

**Political Causes of the Voluntary Transfers to States in Brazil: Analyzing Data,  
1997-2011**

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**Abstract**

This paper explains the political causes of intergovernmental transfers in Brazil, more precisely the voluntary transfers from Central Government to states. We use Panel Regression analyses to investigate what is the best predictor, in the long run, to the voluntary transfers. We show that voluntary transfers are positively correlated with over-representation of the states in the Federal Legislative. Further, any given state whose governor is member of president's party tend to receive more transfers, and those states whose the party's governor is member of the coalition and have, proportionally, a large number of deputies in the coalition also tend to receive more than others.

## **INTRODUCTION**

A very important dimension of federalism deals with the generation and sharing of tax resources. The state's ability to raise tax revenues and its autonomy for the allocation of

revenue is a key issue not only to understand how the intergovernmental relations are organized in Brazil, but also to observe how the country is governed (Alm, 1983; Bird, 1993; Hemming and Sphan, 1997; McLure Jr., 1997; Ter-Minassian, 1997; Musgrave, 1983; Mendes, 2004).

Each federation has its own rule to organize their fiscal system. In the Brazilian case, one of the most important effects of intergovernmental transfers to states is the reduction of the inequalities in the states' revenue per capita. As we are going to show, there are political factors influencing the amount of money the Central Government which is being distributing to state level government year by year in the Brazilian federalism.

“Voluntary transfers” from Central Government to states are not defined by any rule. Representatives of the states can bargain those transfers with the President annually. Those transfers are our object of analyses here.

The paper is organized as follows. In the next section we present our object of empirical analyses, called “voluntary transfers”, describing its characteristics in Brazil. The second section discusses some hypotheses of the literature about the political causes of the intergovernmental transfers. Some of them are empirical studies which deal with the Brazilian case. After that discussion, we present the literature review and the hypotheses that we are going to test. The next section presents our empirical analyses using Panel Data of Voluntary Transfers from 1997 to 2011 to test those hypotheses. Finally, we summarize our findings in the conclusion.

## **STATE'S OWN REVENUE AND THE CENTRAL GOVERNMENT'S TRANSFERS IN BRAZIL: THE RULES AFTER 1988'S CONSTITUTION**

The 1988's Constitutional Assembly redefined the Fiscal System of the Brazilian Federation. Considering the main taxes, nine were centralized in the Central Government. The states were left with three taxes and the municipalities with other three (CF, 1988; Mendes, Miranda and Cosio, 2000). Besides the large number of taxes, the Central Government is also the unique level of government which has the right to create new taxes.

In addition, this decentralized distribution of competences to tax, arranged in the 1988's Constitution, increased the state's own tax revenue. The states were left with Goods and Services Tax (ICMS), which is the most important state's tax and represents a quarter of the total tax revenue of the country. However, despite the fact that states have the competence to manage such significant part of all taxes, the transfers from the Central Government are a very important source of revenue to state government in Brazil as well.

Defined in the Federal Law of Fiscal Responsibilities, Voluntary Transfers correspond to any resource given by another government's level as cooperation, support or financial assistance that is not motivated by any constitutional or legal rule or resources for Health Care Program.

According to Brazilian law, TVU shall be included in the budget of the federal government, and its development involves both Executive and Legislative Branch of the Federal government.

At the beginning of each year the Ministry of Planning and Budget coordinates the process of negotiating the demands of each institution of the Central Government in order to establish the budget for the next year. This process results in the Draft Annual Budget Law (PLOA), which is submitted to the chief of the Executive Branch. The President, in turn, analyzes the project, and then forwards it to the Legislative. In Congress, the draft annual budget law is examined, amended and voted. Once approved by the Legislative, the Annual Budget Bill goes back to the Executive where the President has the veto power of any point of the project. So, even if a particular feature is listed in the LOA, it does not mean that this expenditure will be made. In practice, the Executive Branch can decide not to make the expenditure as it is set in the LOA. Even if there is an amount allocated as Voluntary Transfers in the LOA, nothing but the will of the Executive Branch will determine the amount that will be distribute as voluntary transfers.

A politician from a given state can introduce a feature in the LOA, by the ministry or a parliamentary amendment, but this does not guarantee that the state will actually receive such resources. At the time of execution of the expenditure, the same state will have to convince the Executive Branch to enforce the aforementioned transfer. So, it is easy to see that the main decision-making arena, considering the distribution of TVUs, is located in the Federal Executive.

Hence, TVUs are under full responsibility of the Executive Branch of the Central Government. The President can set the amount of funds to be transferred, as well as the states that will receive it and the conditions for such agreements. This last issue means that TVU may or may not be attached to a given policy, according to the Central Government's orientation. Depending on the agreement between the Central Government and a given State, the Executive Branch of the State level has the autonomy to spend the TVU according to its own will. Thus, it is not difficult to understand why many researchers are working on the question: how this decision-making process works? (Figueiredo and Limongi, 2005; Pereira and Muller, 2002; Arretche and Rodden, 2004).

The next section focuses on the TVU and presents some hypotheses about the political causes of that kind of transfer.

## **POLITICAL CAUSES OF VOLUNTARY TRANSFERS FROM CENTRAL GOVERNMENT TO STATES: HYPOTHESES**

What could explain the transfers from Central Government to sub-national governments in federations? As we have seen, it depends on the transfer. Most of the general answers to that question are better applied to what we have called here Voluntary Transfers. Anyway, there is no consensus about this especially because distinct federations function differently. Intergovernmental transfers can broadly differ from country to country in such a way that sometimes it is difficult to compare them or even reach general conclusion. Despite the idiosyncratic characteristics that sometimes undermine comparisons, some authors have offered explanations to the logic of intergovernmental transfers and to the logic of redistribution of regional income under democracies.

One broadly known approach considers electoral motivations. Meltzer and Richard (1981) argue that redistribution is in direct proportion to the income inequality before tax and transfers. Under democracy, redistributive transfers are effect of electoral competition. This is because the political elite, dependent on the vote in democracies, seeks to meet the median voter preferences. If there are high levels of income inequality and income of the median voter is below the average income, there will be redistribution of income in order to get electoral support of the median voter. Many studies use the median voter as the main factor to explain the redistribution (see Meltzer and Richard, 1981, Bolton and Roland, 1997, Romer, 1975, Baramendi, 2007, Boix 2003; Milanovic, 2000). When the issue involves intergovernmental transfers, these studies assume that the preference of the median voter is coextensive to its region's mean preference. Poor regions are in favor of higher taxation of income and greater redistribution, contrary to the rich ones. When the matter is the central government's choice regarding the amount of transfer that each region will receive, one would expect a calculation of the capitalization of the votes and the amount of redistribution.

If the transfers can be converted into electoral support, the President can choose whether he transfers to regions that gave him electoral support in the previous election in order to retain and reward the support received, or transfer to the regions where there are many "swing voters" in order to expand his support for future elections. Some authors have emphasize the first option is the preferred strategy (Cox e McCubins, 1986), and others that the winner strategy is the second one (Dixit e Londregan, 1996; Lindbeck e Weibull, 1987). So, according to these approaches, we would say that:

***H 1*** *Central government tends to transfer resources to low level government in order to guarantee electoral support for the next run.*

**H 1.a** *He does that rewarding supporters of the previous election*

**H 1.b** *He does that aiming new voters, so he transfers to regions where there are many potential voters.*

This explanation has several theoretical problems. First is the assumption that the mere existence of preference is sufficient to explain the decisions and that the transfer is efficient to get more votes in the next election. Some issues also arise if we think in terms of transfers to low level governments. It assumes that a decision maker in the central government faces no regional veto of representatives opposed to the redistribution of their income to the regions that will receive the resource. Another issue is that intergovernmental transfers, considering that it doesn't go directly to the population but to low level government, and also considering that the low level government defines (in many cases) how to spend the resource, the transfer may capitalize votes not for the president, but for the governor or mayor. If this is the case, the relationship between Governor's Party and the President's Party may be determinant to the amount of federal transfer that the state will receive, once the local ruler can be electorally benefited by the investment. If those points make sense, we would say that:

**H2** *Once voluntary transfers go to the states, it can benefit electorally the governor. So, if the Governor is member of the federal government coalition, he tends to receive more resources.*

**H3** *Once voluntary transfers go to the states, it can benefit electorally the governor. So, if The Governor is member of the President's Party, he tends to receive more resources.*

Different approach considers not the electoral motivation, but the legislative decision-making process and the legislative bargain. Rodden (2009), for instance, argues that in presidential systems the redistribution occurs because the Executive Branch needs Legislative Support. In many cases with multiparty system, it needs to form a party coalition that gives its minimal support to implement its agenda. The discretionary transfers act as a bargaining chip. Rodden (2009) argues that "in Brazil [...] leaders and the president clearly use discretionary spending and intergovernmental transfers to form a legislative coalition. The dictates of legislative bargaining may help to explain the weak correlation between income and transfers" (pp.15-16). Therefore, this is an alternative explanation to the amount of voluntary transfers that each region receives.

Likewise, Gibson, Calvo and Fatelli (2003) examined the cases of Brazil, Argentina, Mexico and the U.S.<sup>1</sup> They concluded that the over-representation of regions or states in the

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<sup>1</sup> We have called it here Constitutional and Voluntary transfers, respectively.

Federal Legislative affect the intergovernmental transfers from The Central Government, producing "distortions in federal spending in favor of areas over-represented" (Gibson, Calvo and Fatelli, 2003, p.105). They get close to the Rodden's explanation when they try to explain why it happens. Examining the Argentinean case more carefully, they argue that sparsely populated states and over-represented "cost less" in terms of investment in exchange for "a unity of political support" in the Legislative Branch. In other words, they argue that transfers are used by the President in order to get Legislative support to his agenda, as Rodden (2009) also argued specifically for the Brazilian case. These explanations can be rephrased like this:

**H4** *Voluntary transfers are used by President to get Legislative support, especially in a context in which his party doesn't have the majority of the seats. The cost for legislative marginal support is low when the state is over-represented and small. So, the transfers tend to be spread between the states over-represented. These states receive more transfer per capita.*

This approach, however, assumes that the President has to negotiate support individually, and that deputies don't follow its parties. However, we must remember that there is no regional party in Brazil. All party must be national. Electoral district are states, and each state has representatives from different parties in the House of Representatives. So, in order to get Legislative support, would have the President to negotiate with a group of deputies from different parties but from the same state, or with a group of deputies from different states but from the same party?

Considering the House of Representatives decision-making process in the Brazilian federal government, empirical studies have shown that parties are strong and that deputies vote according to their parties (Figueiredo and Limongi, 1995, 1999, 2003). Even when decisions impose losses for sub-national governments, parliamentarians have behaved partisan (Figueiredo and Limongi, 2003, 2003; Arretche, 2007, 2010) Cheibub, Figueiredo and Limongi argued that "the idea of a [Federal] Legislative centered in the states must be mitigated [...] the legislative support to the President's Legislative agenda occurs in partisan grounds" (2009, p. 165 – free translation; 2002). Following that understanding, some authors have shown that the will of the governors cannot influence the congressmen's vote decisions, as parties do. (Carey and Reinhardt, 2004; Desposato, 2004). Even though in many cases there are regional interests which are at stake (Arretche, 2010).Indeed, in the most of the situations, the deputies' votes follow the party and party leader's vote, and the parties vote according their position relative to the Central Government: member or not of the government coalition. If this logic can be applied for the decision-making process of the distribution of federal transfers to states, it is important to consider that the President may negotiate with parties in the Legislative context; hence the

state where deputies come from becomes a secondary matter. Indeed, if intergovernmental transfers are used as chip in the legislative bargain in order to build the government coalition and hold it together, it's important to consider that the number of party's seats may influence the decision regarding the transfers. Considering that we are dealing with federal transfers which have been given given to states, it is worth to consider that these transfers may depend on the number of deputies of the state in the coalition. So, the derived hypothesis is:

*H5 The number of states' deputies in the government coalition determines the voluntary transfers*

It is interesting at this point to link legislative bargain and electoral interest. As discussed above, the transfers to states can benefit the Governor and the Legislative decision-making process should be taken into account. Once the legislative bargain happens in partisan grounds in Brazil, we must also test if the state whose governor's party is member of the coalition, and whose party holds a proportionally large number of seats in the Federal Legislative, tends to receive more transfers. This hypothesis is:

*H6 Governor who is member of coalition receives more transfers if his party have proportionally more seats in the legislative*

Finally, Arretche and Rodden (2004) have tested similar hypothesis to the ones we are aiming in order to identify the variables that explain the transfers to states and to municipalities in Brazil, from 1996 to 2000. Using Regression with Panel Data, in terms of electoral motivations to the transfers, they found that in the electoral year the mean of transfer tends to be 0,659 higher and that the states which support president in the presidential election also tend to receive more. Furthermore, in terms of legislative bargain, the small and over-represented states tend to receive a larger amount of transfers than the others. However, they also found that "belonging to the presidential coalition increases exponentially the chances of the deputies to get resources to their states or municipalities" (Arretche and Rodden, 2004, p.568). However, it doesn't matter, they say, whether the governor's party is member of the government coalition.

We follow from this point and tested all these hypotheses. We expanded the Arretche and Rodden's analysis until 2011, starting at 1997, and we included other variables to test the other hypotheses we have discussed above. In the next section we present the empirical analyses.

## **EMPIRICAL ANALYSES**

The hypotheses discussed in the previous section were tested here with data of voluntary transfers from federal government to states since 1997 to 2011. We have used Linear



Model with Panel Data to estimate the effects of independent variables on the voluntary transfers. All the variables used as proxy and the tests we did to guide the model choice are detailed in the annex.

To test the hypothesis concerned with electoral motivations, we use five variables. To verify if the transfers are used to reward states where president have had good electoral support (**H1a**) we used a dummy variable that is 1 if the president has received the majority of the votes. According to the hypothesis, we expect to find a positive relation between this variable and the amount of transfers.

In order to test if the president tends to transfer more to states where he has potential voters (**H1b**) we used the log of the difference of votes received by the president in the first and second round. According to the hypothesis, we expect to see a positive relationship between this variable and the transfers.

To check if the governor's party matter, we use two variables: the first is a dummy variable which is equal to 1 if the governor's party is part of the president's coalition. According to the hypothesis (**H2**), we expect a positive relationship with the voluntary transfers. The second is also a dummy variable, but it is equal to 1 if the governor's party is the same as the president's. If the hypothesis that the president tends to benefits regions ruled by his party (**H3**), we would see a positive and significant relationship with the transfers.

In terms of legislative bargain strictly, we have used the over-representation index, as used by Gibson, Calvo e Fatelli (2003), in order to test if the over-represented states tend to receive more (**H4**). We expect to see a positive correlation with the transfers as well.

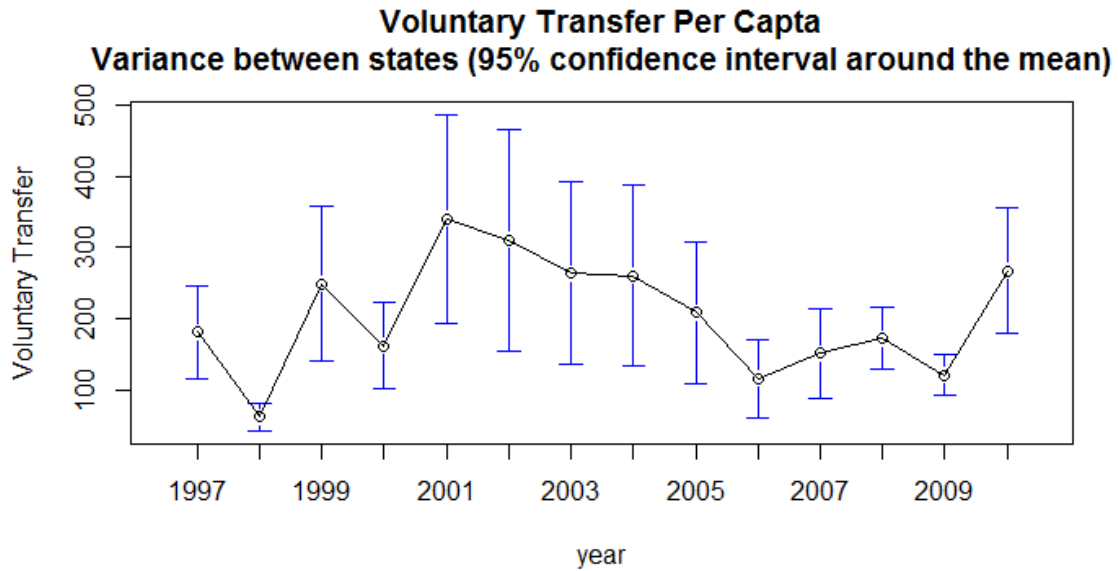
We have measured the proportion of deputies of the states in the government coalition to check whether states which have more deputies in the coalition tend to receive more transfers, as the hypothesis presumes (**H5**). We also verify if the seats of the coalition in the hands of the governor's party are positive correlated with the transfers (**H6**).

Finally, we also added some other electoral indicators. One of them is the competitiveness of the president's and governor's election captured by the effective number of electoral parties. Another one is a dummy that indicates whether it is electoral year. The log of the number of poor in the states and the State Own Revenue are also used to see if there is any correlation between those variables and the transfers.

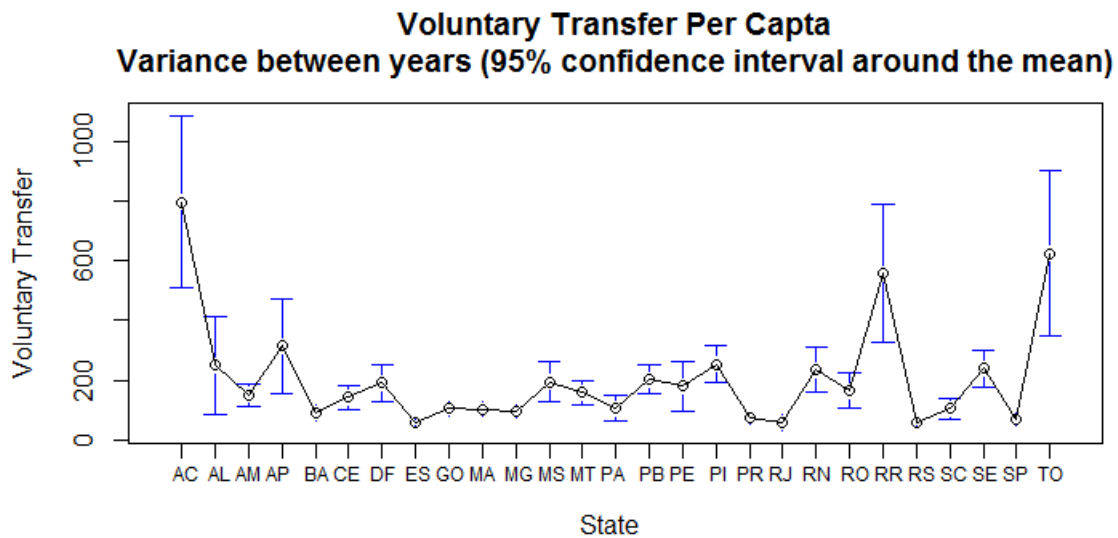
The two graphics below show the variation of voluntary transfers between states and years. There is less variation within states through the years (second graphic below) than within the year across states (first graphic below). In other words, it means that the main source of the

variation in the transfer occurs between states. Holding constant the year, there is a big variation in the amount that the states receive. Holding the state constant, there are no significant variations on the amount of transfers received through the years.

**Graphic 4**



**Graphic 5**



**RESULTS OF REGRESSIONS**

The table 2 shows the results of regressions. In our first model with no interactions and only time-invariant effect, the states where president have potential voters tend to receive *less* transfers. The transfers per capta tend to decrease 37% average to each potential voter, everything else kept constant. Interestingly, the electoral year is also associated with less

transfer. On the other hand, legislative variables are associated with rise in the transfers. States over-represented tend to receive 30% average more if there is a marginal increment in the over-representation index. Governor that are member of The President's party tend to receive 22% average more than others. A marginal rise in the proportion of coalition's seats in the hands of the governor's party represents an increasing of 53% in the TVU.

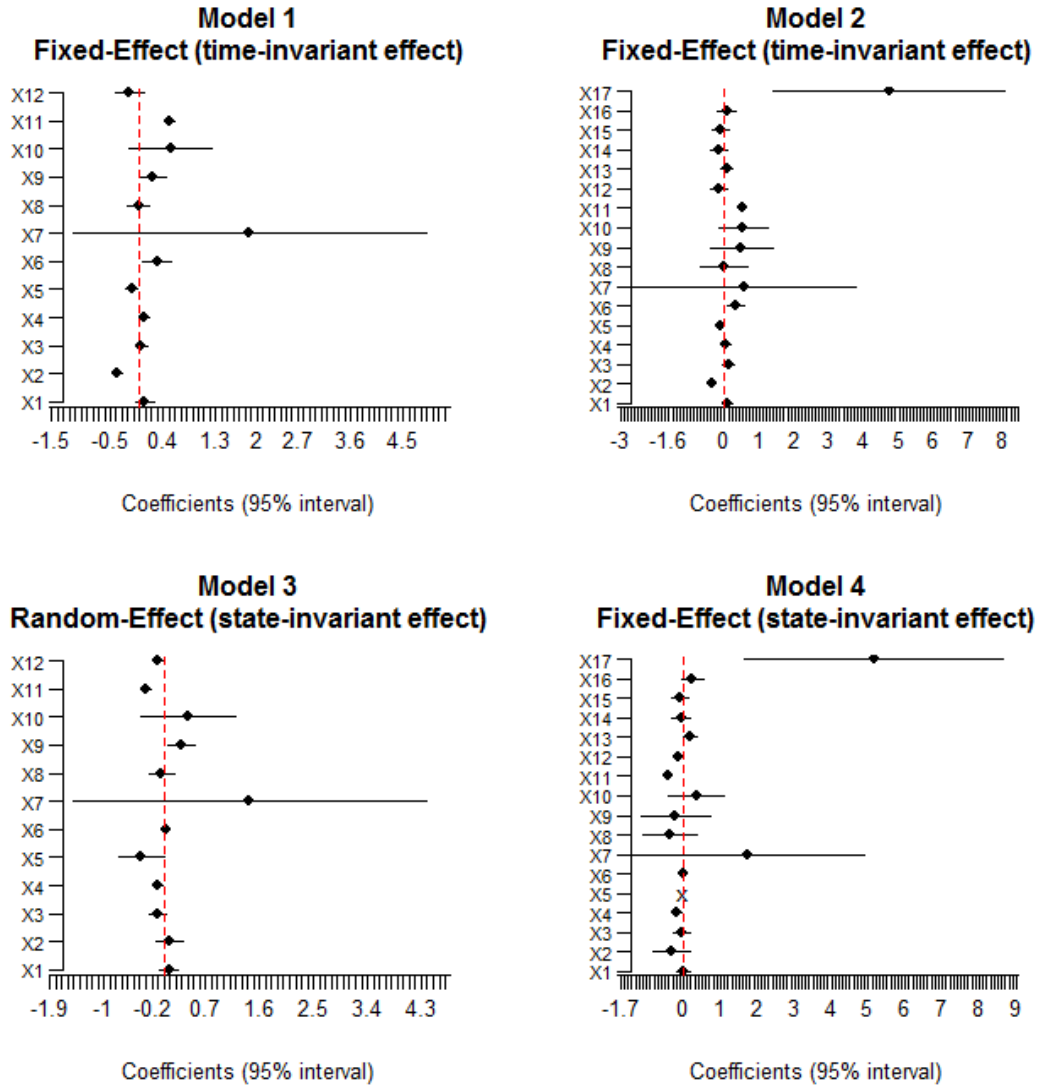
The model 2 that include interactions and considering time-invariant effect yield similar results. The R<sup>2</sup> shows that this model explains more variation of the TVU. There is a huge effect of the interactions between the proportion of state's deputies in the coalition and the fact that the governor's party also belongs to the President's coalition.

Variables	Time invariant		State-invariant	
	Model 1 Fixed-effect	Model 2 Fixed-effect	Model 3 Random-effect	Model 4 Fixed-effect
X1 <i>President award supporters</i>	0.0885 (0.119)	0.067 (0.11)	0.084 (0.077)	-0.005 (0.128)
X2 <i>President award potential supporters</i>	<b>-0.377***</b> (0.055)	<b>-0.373***</b> (0.055)	0.0971 (0.113)	-0.326 (0.280)
X3 <i>Presidential Election was competitive</i>	0.0336 (0.063)	0.109 (0.108)	-0.107 (0.066)	-0.058 (0.130)
X4 <i>Governor election was competitive</i>	0.077 (0.066)	0.035 (0.108)	<b>-0.104*</b> (0.045)	<b>-0.181 .</b> (0.094)
X5 <i>Electoral year</i>	<b>-0.138**</b> (0.045)	<b>-0.138**</b> (0.45)	<b>-0.373*</b> (0.186)	---
X6 <i>Overrepresentation index</i>	<b>0.304***</b> (0.075)	<b>0.330***</b> (0.089)	0.0419 (0.029)	-0.015 (0.046)
X7 <i>State's Deputies in the government coalition</i>	<b>1.87 .</b> (1.12)	0.540 (1.14)	1.434 (1.359)	1.73 (1.578)
X8 <i>Governor's party is member of coalition</i>	-0.020 (0.079)	-0.001 (0.40)	-0.035 (0.109)	-0.359 (0.474)
X9 <i>Governor's party is the President's party</i>	<b>0.22*</b> (0.110)	0.482 (0.59)	<b>0.289*</b> (0.119)	-0.217 (0.621)
X10 <i>Proportion of seats in the coalition that belong to the governor's party</i>	<b>0.53 .</b> (0.311)	<b>0.522 .</b> (0.28)	0.397 (0.407)	0.349 (0.601)
X11 <i>State's own revenue per capita</i>	<b>0.510***</b> (0.039)	<b>0.511***</b> (0.038)	<b>-0.305***</b> (0.039)	<b>-0.398 ***</b> (0.092)
X12 <i>Poors (log)</i>	-0.172 (0.12)	-0.157 (0.127)	<b>-0.107*</b> (0.043)	-0.135 (0.093)
X13 <i>Governor election was competitive X Governor's party is member of coalition</i>		0.054 (0.12)		0.166 (0.126)
X14 <i>Governor election was competitive X Governor's party is the President's party</i>		-0.161 (0.16)		-0.063 (0.226)
X15 <i>Presidential Election was competitive X Governor's party is member of coalition</i>		-0.122 (0.107)		-0.104 (0.118)
X16 <i>Presidential Election was competitive X Governor's party is the President's party</i>		0.052 (0.17)		0.2402 (0.209)
X17 <i>State's Deputies in the government coalition X Governor's party is member of coalition</i>		<b>4.707**</b> (1.56)		<b>5.148 **</b> (1.909)

<i>Adjusted R-squared</i>	0.36	0.37	0.51	0.55
<i>p-value</i>	0	0	0	0

Signif.: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

The graphic below shows the coefficients of the models with their 95% coefficient interval.

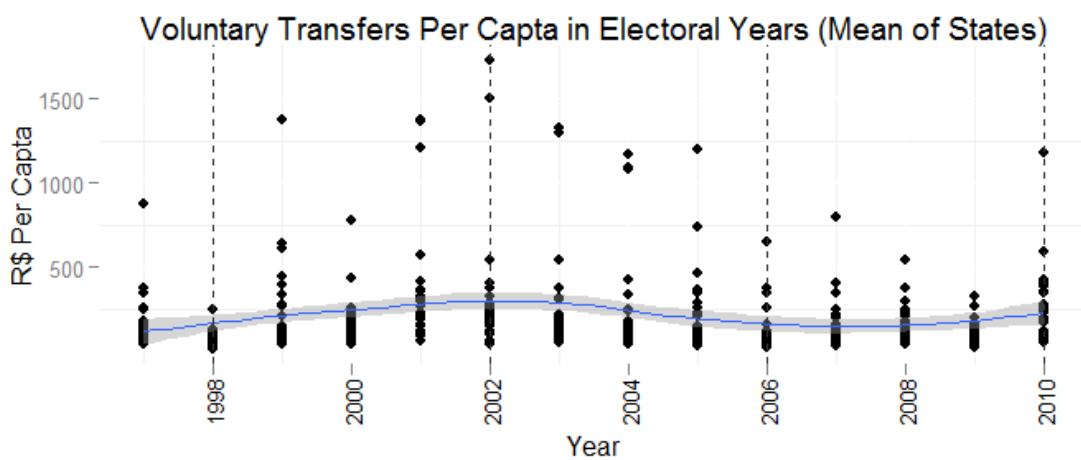


The third column considers state-fixed effect. Once again, electoral years are associated with less transfers. Now over-representation is not significant, but the competitiveness in the state becomes significant. The transfer decreases 10% average when there is marginal rise in the index of competitiveness. When the Governor's party is the same as the President's party, the state tends to receive 28% more transfers. Finally, the model with interaction shows that the interaction between the proportion of state's deputies in the coalition and the fact that the Governor's party is also a member of the coalition implies that the state will receive much more transfers than the others. These two last models have the highest R<sup>2</sup> relative to the others. The

main reason is that there is more variation in the transfers across states than within states, as we have seen on the graphics 4 and 5 above.

One of the strongest findings is the reduction of transfers in electoral years. We have plotted the marginal effect of the electoral years. The graphic 6 below shows transfers in the electoral years. The electoral years are marked with vertical lines. We adjust a line on the mean of the transfers received by states. As the graphic shows, there is no systematic increase in the total transfers just because it is electoral year.

**Graphic 6**



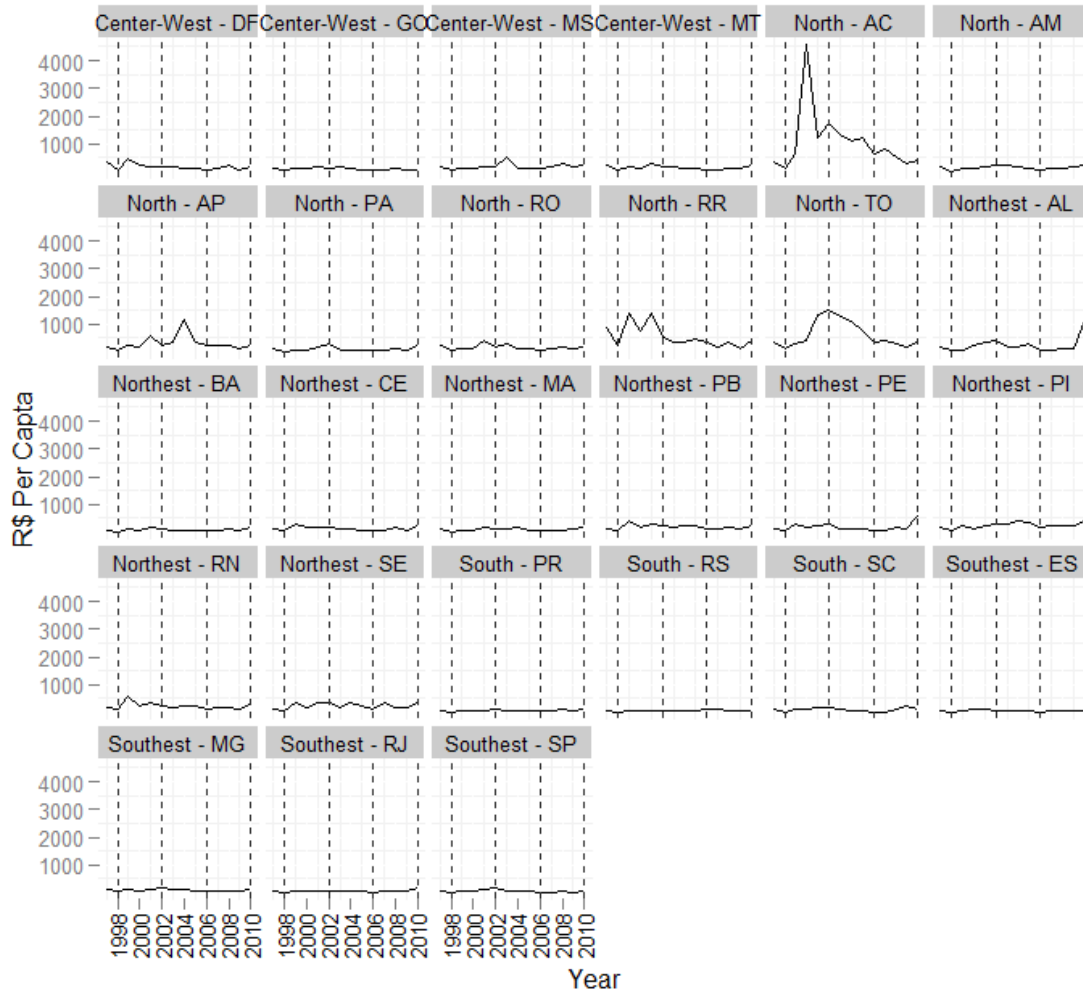
The graphic 7 below shows the same thing, but we plot the marginal effect of the electoral year in all the states separately. The states differ in that issue, but to most states there is no big variation due to the electoral year.

Those results lead us to reject the electoral hypothesis. The President intergovernmental transfers are not an efficient instrument in exchange to electoral support. The main legislative variables that influence the transfers are over-representation and the proportion of state's deputies in the government and the proportion of seats in the coalition that belongs to the Governor's party. The electoral issue appears when we consider transfers to governor's that are members of the President's party.

**Graphic 7**

## Voluntary Transfers Per Capita in Electoral Years (IPCA dec/2012)

### All the States



\* IPCA is the Consumer Prices Index (at december 2012)

### CONCLUSION

The intergovernmental transfers are not all the same. There is more than one sort of transfers. The differences between them imply in different causal mechanism that lead us to find different political causes to them. It is important to consider different approaches according to the characteristic of each kind of transfers. Her we have empirically investigated the transfers that are product of the annual budget negotiation between president and legislative.

We show that Voluntary Transfers vary negatively with the electoral year. When considering time-invariant unobserved effects, it seems that the hypothesis that the President tends to invest in regions in order to get new supporters cannot be considered. Actually, states that have more people voting for the President in the second turn of the elections tend to receive 37% less per new voter. But president has also not rewarded its supporters. States where the

President has received more votes don't receive more nor less transfers as a reward for the votes.

When we think in terms of using transfers as legislative bargain, over-representation and proportion of seats in the coalition are positively correlated with the transfers. However, it says nothing about why it happens. Even though this paper does not explain the causal mechanism, it shows that there is a positive correlation between those variables, and these specific results confirm the findings of Gibson, Calvo e Fatelli (2003) and Arretche e Rodden (2004).

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## ANNEX

### THE DATA SPECIFICATION

Var	Variable Description
Y	<i>Voluntary Transfers Per Capita (Log)</i> Defined in the federal law that defines fiscal government responsibilities, voluntary transfers correspond to any resource given by another government’s level as cooperation, support or financial assistance that is not motivated by any

	constitutional or legal rule.	
Electoral interests	X <sub>1</sub>	<b>President awards supporters: won election in the state</b> 1 if president won the election on the first turn in the state; 0 otherwise.
	X <sub>2</sub>	<b>President awards potential supporters for next election (log)</b> Ratio between votes received in the first and second turn in the state
	X <sub>3</sub>	<b>Presidential Election was competitive in the state (first round)</b> Proxy: Effective number of electoral parties in the state $N = \frac{1}{\sum_{i=1}^n p_i^2}$ , where p <sub>i</sub> is the proportion of the party's votes (Taagepera, 1979)
	X <sub>4</sub>	<b>The governor's election was competitive in the state (first round)</b> Proxy: effective number of electoral parties that run for state government
	X <sub>5</sub>	<b>Electoral year</b> 1 if it is electoral year (general or local election); 0 otherwise
	X <sub>6</sub>	<b>State Governor is member of the President's party</b> 1 if yes, 0 if not
Political Bargain	X <sub>7</sub>	<b>Governor's party is member of federal government coalition</b> 1 if yes, 0 if not
	X <sub>8</sub>	<b>Overrepresentation index (House of Representatives)</b> Ratio between proportion of the state's seats and the proportion of state's population (Gibson, Calvo e Fatelli, 2003)
	X <sub>9</sub>	<b>Proportion of State's Deputies in the government coalition</b> Ratio between the number of state's deputies in the government coalition and the total number of deputies in the coalition
	X <sub>10</sub>	<b>Proportion of seats in the coalition that belong to the governor's party</b> Ratio between the number of party's deputies over the total number of deputies times 1 if the governor's party is member of coalition and 0 if not.
Econ. Var	X <sub>11</sub>	<b>State's own revenue (log)</b>
	X <sub>12</sub>	<b>Number of poor families in the state (log)</b>

\* Sources of the raw data: Y, X<sub>11</sub>: <http://www.tesouro.fazenda.gov.br/index.asp>; X<sub>1</sub>, X<sub>2</sub>, X<sub>3</sub>, X<sub>4</sub>: [www.tse.gov.br](http://www.tse.gov.br); X<sub>6</sub>, X<sub>7</sub>, X<sub>8</sub>, X<sub>9</sub>, X<sub>10</sub>: [www.camara.gov.br](http://www.camara.gov.br), CEBRAP; X<sub>12</sub> and other index used (Population, IPCA): <http://www.ipeadata.gov.br> and [www.ibge.gov.br](http://www.ibge.gov.br).

The dependent variable represents the real transfers to states done in the year t. But the decision about the voluntary transfer happens in the year t-1 when the budget is negotiated. So, we have lagged some variables. The President's first budget after his election is executed in the second year of his four years mandate. In the first mandate year, the budget executed was that one elaborated in the electoral year by the old president. For instance, if the election happens in 1998, in the year of 1998 the actual President will be elaborating the budget that will result in the next year's transfers, which is first mandate's year of the President Elected in 1998. The new President will elaborate the budget during his first madate year and it will be executed right in the next, i.e., his second mandate year. If electoral results influence the decision about voluntary transfers, it will be captured not in the electoral year, neither in the following one, but in the next. So, we had to lag for two years the variables that measure electoral results (x<sub>1</sub> to x<sub>4</sub>).

In the case of the State Own revenue, if President takes it into account in order to define voluntary transfers, it is more realistic to consider that he look at the State revenue at the time t-

1 to decide in the time t how much the state will receive in the time t+1. The same reasoning applies in the variable  $X_{12}$ , the number of poor families in the state. So, these variables were lagged according to this consideration.

Finally, the Voluntary transfers and State Own Revenue were adjusted using the annual consumer price index (IPCA-IBGE) at 2011 December.

## MODEL SPECIFICATION

Our unit of analysis has two dimensions: cross-section (the 27 Brazilian states in the total) and time-series dimension (15 years). For each state, we have fifteen observations: from 1997 to 2011. For each year, we have 27 observations (the states). We use Multiple Linear Regression with OLS estimators.

Let  $i=1,2,3,\dots,27$  represent the states;  $t=1,2,3,\dots,15$  represent the year;  $k=1,2,\dots,j$  represent the  $j$  independent variables (11 in our case). The basic models used are the following:

### POOLED-REGRESSION MODEL

$$y_{it} = \alpha + \sum_k \beta_k x_{itk} + e_{it}$$

### UNOBSERVED-EFFECTS MODEL

$$y_{it} = \alpha + \sum_k \beta_{itk} x_{itk} + v_{it} \quad (\text{Unobserved-effects model})$$

$$\text{where, } v_{it} = \begin{cases} a_i + e_{it}, & \text{if there is time - constant effect} \\ \lambda_t + e_{it}, & \text{if there is group - constant effect} \\ a_i + \lambda_t + e_{it}, & \text{if there is time and group - constant effect} \end{cases}$$

All the following unobserved-effect methods use time-constant error term, but the same algebra applies for group-constant effects. All you have to do is change the index of the group term and apply it to time instead of group.

### UNOBSERVED-EFFECTS MODEL: FIRST-DIFFERENCE METHOD

$$\Delta y_{it} = \sum_k \beta_{itk} \Delta x_{itk} + \Delta v_{it} \quad (\text{First-difference model})$$

$$\text{where, } \Delta y_{it} = y_{it} - y_{it-1}; \quad \Delta x_{itk} = x_{itk} - x_{i(t-1)k}; \quad \Delta v_{it} = (v_{it} - v_{it-1}) + (a_{it} - a_{it-1});$$

### UNOBSERVED-EFFECTS MODEL: FIXED-EFFECT METHOD

$$\ddot{y}_{it} = \sum_k \beta_{itk} \ddot{x}_{itk} + \ddot{u}_{it} \quad (\text{Fixed-effect model})$$

$$\text{where, } \ddot{y}_{it} = y_{it} - \bar{y}_i \quad \text{and, } \bar{y}_i = \frac{1}{T} \sum_{t=1}^T y_{it} \quad (\text{same for } \ddot{x}_{itk} \text{ e } \ddot{u}_{it})$$

### UNOBSERVED-EFFECTS MODEL: RANDOM-EFFECT METHOD

$$y_{it} - \eta_{it} \bar{y}_{it} = \alpha(1 - \eta_{it}) + \sum_k \beta_k (x_{itk} + \eta_{it} \bar{x}_{itk}) + e_{it} \quad (\text{Random-effect model})$$

$$\text{where, } \eta_{it} = 1 - \left[ \frac{\sigma_e^2}{(\sigma_e^2 + T\sigma_a^2)} \right]^{1/2}$$

## MODEL/METHOD CHOICE

If the  $\beta_k \neq \beta_{itk}$ , we cannot use the pooled regression because the coefficients vary from state to state and/or year to year. The Lagrange Multiplier test as computed by Breuch and Pagan (1980) was made to test the presence of state or time-invariant effect. The test returns a p-value near to zero under the Null hypotheses that the coefficients in the pooled regression are all the same that the ones in the unobserved-effect models. It indicates that group or time effect must be considered. We also did the test suggested by Wooldridge (2002) for unobserved effect and we got the same result. We conclude that a single OLS-pooled regression would produce biased estimators, so we must use unobserved-effect model. Breuch and Pagan (1980) test indicates that both time and state effect must be used.

We did a Hausman (1978) test which verifies if fixed or random effect should be used. Random effect is preferred when there is no correlation between regressors and the error component ( $a$  and/or  $\lambda$ ) term (Wooldridge, 2012). In the Hausman test, the Null hypothesis is that random effect is preferred. For all models, but the one with state-invariant fixed effect and no interactions, the fixed-effect method is preferred.

The Wooldridge (2002) proposed a test for serial correlation for first-difference model. This test can be seen as “a specification test to choose the most efficient estimator between fixed-effect and first-difference” methods (Croissant and Millo). If the idiosyncratic error ( $e_{it}$ ) are random (uncorrelated), the differenced errors ( $\Delta v_{it}$ ) are correlated. In this case, the fixed-effect method produces more efficient estimators than the first-difference method. The null hypothesis of the Wooldridge’s test is no serial correlation in the differenced error ( $\Delta v_{it}$ ). The test returned a p-value = 1.5e-12. On the other hand, the same test for serial correlation in the idiosyncratic errors ( $e_{it}$ ) (null hypotheses that there is no serial correlation) returned p-value=0.005. So, although fixed-effect seems to have a better performance, it is necessary to correct the serial correlation. We did this by using autocorrelation-robust covariance estimators that also adjust the results of the regression when there is heteroskedasticity.

The Breusch-Pagan test for homoskedasticity (Null hypothesis is that there is homoskedasticity) returned that the models are heteroskedastic. So, as all the models also presented serial correlation, both across time and groups (states), we fixed that issues using Robust covariance matrix estimation (see Arellano, 1987; Stock and Watson, 2006; MacKinnon and White, 1985; Cribari-Neto, 2004; see also Croissant e Millo that presents the plm R package that was used in the analyses done here).

To summarize, the tests indicate that the unobserved effect model with fixed-effect method is the best choice to get unbiased and consistent estimators, except in the case we use state-invariant fixed effects. Both time and state fixed-effect must be taken into account.

All the tests were made using plm R package, and the R statistical software, version 2.14.1.

