REGIONAL INEQUALITY AND BRAZILIAN CONSTITUTIONAL FUNDS

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Abstract: There is considerable evidence to demonstrate that the regional development in developing countries shows high level of spatial concentration. The aim of this paper is to analyze the Brazilian case to identify if the Brazilian constitutional funds (FNO and FCO) have a positive impact on the regional inequality. These funds have been created in 1989 in order to finance economic activities in the North and Northeast regions. Our results show that regional growth in Brazil over the last 10 years has not been affected by these constitutional funds. On the other way, public infra-structure, education and health have a positive relation with regional growth, which suggests that the public expending on those funds should be directed to these regional attributes.

Keywords: Brazil, regional economics, regional inequality, spatial econometrics.

Classificação JEL: R11, R58, O18

Introduction

The process of economic development in the Brazilian territory occurred in an unequal form, and because of this, it has originated a country with a huge economic and social disparity among the regions. This characteristic concentrated model of Brazilian growth provided the formation of a society with one of the biggest worldwide rate of inequality.

In the end of XX century, the three regions less developed in Brazil – Northeast, Center-west and North - represented together about ¾ over the territory and almost ½ of the population, corresponding for less then ¼ of the GDP (Gross Domestic Product). The per capita income in the Northeast was less than a half of national average in 1997. When observed others indicators, like Human Development Index (HDI), it is verified that, even Brazil being classified as a country with a high average income in the worldwide scenery, with an average

index of 0.83 in 1996, the HDI of North and northeast, despite the high tendency of the three last decades, still has showed, respectively, results 12.39% and 26.73% lower than the national HDI in 1996. In 1997 the infant mortality rate in Northeast was 2.6 times higher than the South region. Related to this result there are the sanitary conditions, since in Northeast less than ¼ of the urban residence have sanitary installations connected to the general net of sewers, and while in the North region this rate does not reach 10%.

According to Furtado (1997) “the disparity of the income levels that exists between Northeast and the Center-South of Brazil constitutes the most serious problem to be faced at this present time of the national economical development”.

This article fits in this context. We tried to evaluate the contribution of Brazilian Constitutional Funds for the growth of the cities that belongs to this Funds, and consequently to reduce the Brazilian’s regional inequalities.

There are four parts in this article. The first one is a problematic synthesis about the regional development in this country. The second part introduces the theories of an unequal economical growth which inserts the argument of failed coordination. The third section presents and argues the results found about the Constitutional Funds impact. And the last part concludes the article.

1. The Policies of regional development

Due to the regional problems in Brazil, policies that aimed to fight against these problems have started to be implemented in the beginning of the XX century, and they got a bigger dimension from 1950 on. Starting with the idea that the instability in the development of the delayed regions does not affect only these regions, but also the whole country growth the regional policies are concerned with the correction of this regional instability to guarantee to the poorest regions necessaries resources to their growth and improving social conditions to promote an equal brazilian economical growth. However, the regional development policies implemented during 1950 to 1970 decades, do not contribute in a effective form to reduce the inequalities in Brazil.

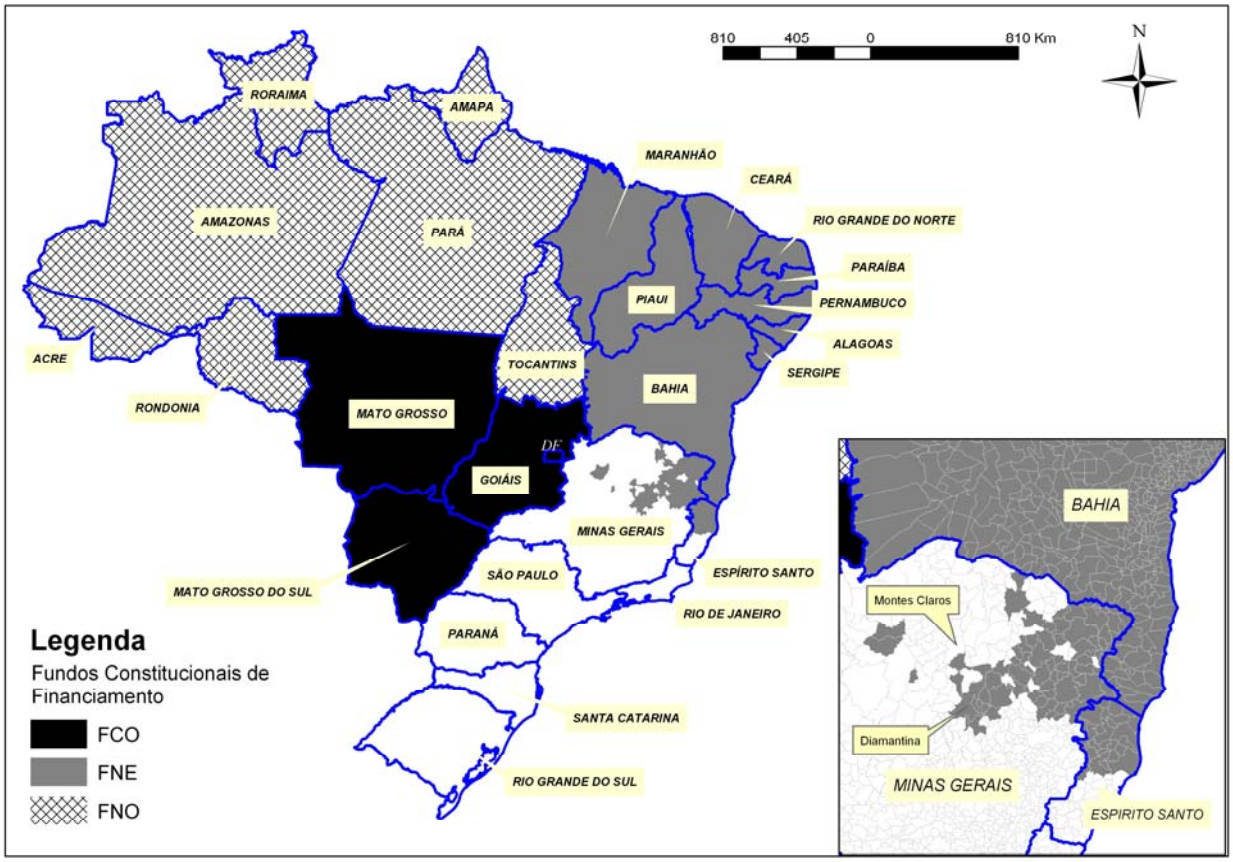
In the 80's the dynamics of the old policy of regional development was exhausted. The fiscal and financial crisis of the State, followed by a process of chronic inflation, made the regional development question left in a second plan.

Only in the end of the 80's, with the promulgation of Federal Constitution in 1988, a more prominent role was given to the regional development. The Federal Government has created a structural policy of regional development that aimed to reduce the regional inequalities in Brazil. Nowadays, this regional policy structure is formed by the Ministry of National Integration, that supervises the development funds of Northeast and Amazonia (FINOR and FINAN), and the National Constitutional Funds.

The NCF is concerned to correct the regional inequality guaranteeing to the poorest regions necessaries resources to their growth and improving their social conditions. Considering this, the law nº 7.827 in 1989 september 27th, has created the National Constitutional Funds of Center West (FCO, *Fundos Constitucionl do Centro-Oeste*) and the National Constitutional Funds of Northeast (FNE, *Fundos Constitucionais de Financiamento do Nordeste*). These Funds count with a permanent resource source that come from 3% of the total collected IPI - *Imposto sobre Produtos Industrializados* - (a federal excise tax on the manufacturing of goods) and from IR – *Imposto de Renda* – (income taxes). The resources distribution among the Funds is 1.8% to FNE; 0.6% to FCO and 0.6% to FNO. These resources are repassed from the Treasury Department to the Ministry of National Integration, then they repass to the regionals banks (Banco do Nordeste – BNB and Banco da Amazônia – BASA) because these banks have the ability to manage the resources. In the Centre-west case, these abilities are atributed to Banco do Brasil (a federal public bank).

According to the map 1 the Constitutional Funds is represented as: a) FNO in the North states; b) FNE in the Northeast region and some cities from Minas Gerais and Espirito Santo states including in the acting area of the extinct SUDENE (Superintendência de Desenvolvimento no Nordeste, the former development agency in the region); c) FCO in the Center-west's states.

Map 1 – Acting area of the Constitucional Funds



In consensus with the Constitutional Funds' mission and with the lines of direction and goals established to the development of the beneficiary regions, the financial programs search a great effectiveness in the application of the resources, in order to increase the enterprises productivity, to create new jobs, to increase the tributary collection and to improve the income distribution (Ministério da Integração Nacional, 2003).

According to the Ministério da Integração Nacional (2003), respecting the nature of the development regional plans in the formulation of the financial programs, it is necessary to observe some criteria: a) the financing is granted exclusively to the productive sector of the beneficiary regions; b) it will be given preferential service to the activities of mini and small agricultural producers, and

mini and small companies; the activities that use intensively raw materials and local skilled labor and the basic food production to the population; c) the action must be integrated to the federal institutions hosted in this regions. d) the enterprises need to considerate the environment's preservation. It will be given support to create new centers, activities and developments policies that can reduce social and economic differences among the regions.

Nowadays, the Funds count with a biggest volume of resources designated to the regional development. According to the Ministério da Integração Nacional (2003), the Constitutional Funds' resources predicted to 2004 summed R$ 6.5 billions allowing enlarging the resources' mass available with subsidiary interests, to the financing of productive activities in sectors like farming, mineral, industrials, agro-industrials, tourism, commercial and private infrastructure in these three regions.

2. Regional economic growth and its determinants

Why some countries or regions are richer, with an elevated level of economic development, while other are poorer? Why some countries or development regions industrialize and offer good pattern of life, while other countries or regions remain on the edge of the industrialization process? Which are the causes of the economic growth in some countries or regions and the stagnation of others?

These questions point to the dichotomy between developed regions and underdeveloped, and the big challenge of economic development theory is to try to explain the differences of economical performances between countries and regions. According to Chein Feres and Lemos (2004) a fundamental point that evolves the economic development theory is the idea of unequal development, in which inserts the argument of coordination's faults.

According to Matsuayama (1996) the argument of market failure try to explain the reason of the economic diversity between country or regions, therefore, why exist poor countries and regions. Based in a model with multiples balances,

the author argues that rich countries, in certain way, are guided to reach the Pareto-improving situation, while the poor countries fail to get the necessary coordination with the economics agents.

For Ray (1998), in general way, these coordination's faults happen, basically, due to the interaction between history and expectations, that is, the way that economic agents act in the present and in the future, depend of the initial economy conditions as well as the expectation about the future. It is detached that the initials conditions are not limited only for the initial endowments of production factors or income, but also to the own society structure, in terms of traditions, education, or related to the unequal levels and poverty.

To think about the causes of disparity between countries or regions under the argument of coordination faults requires a rescue of the theory: The Balanced Growth Theory, developed by authors like Rosenstein-Rodan (1943), Nurske (1953), and Murphy (1989), and the Unbalanced Growth Theory conceived by authors like Myrdal (1957), Hirschman (1958).

With the idea of Balanced Growth, the systematic support to the argument of industrialization as a manner to change the economic structure of countries and regions less developed is given by the emphasis of Rosenstein-Rodan (1943) in the external economy that it can be achieved through industrialization, and its defense of a "big push" in the form of a sufficient industrial investment to transcend the development obstacle. Thus, if some sectors of economy adopt simultaneously, increasing return technologies, each one of this sectors can create an income becoming in a source of goods demand in other sectors, and with this way increasing the market and becoming the industrialization economically possible.

From the work of Rosenstein-Rodan (1943) develops the model of balanced growth or the "big push" of Nurske (1955) where poor countries or regions living in a "poverty vicious cycle" what makes the economic development process difficult. This implies a circle junction of forces tending to act and react in another way to support a poor country in its poverty state. Therefore, the idea of an "a country is poor because it's poor".

According to Nurske (1955), perhaps the most important circular relationship are those that make the accumulation of capital in behind economies difficult. The capital's offer is governed by the capacity and the disposition to the savings; the demand to the capital is governed by incentive to the investiment. A circular relationship exists on both sides of the problem in capital formation in poor countries or regions in the world. But what would it be the explanation to occur, in poor areas, the problem of capital formation leading these economies to a constant process of poverty? The explanation presented for Nurske (1955) was the limitation of the internal marketing size.

Facing the real limitation of market's size in countries or underdeveloped regions the individual businessman would not have the incentive to make investments because he would have knowledge about the market demand conditions. The difficulty caused by the reduced size of the market indicates the incentives of individual investments to just one production line defined by the proper investor. Therefore, the total effort of investments in the economy would be reduced in order to preserve, in the delayed economies, the lower Pareto condition.

The key to change the countries or regions from the bad balance state to the good balance state in the stable economic growth, according to Nurske (1955) it would be make some capital application more or less synchronized, in a big variety of industries with different sectors, that is, a plan of public investments in large scale.

Based on Rosentein - Rodan's argument (1943), Nurske (1955) defends that the investments made in a large scale provide the complementarities of the industries differences, this is, the industries become consumers from each other. As a result, it would have an increase of the market size because it would occur in this economy a higher level of the economics' efficiency and it would imply in an increase of production capacity.

The most important formalization of the "*big push*" occurs in the end of 1980 decade with the work of Murphy et al. (1989), which objective is to understand the causes of some countries develop industries and others do not and the emphasis

of State intervention as a possible accelerator of growing economic process. Accordant with the authors in many of the economic growth problem in underdeveloped countries, an important restriction in the industrialization process it is the market reduced size. This happens because when the domestics markets are small and the international trade is not free and costly, the industries would not be able to create sufficient sells to adopt increase return technologies, and because of this the industrialization become difficult.

Murphy at al (1989) started from the idea about imperfect competition with *spillovers* of gathered demand*,* and they tried to understand the importance of demand's *spillovers* among the sectors, considering some stylized models of underdeveloped economy with small domestics markets and they discussed about how this markets can be expanded, in order to one country leave the non-industrialization's trap. They also tried to detach the industrialization contribution in a specific sector to enlarge the market size in other sectors. Such *spillovers* create the possibility to the investments" coordination among the sectors, which the government can promote, is essential to the industrialization, meaning the *spillovers* are strong sufficient to create a "*big push".* In this way there is a link between "*big push*" to the multiples balances competition, being the last one characterized by a movement from the balance traditional production to an industrialization balance. In agreement with the "*big push"* concept the authors noticed that the interdependence between the technologies choice and the market's size are source of multiples balances. The relationship is that the adoption of the modern technologies with raised fixed cost depends of the market size, and the market's size itself depends of the profits got from the modern technologies adopted.

In contrast, the multiples balance come naturally if one industry in a growing process increases the market's size of other industries even if this same industry has some loss. This happens when the industries increase the profits of the other ones through different ways that it is not their proper profits. In the formulation of the "*big push*" theory, the model only presents multiple balance when the authors insert the wage prize or a compensatory differential to workers migrate from the

traditional production to the industries and demonstrate the coexistence of two balances, the first one the markets are big sufficient to the industries use modern technologies and the other one the markets are small sufficient to justify the usage of this technologies. Also, even if a industry loses their resources it can beneficiate the sectors of other firms because they increase the work income, therefore, their products' demand.

Another important component from "*big push"* presented by Murphy et al. (1989) is the investments in infrastructure, like railroads and highways. Nevertheless, to such investments, the market's size becomes, in a particular way, important, since that most part of the costs being fixed. It is because the construction of an infrastructure that many times depends of the demand of users potentials. This users can reach bigger markets if the prices of their goods were reduced using a railroad or highways. In summary, all those mechanisms of transition that help to create the *"big push"* become relevant to the growth of country or less developed regions.

In contrast to the balanced growth theory as originally developed by Rosenstein-Rodan, it is possible to think the economic growth process of underdeveloped areas by means the unbalanced growth theory. The unbalaced growth theory, developed, initially by Myrdal (1960) and Hirschman (1961) tries to show that without intervention of the State in the economic development process, the inequalities between the developed economies and the underdeveloped ones have a tendency to perpetuate. In conclusion, an adequate and effective program of investments, a fiscal system corresponding with the necessities, could reduce the question about social-economics inequalities.

From the unbalanced growth theory, the economic delay of some regions can be thought as a process of circular and cumulative causation (Myrdal,1960). This analysis consists in refute the hypothesis of stable balance to the social reality, this is, do not exist an automatic tendency towards self – stabilization. The stable balance is based on the idea that the social process tends to a position that permit describe as a state of force's balance. However, for the author, the system

does not move spontaneously toward to any form of balance between the forces, but it is always moving away from this balance.

Finally, Myrdal (1960), detaches the importance of policies that minimize the disparities. Such policies must to consider some reforms that improve the capacity of production, that increase the productive, that provide necessary resources to they become economically viable and also make possible a social reform. In addition, the interference of the State must create ways to fortify the “propeller effects” and diminish the inequalities.

Still following unbalaced growth theory, Hirschman (1961), contests the Rosentein - Rodan’s balanced growth theory referring to this theory as identical to the Say’s Law and, therefore, it can not be considerate as a developed mode, once its application demands a considerable amount of resources to the simultaneous development, and this resources are limited in underdeveloped countries. So, Hirschman argues that if a country were in conditions to apply the balanced development doctrine, then, preliminarily, it would not be an undeveloped country.

It was a disagreement with the theory of the balanced growth that motivated Hirschman to elaborate a different thought regarding the problems of economic development. The main focus is to follow a deliberate policy of non-balanced growth, that is, to promote the development in certain keys sectors of the economy, chosen on the basis of numbers of chaining back and forth, as well as to intrinsic profitability of the same. As the chaining is creating by these sectors, the market will response to the non-balanced situation carrying through other investments.

Thus, the development must be understood as a extensive process, promoted by an unbalanced chain that consists in the expansion of one sector from the expansion in another. As example, if a determined industry has its profits increased it will raise its investments and the search for products of another industry, consequently, this one will have a raise of its profits.

Based on the idea of unbalanced chain, these must be kept by means of a policy that aims the development, reaching through the completive effect. this leads to a concept of induced investment, this is, each inversion induces a new

investment, working as a multiplier. Concluding, unbalance creates development that creates a new development and so on.

It is possible to say, that one of the contribution of the study of Hirshman' (1961), centered in the interregional and international transmition of the economic development, as much as the study of Myrdal (1960), which focus is the process of circular and cumulative causation, was to establish the idea of the intrinsic nature of the unequal economic development in the space. In contraposition to the concept of balanced and convergent development, these authors argue that the existence of increasing returns in the space, by means of the pecuniary externalities, make possible the creation and recreation in the space of the relation centre and periphery. From there, to have been rescued for the theoreticians of economic geography (Chein Feres and Lemos, 2004).

3. Results and Discussion

3.1 Explanatory analysis

Before presenting the econometrical results, we have to analyze the patterns of the variable spatial behavior, to be able to verify the spatial autocorrelation. The analysis of the spatial autocorrelation presence or not become more efficient with the aid of an exploratory spatial analysis, which compares the observation behavior in the neighboring localities. With this objective it was created *Moran' scatterplot* graphics and maps a from the LISA indicator. This analysis is based on the construction of *Moran' I* indices that test the existence of the spatial autocorrelation[1].

[1] To the data exploratory spatial analysis it was utilized the geometrical program Geoda 0.9.5-i.

The formalization of *Moran´s I* test is:

$$I = N/S_0 \sum_i \sum_j w_{ij}(x_i - \mu).(x_j - \mu)/\sum_i (x_i - \mu)^2 \quad (1)$$

The number of the observations is given by *N, w_{ij}* are the elements of weight matrix, x_i, x_j are the observation to the localities i and j, respectively, and S_0 is a scale constant, which refers to the sum of all weight.

The formalization of LISA statistic is the following one:

$$I_{i,t} = \frac{(x_{i,t} - \mu_t)}{m_0} \sum_j w_{j,t}(x_{i,t} - \mu_t) \quad com \quad m_0 = \frac{(x_{i,t} - \mu_t)^2}{n} \quad (2)$$

Where $x_{i,t}$ and the observation in a region *i* to the period *t*; μ_t is the average of the observations through the geographics spaces in the period *t* and, the sum *j* includes only the values of *j* neighbors.

The analysis was made, initially, for all cities from this referent country in 2000. After that, it was made an analysis only with the cities from North and Centre-west cities due to these cities are inserting in the regions where Fundos Constitucionais de Financiamento acts, also for year 2000.

To all Brazilian cities, the results showed in table 1 inform the *Moran's I,* statistic values, the standard deviation, statistical value Z and the significance (p-value).

Table 1 – Moran´s I statistical variables

Variable	I	Standard desviation	Z-valor	Prob
Per capita Income (*Yc*)	0.8198488	0.008038	102.022149	0.000000
Growth rate of *Yc*	0.3157817	0.008038	39.309835	0.000000
HDI-M[1]	0.8583363	0.008038	106.810480	0.000000
Population Scholarship[2]	0.7208214	0.008038	89.701881	0.000000
Life Expectancy[3]	0.7589381	0.008038	94.444084	0.000000

[1] Human Development Index Municipal .
[2] *Proxy* to education.
[3] *Proxy* to health.

The statistic of *Moran's I* is positive and the significance is higher (p-value = 0.000) this indicates a spatial autocorrelation to all variables, suggesting the existence of agglomeration of low values or high values.

Accordingly with the *Moran's I* statistic results the cities with high (low) values to the selected variable are located near to other cities that present, also, high (low) values to these variables. As an example, in the case of the city *per capita* income variable, this means that richer cities (poor) have a tendency of agglomerating near to the richer cities (poor). This analysis can be done to the other variables presented in table 1.

Using these results, it was made *Moran' scatter plot* graphics and maps from LISA's indicator that are attached.

Observing the *Moran' scatterplot* graphics (Graphic 1), made from *Moran's I*, we realize that exists positive autocorrelation for all selected variable. This shows the agglomerate predominance of high-high and low-low kind in Brazilian regions. Thus, for graphic (1b) all the brazilian cities that grew more (less) during the period of 1991-2000 tend to have around neighbors with the same performance. The same happens with the analysis of (1a), (1c), (1d) and (1e) graphics, the Brazilians, relatively developed cities[2] (underdeveloped), tend to posses, also, developed (underdeveloped) neighbors. With *Moran' scatterplot* we can confirm a strong regional concentration related to the variable selected (economic and social) and therefore, economic and social inequalities evidences in the country.

The maps analysis (Map 2 – attached) made from LISA indicator also reveals that Brazilian cities tend to concentrate themselves in two general categories: Centre-west, South and Southeast regions (central regions) characterized by high-high values of the variable, and the North region and Northeast (peripheries regions) characterized by low-low values of the variable. Thus, cities from the central regions showed high rate of human developement , education, *per capita* income and life expectation, followed by the neighbors' cities that also presented these characteristics. The opposite is observed in the periferic

[2] As the richest (by the per capita income) or better education level, better healthy state and human developmeent

regions. We can see that some cities are characterized as *outliers* – cities with high values surrounded by low values form the neighbors - an economics *enclave*.

Consequently, comparing the Map (2a) referring to the cities *per capita* income, with the other maps created (2b), (2c) and (2d), it is possible take information about the spatial relationship among social, human and social development. In summary, we can say that Centre-west, South and Southeast regions detach in the social- economics indicators, while North and Northeast regions detach the worst results supporting the problems of inequalities in Brazil.

The same spatial exploratory analysis was made with reference to the cities of North and Center-west regions. According with table 2 the statistic *Moran's I* é highly significative (p-value = 0.000) and positive, which means a spatial autocorrelation for all variable, this result is similar to the analysis made to all Brazil's cities. In the same way, the result of *Moran's I* indicates the existence of low values agglomeration or high values, also to the regions that receive the FNO and FCO.

For the FCO and FCO values contracted, the coefficient of *Moran's I* statistic presents a certain degree of spatial autocorrelation, indicating that the cities with high (low) values contracted from the Funds have a tendency of agglomerate near to other cities with high (low) values contracted as it is shows in Map (3a). However, the spatial autocorrelation from FCO and FCO, if it is compared to the other analyzed variable, it is less intense, as we can see by the coefficient of *Moran's I* statistic, in table 2.

Table 2 - *Moran´s I* statistical variables to select municipal district in region of FCO and FNO

Variable	I	Standard Desviation	Z-valor	Prob.
P*er capita* Income (*Yc*)	0.5919201	0.020504	28.922919	0.000000
Growth rate of *Yc*	0.3036502	0.020504	14.863791	0.000000
Values contracted of FNO and FCO[1]	0.0779674	0.020504	3.857080	0.000115
HDI-M[2]	0.6726117	0.020504	32.858307	0.000000
Population Scholarship[3]	0.4648778	0.020504	22.726974	0.000000
Life Expectancy[4]	0.4986045	0.020504	24.371849	0.000000

[1] Values in million of Reais (R$).
[2] Human Development Index Municipal
[3] *Proxy* to education
[4] *Proxy* to health.

An explanation to the contracted values agglomeration of FCO and FNO is that, despite the concession of financing being exclusively directed for enterpriser of productive sectors of North and Centre-west regions, that is, it includes all the cities of the benefited regions; Constitutional Funds in these regions are demand's resources. Thus, enterprisers in some cities posses more facilities to get financing, maybe because they can afford the commitment with bank that manage the Funds, or because the access and knowledge of information about the resources or because of other economics or social factors.

3.2 The model of economic growth for cities using cross section

The initial estimates had been made with the ordinary least square (OLS) method:

$$Y = \beta_1 + X_{i,t}\beta_i + \varepsilon_i \qquad (3)$$

Where: *Y* is the differential of *per capita* income growth of cities from North and Centre-west in relation to the growth of Brazil *per capita* income; $X_{i,t}$ are the social and economics variables, demographics and the FCO and FNO in the basis year

of 1991 presented in the picture 1; β_i are the estimated parameters to the *K* explainable variable; and ε_i the error term. The differential of growth was been used as a dependent variable with the objective of capturing the impact of the explainable variables in the inequality of growing of municipal *per capita* income It is expected, if well succeed, the Funds have a positive impact, this is, that the differential of growing be minor as much bigger the outlays from Funds in that city.

Picture 1 – Description of variables in Municipal level

Variáveis	Siglas	Fonte	Description
Differential of *per capita* Income growth (dependent variable)	Dif_log		Growth tax of *per capita* income of the cities of sample least the average growth tax of *per capita* income of the Brazil.
P*er capita* Income	Yc	IBGE	Logarithm of *per capita* income. Values (R$) of 2000.
Contracted values of FNO and FCO	VC91	BB[2]/Ipea e Basa[3]	Contracted values of FNO and FCO in million of Reais (R$).
Proxy Health: mortality tax	TMI91	IPEADATA e ADH/Pnud[1]	Number of children that won´t survive in five first year of life in each thousand children living born.
Proxy to infrastructure: Percentage of domiciles with electric energy	DEE91	ADH/Pnud[1]	Percentage of people that live in domiciles with electric energy
Proxy to infrastructure: Percentage of domiciles with garbage collection	DCL91	ADH/Pnud[1]	Percentage of people that live in domiciles with garbage collection.
Proxy to human recourse: Average years of study.	AME91	IPEADATA e ADH/Pnud[1]	Average years of study of people with of 25 or more years old.
Demographic Density	DD91	ADH/Pnud[1]	Rate between population and territory extention of cities (inhabitants/km²).
Proxy to migration: populational growth tax	Migr		Growth tax of the population of city.

[1] Human Development Atlas.
[2] Brazil Bank [3] Amazônia Bank (Public Bank in State Amazônia).

As indicate in table 3, the test F for this model accuses collective significance of the coefficients despite the individuals coefficients of variables, contracted values of FNO and FCO and demographic density do not reveal significant. The signals of infantile mortality tax, population growth tax, domiciles

with garbage collection, domiciles with electric energy and average years of study showed how the expected and their coefficients were highly significant (p-value = 0.000), confirming the importance of social variables and infrastructure for the process of economic growth.

Table 3 – Results of the OLS

Dependent variable: Differential of *per capita* Income growth (Dif_log)
Number of observation: 895

Differential of *per capita* Income growth (Dif_log)		
Variables[3]	**Coefficient**	**Standard Desviation**
Constant	0.00835024**	0.002
P*er capita* Income (Yc) in 1991	-0.000149689**	1.01886 E-05
FCO e FNO (VC91)	0.0000511+	0.000074
Infantile Mortality (TMI91)	-0.000104382**	1.60665 E-05
Domiciles with electric energy DEE91)	0.000100467**	2.41381 E-05
Domiciles with garbage collection (DCL91)	3.68026 E-05*	1.7496 E-05
Scholarship (AME91)	0.00748271**	0.001
Demographic density (DD91)	-5.87285 E-06+	5.5813 E-06
Migration (Migr)	-0.00327931*	0.001
R^2	0.2410	---
R^2 ajusted	0.2342	---
Conditon Number	18.43	---
Koencker-Bassett	69.983380**	---
White	140.362738**	---
Jarque-Bera	27.065377**	---

Note: (**) Significative in level of 1%; (*) Significative in level lesser that 5%;(+) Not significative.

[3] Every variables with basic in 1991.

The adjustment of the model (R^2) is 0.2410 and the ajusted R^2 is 0.2342. The *Koenker-Bassett's* test (p-value =0.000) indicated the presence of heterocedasticity. This problem was confirmed by the *White* robust test (p-value = 0.000). The hypothesis in the presence of heterocedasticity in the model can be due to the fact of the model does not considerate spatial factors, this is, the presence of heterocedasticity in the model using special data would be a consequence of both, heterogenous and/or spatial autocorrelation in the variables. This question will be commented in topic 3.3, where will be use a spatial model with the objective of considerating the huge spatial diversity which is characteristic of a country endowed with great territorial area as it is the Brazilian territory.

The diagnostic used to detect a possible problem with multicollinearity was the *Condition Number* , which is given by the square root between the higher and lower eigenvalue of the cross products matrix (X'X). Usually, one value of *Condition Number* bigger than twenty is enough to accuse the problem (Greene, 2003) The result presented 18.43 as *Condition Number* rejecting the hypothesis of multicollinearity.

Concluding, it was made the *Jarque-Bera* to verify normality. The test is highly significant (p-value = 0.00000) rejecting the null hypothesis of normality in the residuals.

3.3 The spatial model

The spatial analysis is characterized by taking in consideration the way about how the observations are spatially distributed. Formal, the spatial approach is expressed by the matrix of spatial weight, *W,* with elements $w_{ij,}$ where the index *ij* corresponds to the neighbor *j* of the observation i. The matrix elements different from zero reflect the possibility of spatial interaction, between this two observation, that can be expressed in different ways, such as physics contiguity, posses centers in a limit of critical distance, or by a function of inverse distance or the square of the same one. This notion about neighborhood can be based on economics

distances, in the social structure, in the economic flows matrix and others. The elements equal to zero indicate the absence of spatial interaction between the observations.

The spatial autocorrelation, or generically the spatial dependence, is a situation that the variable, or the error, in each city is correlated with the dependent variable observation or the error in other cities. The consequences of ignoring the spatial autocorrelation in a model of regression when it exists, in fact, depend of the formulation of the alternative hypothesis. Like in all specification error tests, the null hypotheses reflect the absence of this kind of error, or, in this case, a standard regression model with homocedastic and uncorrelated errors. There are, in this situation, two alternative models. In the lag model, the spatial autocorrelation ignored is related with the dependent variable. This alternative is formalized by a spatial compound model autoregressive:

$$y = \rho Wy + X\beta + e \qquad e \sim N\left(0, \sigma^2 I\right) \tag{4}$$

When this kind of spatial autocorrelation is ignored, the OLS estimator becomes biased and all the inferences based on standard regression, this means, without *Wy*, become incorrect. It is a situation, therefore, similar omission of significant explicative variable in the regression model.

The other way of spatial autocorrelation refers to the regression error, this is the spatial error case or spatial dependence as disturbance. Formally, it is expressed by a spatial process in the errors or the autoregressive type or mobile average.

$$Y = X\beta + \varepsilon \qquad \varepsilon = \lambda W\varepsilon + u \tag{5}$$

The consequences of ignoring the errors spatial dependence are the same of heteroskedacity, this is, the OLS estimator remains unbiased, but it becomes not efficient, once it ignores the correlation between the errors. In this way, the

interferences based on statistics *t* and *F* become misleading and the indications of model adjustments are based on incorrect R^2.

The diagnostic of spatial dependence, made after the OLS model, used four spatial weight matrices: *queen, rook,* the inverse of distant square ($1/d^2$) and the five nearest neighbors (*k*=5). The result is presented in table 4[4]

Table 4 – Diagnotic to spatial dependence[5]

	Matrix			
Test	**Queen**	**Rook**	$\left(1/d^2\right)$	**K = 5**
Moran's I (error)	15.6718^{***}	15.7877^{***}	20.7463^{***}	16.2779^{***}
Lagrange Multiplier - LM (error)	234.395^{***}	238.149^{***}	396.346^{***}	252.031^{***}
LM robust (error) - LM_{err}	73.4616^{***}	74.1213^{***}	124.746^{***}	93.6312^{***}
Kelejian-Robinson (error)	250.089^{***}	248.739^{***}	3.012300^{+}	247.144^{***}
Lagrange Multiplier (lag)	164.551^{***}	167.853^{***}	274.652^{***}	165.035^{***}
LM (lag) - LM_{def}	3.61778^{**}	3.82509^{**}	3.052595^{**}	6.63473^{**}
Lagrange Multiplier (SARMA))	238.012^{***}	241.974^{***}	399.398^{***}	258.666^{***}

Note: (***) Significative in level of 1%; (**) Significative in level lesser that 5%; (*) Significative in level lesser that 10%; ($^{+}$) Not significative.

It's possible to verify that the results to spatial dependent are very similar having as reference the spatial weight matrices used in this work. To all spatial matrices, the low probability of *Moran's I* point to the presence of positive spatial autocorrelation in term of errors.

The Lagrange Multiplier test (LM error), is also similar to all spatial matrices. In this model, the null hypothesis that the errors do not follow a spatial autoregressive regime is rejected. In the same way, the test of *Kelejian-Robinson,*

[4] The use of *ad-hoc* neighborhood matrices have been creating some discussion in the literature. Some authors recommend an endogenous parametric estimation of the distance matrices (Conway, 1999), however, conditions of regularity are not easily satisfied in this approach, what makes it difficult to establish assymptotic properties of this estimators (Anselin, 2002; Kalejian and Prucha, 1998,1999). Matrices of contiguity and distance, as those used in this work, satisfy the regularity principles that guarantee that the assymptotics properties of the estimators are known, and if they base on structural characteristic of geographic space that are, by definition exogenous

[5] The econometrical used to make the stimation by OLS and the spatial model was the *SpaceStat Software* 1.80.

a robust procedure of specification points to some kind of spatial autocorrelation in terms of errors.

The Lagrange Multiplier test of spatial lag, (LM lagged), has the objective of inquiring the existence of a spatial dependence among the neighbors observation. As showed in table 4, we also rejected the null hypothesis which indicates the presence of spatial lag in the model.

According Anselin (1992), if exists the normality of errors, the best alternative to the diagnosis of the spatial dependence is analyze the LM tests together, the test that posses the higher significance will indicate the best alternative. However, the estimated model did not present normality and all tests of spatial dependence are higly significative, this implies in a bigger difficult in choosing the best alternative: the spatial error model or the spatial lag model.

Once we can guarantee the assyntotic properties of the estimators are known, and if they base o To define which alternative was more appropriate we used the results of robust test $ML_{err,}$ ML_{lag}. The statistic is higly significative to all spatial matrices. When we analyse the statistic ML_{lag} we realised that the level of significance and the values are lower if we compare to the statistic ML_{err} . Therefore, we can conclude, by means of robust test, the best alternative to be estimated is the spatial error model.

After we made the specification tests in the spatial error model, presented in equation (5) was estimated. The ideal would be use the maximum likelihood method, however, as we can verify in the OLS regression result, the errors are not normally distributed, which make inefficient the use of this method, according to Anselin (1992) and Greene (2003). As an alternative, following the Anselin' sugestion (1992) it was used a Generalized Method of Moments (GMM).

To the analysis of the estimated results presented in table 5, it is necessary, be conscious, according Anseling (1992) that R^2 is not applicable as a measure of adjustment in model with non spherical errors[6]. In this case, the econometrical program used to the estimation supplies three pseudo- R^2. The first one is the

[6] The spatial error model is a special case of the model called non-spherical error, this is, it is a specification or regression which the supposition of errors are not correlated and homocedasticidade are not satisfied.

reason between the variance of the predict values and the observed values of dependent variable[7]. Another one is the correlation to the square between the predict values and the observed values (listed in the result as *Sq Corr*). The third one is an application of adjustment suggested by Buse (1973), *apud* Anselin (1992) listed in the result as R^2 (Buse).

Table 3 – Results of the GM [8]

Dependent variable: Differential of *per capita* Income growth (Dif_log)
Number of observation: 895

Error Spatial Model
Dependent variable: Differential of *per capita* Income growth (Dif_log)

Variables	**Coefficient**	**Standard Desviation**
Constant	0.00873139**	0.002
P*er capita* Income (Yc) in 1991	-0.00018063**	1.01948 E-05
FCO e FNO (VC91)	0.0000362+	0.0000601
Infantile Mortality (TMI91)	-7.55353E-05**	1.9045 E-05
Domiciles with electric energy DEE91)	8.45799E-05**	2.58672 E-05
Domiciles with garbage collection (DCL91)	3.22151E-05*	1.60174 E-05
Scholarship (AME91)	0.0076601**	0.001
Demographic density (DD91)	-2.86734E-06+	5.05742 E-06
Migration (Migr)	-0.00108417+	0.001
Lambda (λ)	0.487213**	0
R^2	0.2959	---
Sq. Corr.	0.2173	---
R^2 (Buse)	0.2708	---

Note: (**) Significative in level of 1%; (*) Significative in level lesser that 5%;(+) Not significative.

[7] The econometrical program *spaceStat* 1.80 used to make the stimation return as R^2 exactly this reason.

As we see the results in the table above, the coefficients of Migration (Migr), FCO and FNO (VC91) and the demographic density (DD91), are not significant. To the other variable the coefficients are significants and the signals remains the same found in the OLS method. In addition, the coefficient of disturbed parameters (λ) is highly significant (p-value = 0.000) with a positive signal, which can indicate spatial heterogenaity. Also indicates that, in the estimated model, some spatial correlated variable was not included.

The variable that interest in this work, the FCO and FNO funds, did not had a significative relationship with the economic growing in regions where they are inserted. Thus, the regional development policy using the FCO and FNO, was not a relevant component to stimulate the growth of cities. This can indicate that in less developed regions the reduced supply, imperfect credit markets and social inequalities can reduce significantly the potential demand spillovers from FCO and FNO.

Therefore, it can be necessary a redefinition of the regulation of these funds, as well as the regional planning, in a way to create a clear direction to a sector or regional allocation of resources and then, reach the poorest cities in this regions creating efficient results.

It is important to say that in this present work it was not possible verify the impacts of FCO and FNO from a microeconomic analysis of economic development. So, it was not possible analyze the impacts of FCO and FNO on welfare, income distribution or job creation. It can be that, despite the relationship is not significative between FCO and FNO with the differential of growing between the *per capita* income of the benefits cities and the national average, exist important impacts of microeconomic view.

The coefficient of *per capita* income level is negative and significative. This result tell us that the cities with initial level lower have a tendency to growth quickly and presented a differential in the growth tax of income *per capita.* However, this result does not inform if occurs a process of regional convergence in terms of *per*

[8] The results are based in the queen spatial matrix. We not show with another spatial matrix (rock, inverse of distance square and k = 5) due equal results.

capita income among the cities analyzed. Maybe the cities of lower income *per capita* , despite of presenting the biggest growing is compared to the cities with higher income , still remains in a lower Pareto equilibrium, this is, they are not directed to reach an improved Pareto equilibrium.

Both infrastructure *proxies*, percentage of houses with electric installations and garbage collection, presented positive and significant relations with the differential of growing tax of the per capita income between the cities and the national average. This result, similar to the infrastructure *proxy* in the state analysis, supports the importance of a good infrastructure in the process of economic growth in regions less developed, once, the adequate infrastructure tends to provide benefits and, thus, attract new investments to the region. Again, they indicate the necessity of resources of the funds being directed to the development of an adequate infrastructure to the benefited regions.

Another variable that presented a significative and positive relation, with the differential of growing tax of cities in North and Centre-west regions with national average, was proxy to the capital human level. This result shows us that exists a positive relationship between the level of population scholarship and economic growth. Therefore, cities that presented average years of higher study have a tendency of presenting a economic growth bigger than the national average.

The coefficient of infantile mortality tax is negative, showing that a worse health state is associated to a lower economic growth of the cities. However, it can exist endogeneity between the *per capita* income and infantile mortality: when the mortality is small it means a bigger *per capita income* and accelerate growing or the opposite. In this direction was not possible to make an analysis of causality due to the existence of endogeneity between the variable *per capita* income growth and infantile mortality rate.

Finally, the coefficient of demograohic density variable was not significant. So, it was not taken the congestion effect, this is, areas densily inhabited could have higher costs, promoting external deseconomies and thus, a lower growing in *per capita* income in the cities analysed if it is compared to the average growth of the national *per capita* income.

4- Conclusion

This paper tried to analyze an empirical evidence available about the impact of Constitutional Development Funds of North and Centre-west in the reduction of the regional inequality in Brazil. Naturally, the impact of those funds outlays are not summarized to the growth of *per capita* income, analyzed in this paper. Social-economic indicators as income distribution, poverty, human development and others can have being more affected then the *per capita* income. However, it is not likely that a significant improvement in these indicators, due to the impact of Development Funds, would not reflect in the *per capita* income and in the differential of city growth, in the long run.

The results presented in this work suggest that the impact of Development Funds was very low. Taking this hypothesis as true, we have to discuss the causes of this inefficiency, once that the implicit objective of Fundos is the reduction of regional inequality. The data presented in this work do not allow to analyse this question, it would be necessary a micro financing analysis of financed economic activities, interest rates, etc. to make this possible. However, some hypothesis can be raised. The Development Funds are essentially directed by the demand side, this is, they are requested for the local economic activities that attend the requirements of the Development Funds. Thus, it is likely that in the included area of Development Funds, only the activities more developed in cities with better access to the bank offices and information infrastructure can request this resources. There is no role for regional planning, or any direction of sectoral allocation. Therefore, if the resources are directed only by market forces, it's not likely that sectors or less developed areas will be attended. The result is that the impact of Development Funds tends to concentrate in richest cities that are included in the designated area, with little impact in the rest of the Brazilian territory.

Therefore, with this "demand-driven" characteristic of Development Funds, which provides a concentration of resources in a few cities from beneficiary regions, it becomes necessary a regional planning policy of Development Funds as

a manner to surpass or attenuate the problems of market failure which take to the unequal development among the Brazilian states.

Starting from the regional planning of FCO and FNO it is expected to create a coordenation among the economics agents to make possible that states of regions North and Centre- west in the country, that are locked in a poverty trap, as Myrdal (1960) says, be able to create mechanisms of incentive to the investments in a form to influence the structural that exists and, thus, create conditions to surpass the initial structure of inequalities and poverty where they are inserted.

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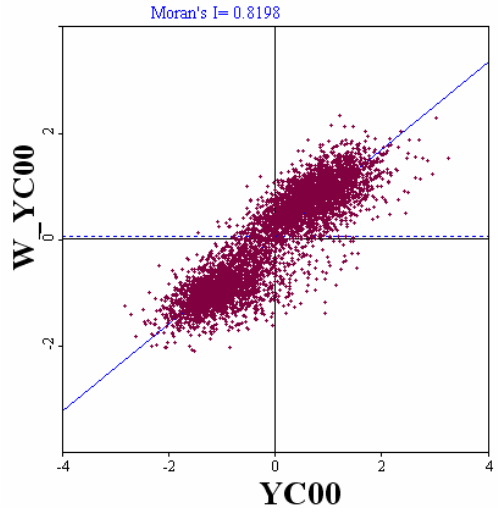
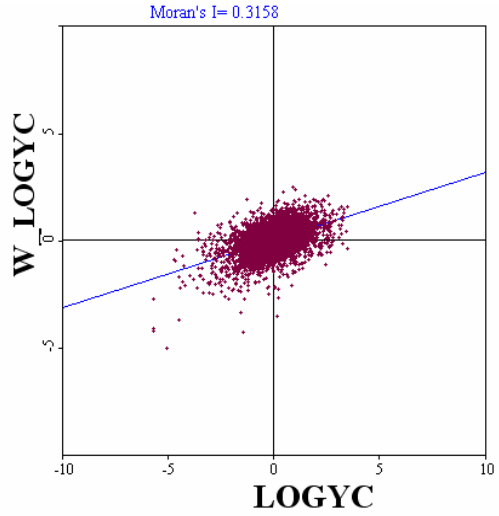
ANNEX

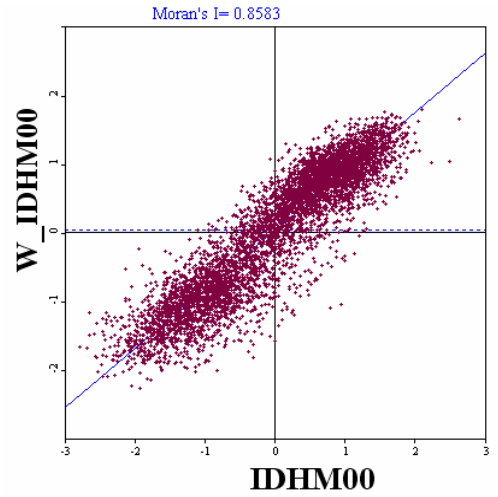
Graphics 1: *Moran' scatterplot* to selected variables



Graphic 1(a): *Moran scatterplot* to *per capita* income, 2000.



Graphic 1(b): *Moran scatterplot* to growth per capita income tax – 1991-2000.



Graphic 1(c): *Moran scatterplot* to HDI, 2000

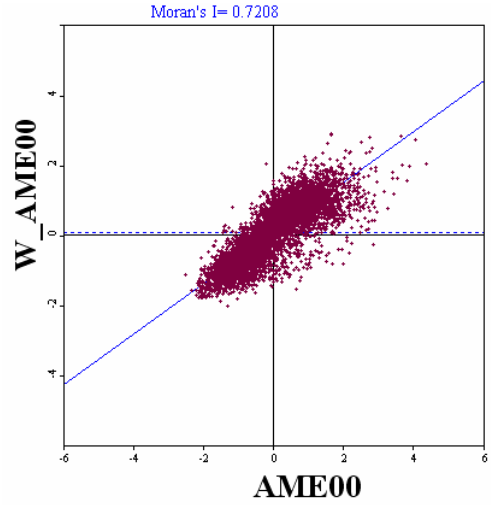


Gráfico 1(d): *Moran scatterplot* to average years of study of people with of 25 or more years old, 2000.

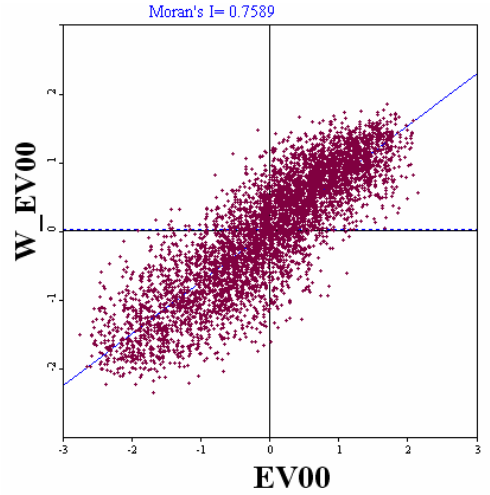
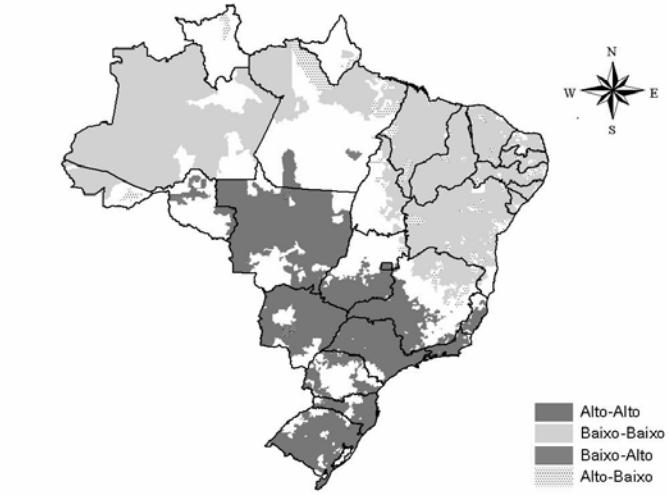
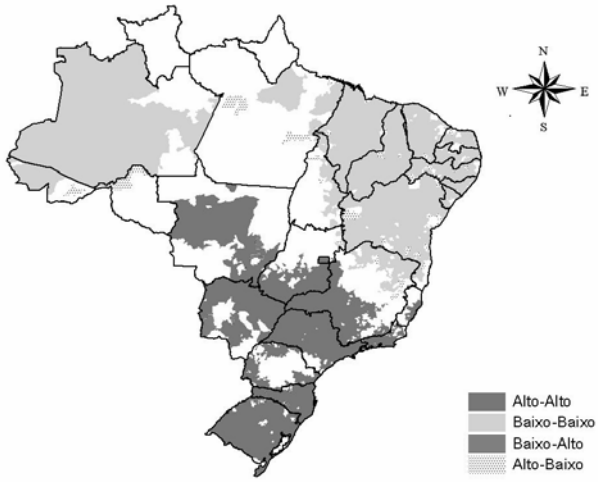


Gráfico 1(e): *Moran scatterplot* to life expectancy., 2000.

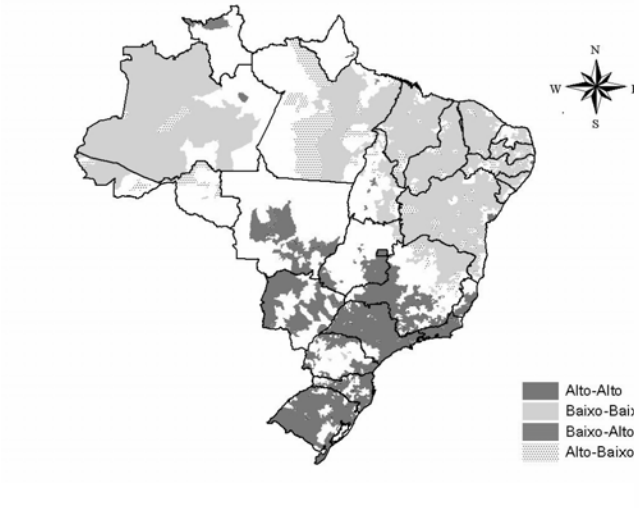
Map 2: Maps of *Moran scatterplot* to selected variables: Brazil



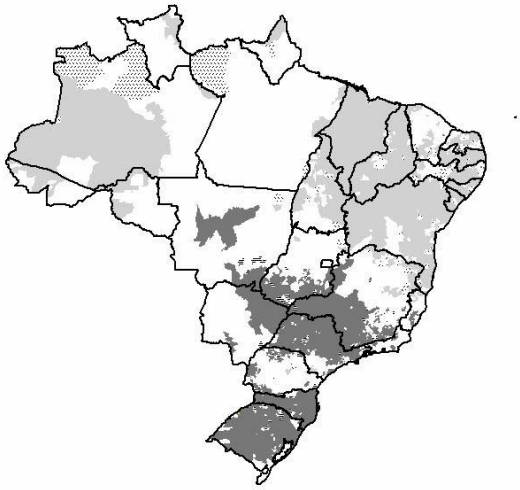
Map 2(a): Spatial distribution of *per capita* income, 2000.



Map 2(b): Spatial distribution HDI, 2000.



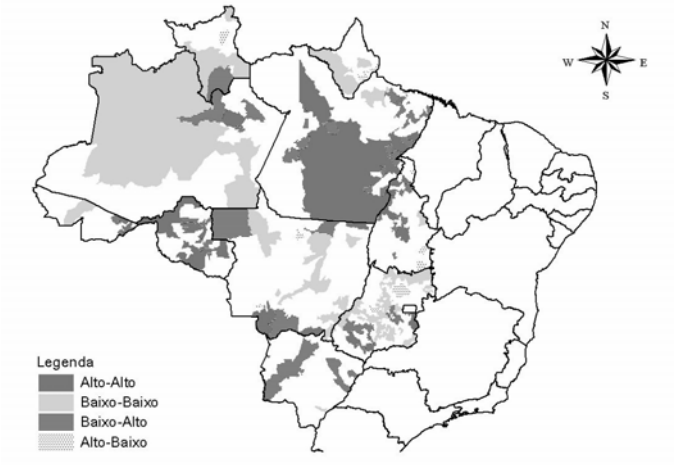
Map 2(c): Spatial distribution average years of study, 2000

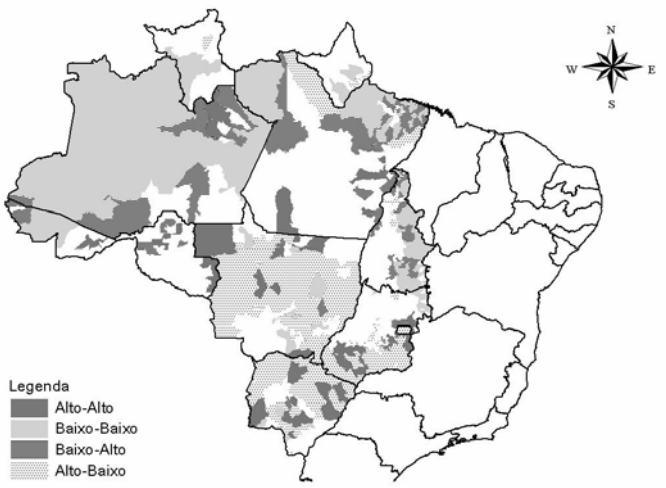


Map 2(d): Spatial distribution to life expectancy., 2000

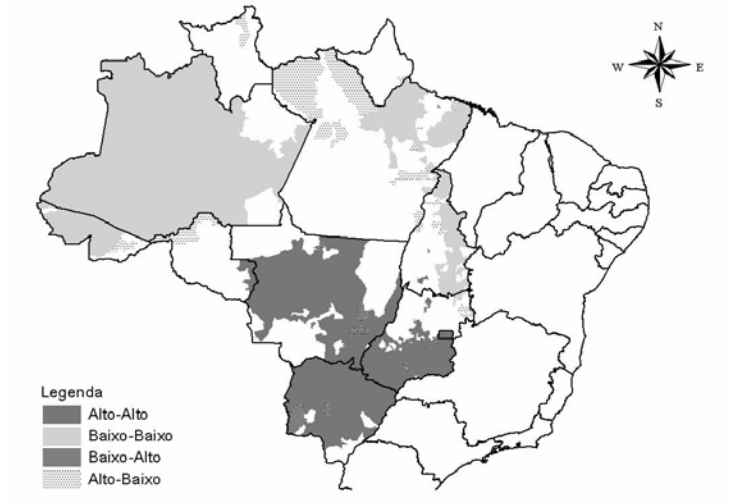
Map 3: Maps of *Moran scatterplot* to selected variables: regions Center-west and North

Mapa 3(a): Spatial distribution FNO e FCO, 2000.





Mapa 3(b): Spatial distribution *per capita* income versus Fundos contracted, 2000.



Mapa 3(c): Spatial distribution HDI, 2000.