	(0.021)	(0.021)	(0.021)	(0.022)
Young	-0.041*	-0.042*	-0.042*	-0.040*	-0.043*
	(0.023)	(0.023)	(0.023)	(0.024)	(0.024)
Men head of the family	-0.019*	-0.019*	-0.019*	-0.021*	-0.019
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Couple	0.012*	0.012*	0.012*	0.011*	0.012**
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Gender	-0.030	-0.029	-0.030	-0.033	-0.028
	(0.035)	(0.035)	(0.035)	(0.036)	(0.036)
Constant	2.689	2.621	2.646	2.744	2.492
	(2.295)	(2.271)	(2.298)	(2.310)	(2.338)
State dummies	yes	yes	yes	yes	yes
Fixed Effects Variables	yes	yes	yes	yes	yes
Pseudo R^2	0.354	0.354	0.354	0.354	0.354
Bic	9901.598	9900.455	9901.315	9894.713	9896.889
N	4140.000	4139.000	4140.000	4135.000	4135.000

See notes on table A.2.1.

Table A.2.6 – Tobit marginal effects estimates on the proportion of non-poor beneficiaries (leakage) using municipality dummies to capture the fixed effect
Median voter above the poverty line (PNAD data from 2001 to 2007)

	Tobit FE-I	Tobit FE-II
Time commuting poor	0.279	
	(0.230)	
Time commuting non poor	1.284	
	(0.810)	
Isolated poor		-0.0001
		(0.003)
Income	0.432*	0.452**
	(0.227)	(0.179)
Inequality/Proxy for tax price	2.490***	1.791***
	(0.753)	(0.635)
Size of the program	0.855***	0.868***
	(0.007)	(0.007)
Population	-0.001	-0.001
	(0.002)	(0.002)
Schooling	0.157	0.013
	(0.153)	(0.128)
Nonwhite	-0.000	0.002
	(0.009)	(0.007)
School attendance	0.005	-0.012
	(0.019)	(0.016)
Family members less than 15 years old	-1.279	-1.061
	(0.852)	(0.736)
Young	-0.037	-0.032
	(0.035)	(0.030)
Elderly	-0.082**	-0.064**
	(0.037)	(0.030)
Men head of the family	0.002	0.005
	(0.012)	(0.010)
Couple	0.020	0.017
	(0.013)	(0.011)
Gender	0.014	-0.002
	(0.026)	(0.022)
Year_2002	0.254	0.275
	(0.288)	(0.249)
Year_2003	0.137	0.219
	(0.237)	(0.206)
Year_2004	0.533**	0.640***
	(0.264)	(0.228)
Year_2005	0.272	0.336
	(0.268)	(0.230)
Year_2006	0.929***	1.105***
	(0.320)	(0.270)
Year_2007	0.206	0.338
	(0.329)	(0.276)
Constant	1.975	12.668
	(22.456)	(21.077)
Pseudo R^2	0.383	0.384
Bic	24034.386	27933.592
N	3928.000	4790.000

See notes on table A.2.1.

Table A.2.7 – Within Estimator effects on the average number of benefits per capita in the poor households that receive at least one benefit
Median voter above the poverty line (data from 2004 and 2006 PNAD)

	FE-I	FE-II	FE-III
Time commuting poor		0.10848**	0.10885**
		(0.04308)	(0.04182)
Time commuting non poor		-0.13851*	-0.14779*
		(0.08126)	(0.08227)
Isolated poor	0.00078		0.00065
	(0.00059)		(0.00058)
Income	0.00365	-0.01216	-0.00682
	(0.02651)	(0.02676)	(0.02683)
Inequality/Proxy for tax price	0.06050	0.07507	0.06963
	(0.06922)	(0.07055)	(0.06944)
Size of the program	0.00028	-0.00040	-0.00040
	(0.00087)	(0.00092)	(0.00090)
Population	-0.00001	-0.00007	-0.00006
	(0.00020)	(0.00022)	(0.00021)
Schooling	0.04038**	0.04196**	0.04135**
	(0.01714)	(0.01817)	(0.01806)
Nonwhite	-0.00119	-0.00138	-0.00132
	(0.00103)	(0.00109)	(0.00107)
School attendance	-0.00150	-0.00106	-0.00107
	(0.00201)	(0.00194)	(0.00194)
Family members less than 15 years old	-0.08834	-0.07806	-0.09572
	(0.08244)	(0.07750)	(0.08000)
Young	-0.00183	-0.00298	-0.00206
	(0.00376)	(0.00355)	(0.00362)
Elderly	-0.00401	-0.00535	-0.00495
	(0.00405)	(0.00432)	(0.00418)
Men head of the family	-0.00102	-0.00051	-0.00051
	(0.00111)	(0.00106)	(0.00106)
Couple	-0.00184	-0.00174	-0.00168
	(0.00137)	(0.00141)	(0.00141)
Gender	-0.00388	-0.00277	-0.00278
	(0.00281)	(0.00290)	(0.00287)
Income of the isolated poor	0.00059	0.00044	0.00033
	(0.00036)	(0.00036)	(0.00037)
N. recipients	-0.000001	0.000001	0.000001
	(0.00000)	(0.00000)	(0.00000)
Year_2006	0.00055	0.00360	0.00064
	(0.01670)	(0.01723)	(0.01669)
Constant	0.70130**	0.72146**	0.67466**
	(0.31723)	(0.34339)	(0.33096)
R^2	0.07459	0.10912	0.11409
Bic	-2128.15600	-2100.10711	-2098.50565
N	726.00000	700.00000	700.00000

See notes on table A.2.1.

Table A.2.8 – Within Estimator effects on the per capita value of benefits received by the poor households contemplated by at least one benefit
Median voter above the poverty line (data from 2004 and 2006 PNAD)

	FE-I	FE-II	FE-III
Time commuting poor		4.45804	4.50498
		(2.87093)	(2.78416)
Time commuting non poor		-11.37866*	-12.06350**
		(6.07812)	(6.09636)
Isolated poor	0.09876		0.05604
	(0.07050)		(0.04047)
Income	3.22657	-0.13067	0.33411
	(2.77402)	(1.68912)	(1.73437)
Inequality/Proxy for tax price	-10.11845*	-5.28963	-5.78598
	(5.18209)	(4.52741)	(4.43784)
Size of the program	0.16405**	0.06775	0.06785
	(0.07758)	(0.06651)	(0.06722)
Population	0.01565	0.00889	0.01003
	(0.01705)	(0.01386)	(0.01395)
Schooling	1.30302	1.84325*	1.80960*
	(1.19416)	(0.98059)	(0.96381)
Nonwhite	-0.15561**	-0.14914**	-0.14622**
	(0.07470)	(0.07249)	(0.07144)
School attendance	-0.07759	-0.06184	-0.05991
	(0.13617)	(0.10850)	(0.11017)
Family members less than 15 years old	2.59289	3.37867	1.85241
	(5.32678)	(5.15889)	(4.94588)
Young	-0.56902*	-0.57005*	-0.48880*
	(0.34189)	(0.31141)	(0.28582)
Elderly	0.21236	-0.23394	-0.20065
	(0.34973)	(0.30563)	(0.29093)
Men head of the family	0.00762	0.00366	0.00213
	(0.07754)	(0.06937)	(0.06905)
Couple	-0.02510	-0.01472	-0.00985
	(0.09919)	(0.09531)	(0.09420)
Gender	-0.40016*	-0.27933	-0.28095
	(0.22326)	(0.20684)	(0.20488)
Income of the isolated poor	0.04900*	0.02910	0.01866
	(0.02574)	(0.02326)	(0.02648)
N. recipients	-0.00005*	-0.00003	-0.00004*
	(0.00003)	(0.00002)	(0.00002)
Year_2006	1.42038	2.28406**	2.03668*
	(1.25133)	(1.12929)	(1.13226)
Constant	51.25517*	55.83434*	51.58385*
	(29.13360)	(29.93946)	(28.50840)
R^2	0.21986	0.23506	0.24369
Bic	4171.68978	3678.40897	3676.06490
N	718.00000	693.00000	693.00000

See notes on table A.2.1.