Wages and Net Fiscal Benefit in a Federation: Evaluating Intergovernmental Grants in Brazilian Municipalities

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Abstract: In this article, we estimate the net fiscal benefit and the fiscal effect of unconditional grants on wages in metropolitan and non-metropolitan areas for 26 States from 2004-2009 period in Brazil. In particular, we explore the analytical framework proposed in Albouy (2012) to investigate the efficiency and equity effects of unconditional intergovernmental grants in Brazil. This framework can be understood as a positive exercise to comprehend whether grants mitigate the net fiscal benefit differences across localities and whether they promote equalization in certain criteria. Results suggest that grants distribution can be improved in both equity and efficiency. Our estimates of the net fiscal benefit indicate that the unconditional grant policy in Brazil is associated with inefficiency because higher paying areas in metropolitan regions are negative recipients of grants. More interestingly, we find that, contrary to conventional wisdom, grants distribution, although positively associated with certain minorities characteristics, is negatively related to our measures of inequality.

Keywords: Intergovernmental Transfers, Fiscal Federalism, Net Fiscal Benefit.

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1. Introduction

The equalization aspects of intergovernmental grants have generated much debate in the public finance literature. In the search for stronger or weaker equalization, central governments encounter several issues regarding efficiency (see Buchanan 1950; 1952; Musgrave 1961; Boadway and Flatters 1982). A relevant debate in this literature is fiscal capacity equalization or the discussion over equalization based on source revenues compared with residence-based resources (Boadway 2004).

In this article, we estimate the net fiscal benefit and the fiscal effect of unconditional grants on wages in metropolitan and non-metropolitan areas for 26 States under the 2004-2009 period in Brazil. In that country, unconditional grants are the main source of revenues for local governments where much of the public provision is locally provided (Higgins et al. 2015). Moreover, local governments can engage in redistribution through the public provision of private goods such as health and education services at no cost to their citizens (Besley and Coate 1991; Boadway and Keen 2000) [1]. This reinforces the importance of comprehending the redistributive and efficiency effects of grants on those municipalities[2]. In particular, we explore the analytical framework proposed in Albouy (2012) to investigate the efficiency and equity effects of unconditional intergovernmental grants in Brazil.

In contrast to income inequality literature, in which most research approach direct transfers (cash transfers) and indirect tax in the income analysis (e.g., post-fiscal income), the current framework allows us to understand the fiscal impact of grants on location wages. In fact, if a worker lives in an area with net fiscal benefits above the national average, she has access to a publicly provided good at a lower cost; put differently, her net income rises more than the wage variation (refer to Albouy 2012, pp. 832). Previously, Beeson et. Al (2010) found that local fiscal policies are associated to wage distribution.

There is a broad body of literature that discusses the analytical basis for vertical equalization in a Federation. According to Buchanan (1950), the main aspect of equalization is to assure that individuals, mainly the poor, have access to public provisions separate from where they choose to live. In a broad sense, this type of redistribution typically means horizontal equalization; richer communities should provide resources to their poorer counterparts. As developed by Albouy (2012), the literature on fiscal federalism has discussed how it is possible to conciliate both efficiency and equalization objectives when the resources are available according to individual characteristics instead of community characteristics (e.g., poorer communities versus poorer individuals).[3]

In most equalization systems, unconditional grants are negatively associated with a measure of fiscal capacity. In fact, most developed countries use '*Representative Tax System'* (RTS) to pursue fiscal equalization. In this system, central governments attempt to estimate fiscal capacity and to promote equalization based on fiscal need. However, it is very difficult to determine fiscal need, and there is much discussion regarding whether revenue equalization should be a sole source or destination based. Despite this, few works provide straightforward models that consider local characteristics such as labor force composition and productivity, differences in local resources or costs, or income inequality to evaluate the equity and efficiency of grants (Boadway and Flatters 1982).[4]

An interesting aspect of Albouy's model is that, to address the net fiscal benefit, it considers potential earnings instead of nominal wages and incorporates a federal tax differential. According to this analytical framework, grants should mitigate the net fiscal benefit differences across localities in such a manner that, in equilibria, all households from different regions would encounter the same net fiscal benefit. The rationale for this belief is that grants should not incentivize workers who live in more productive labor markets to move to areas with lower productivity to obtain higher net fiscal benefits. Albouy (2012) maintains that living in a low paying area is different from being a lower paid worker. Thus, grants should be redistributed to areas with lower paid individuals.

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[1] Besley and Coate (1991) provide a model to investigate first-best redistribution of publicly provided goods with imperfect information on the part of the government.

[2] Moreover, Boadway and Marchand (1995) find that overprovision of publicly provided goods could be welfare-enhancing.

[3] However, because Federations distribute resources based on jurisdictions characteristics instead of household or individual characteristics, it is not possible to approach equity without producing inefficiency.

[4] For a previous and comprehensive discussion of Fiscal Federalism in Brazil regarding equity and efficiency, see Shah (1991) pp. 92. Mendes et. Al (2008) provides a descriptive analysis in Portuguese.

Concerning equity, we expand the analysis because we estimate an inequality index (Gini Index) separately for each unit of observation, and we incorporate other inequality measures into the analysis, such as median wage and rank ordering of wage distribution. Moreover, we explore the fact that in Brazil, the minimum wage is an important bottom threshold for formal workers earnings to address the efficiency effects of grants. Finally, the distinction between fiscal benefits in metropolitan and non-metropolitan areas is an important issue in Brazil[5] because there are nearly half the population with a huge demand for public services. Thus, in contrast to Albouy (2012), we examine metropolitan and non-metropolitan areas separately, and we include wage inequality indexes in the analysis. Regarding methodology, we obtain a suitable number of observations (61 areas in Brazil against 9 provinces in Canada) to develop panel data approach in which fixed idiosyncrasies of the data unit are removed.

Coefficient estimates of grants on location wage suggest that a worker that moves to increase her earnings will encounter a decrease in federal grants and a decrease in NFB (approximately 4% and 3%, respectively), decreasing her total gains. Although the inefficient effect of grants on location wage is low, the current policy of grants distribution works against formalization of the labor market. Regression coefficient of grants on the share of individuals with minimum wage suggest that if individuals move to metropolitan areas with a higher share of formal jobs, they will lose fiscal benefits. Regarding equity, grants do not reach minorities living in higher paying areas in contrast to minorities living in lower paying communities. Grants in Brazil are also not associated with local public provision costs. More importantly, our results indicate that the most populated metropolitan areas in Brazil are the most harmed in terms of the Net Fiscal Benefit.

To discuss equity and efficiency issues in grants distribution in Brazil, the paper is presented as follows. The next section provides the institutional background in Brazil, as well as our data. Section 3 details the Net Fiscal Benefit (NFB) specification and results. Finally, Section 4 provides the conclusion.

2. Institutional Framework in Brazil and Data

To approach grants and net fiscal benefits in Brazilian municipalities, we need to comprehend several issues, such as Fiscal Federalism, including sourced-based taxes as royalties, wage inequality and income tax. In this section, we provide a brief description on those topics.

In Brazil, municipalities have a large fiscal gap (difference between expenses and revenues). This phenomenon happens because although the central government has a great share of the total tax revenues, local jurisdictions have a small share of the total tax basis and have a great share of the public expenses. In fact, municipalities in Brazil provide the public services of elementary education, social care, less sophisticated health services (such as first aid) and infrastructure, including public transportation (excluding subway services), road maintenance and public leisure areas such as parks and local libraries.

In Brazil, as noted by Mendes et al. (2008), in contrast to other countries with a similar level of development, vertical grants correspond, on average, to approximately 65% of municipalities' total revenues (for comparison, in Mexico, the grants' share of local revenue resources are less than 30%). This large dependency on grants reinforces the relevance of evaluating the equity and efficiency effects on grants distribution from the central government to local jurisdictions.[6]

The most important budget resource to municipalities in Brazil are the block grants from central government labeled MPF (Fundo de Participação dos Municípios, in Portuguese). Resources from the MPF represent, on average, approximately 1.2% of the Gross Domestic Product (GDP) (Mendes et al. 2008). The main objective of the MPF is to address municipalities' fiscal gaps, redistributing resources from the Federal Tax on Consumption (primarily levied on sin goods such as cigarettes and alcohol, and on telecommunications and gas) and the Federal Income Tax (levied on individuals and corporations).

[5] See also Shah (2012) for a discussion of the importance of grant resources on metropolitan areas.

[6] There are two local taxes in Brazil: a property tax and a tax associated with local private provided services such as restaurants, shopping centers, and groceries, etc. On average, they represent less than 15% of municipalities' total revenues, being more important in large municipalities. We do not include these taxes in the analysis because they are residence based revenues. According to Albouy (2012), this type of tax should reflect the local cost of public provision. In fact, there is widespread agreement in the literature about equalization differences (or fiscal need) for only sourced based revenues (see Albouy pp. 827, 2012).

MPF grants distribution follows a complex formula. State capital municipalities (27 observations, including district capital Brasilia) receive 10% of total MPF resources according to population size and average inverse income. The remaining 90% of the resources is allocated to non-State capitals; however, municipalities with more or less than 142,000 inhabitants receive different treatment. Municipalities with less than 142,000 inhabitants obtain resources based exclusively on 17 different population cutoffs. In contrast, municipalities with more than 142,000 inhabitants obtain additional resources of 4% (from the 90% share) of the fund, which is also based on population size and average inverse income. On average, because of this intricate rule, less populated municipalities tend to obtain more grants per capita than more populated cities.

The differences between the average MPF per capita in large cities compared with small cities in Brazil has raised debate over different criteria for grants allocation in metropolitan versus non-metropolitan areas. Despite the expected differences between metropolitan and non-metropolitan areas' fiscal needs, there is minimal agreement in the literature on whether grants distribution should vary according community size or geographic location. Although the analytical basis for grants equalization is independent of community size, larger cities tend to have a higher number of local public services and a broader variety of services compared with small and rural communities (Reschovsky 2007; Slack 2007).

On the one hand, it is not efficient to provide large amounts of grants for inhabited and isolated geographic areas, which have high costs for public provision (Slack 2007). On the other hand, certain central governments could find it advantageous to provide incentives for migration from high to low inhabited areas when congestion costs in the former are higher than equalization costs in the latter (Dafflon 2007). This difference in public provision is primarily justified in the public finance literature by population density or more social-economic diversity across households.

The second most important grants for municipalities originate from the States (second tier of government). States return approximately 20% of the sales tax revenues to the municipalities where the tax was originally collected.[7] This 'returning' grant is also a blocked grant and can be freely allocated; however, what makes this State grant unconventional is that sales tax in Brazil is both a source and destination based tax. In fact, sales tax revenues originate from residence consumption (destination based) and local production (source based). Although there is no information available regarding the share of destination and source-based revenues, we will incorporate sales tax into the analysis (refer to Figure 3 in Section 4). [8]

Furthermore, municipalities obtain resources from the use of territorial resources as royalties. The federal government collects approximately 10% of the oil production value. The criteria for royalties' distribution to States and municipalities follow geographic closeness; in fact, coastal distance to the oil installation is dependent on geographic coordinates and latitude. According to the National Agency of Oil (ANP, in Portuguese), in 2010, approximately 33% of royalties' total revenues were distributed to municipalities as follows: 29% to States and 28% were available to the central government. However, most of the oil extraction in Brazil is offshore, and it is highly concentrated in certain States. In particular, approximately 82% of the total oil production and 92% of offshore production occurs in the State of Rio de Janeiro (Monteiro and Ferraz 2010). Thus, certain municipalities is this State heavily benefit from this source-based grant.[9]

[7] In fact, states redistribute 25% from total resources. However, 75% of these shares are source-based, and the remaining 25% follow another state criteria (could be equalization). See also Shah (1991), Section 2.61, for further details.

[8] Additionally, municipalities obtain two categorical grants as follows: one for educational expenses and another for health expenses. Fundeb is the categorical grant for education in Brazil. It is mainly an equalization grant. Municipalities obtain resources according to their share of total enrollment in each State. The idea is to guarantee a minimum expense per student from elementary and secondary levels in any locality. However, the resources for this education categorical come mainly from municipalities (MPF grants) and States, with a small share (less than 10% on average) of central government resources. Each State manages its own Fundeb fund. Similarly, grants for the healthcare system (SUS, Sistema Único de Saúde, in Portuguese) aim for equalization. Resources come from a central fund that redistributes to States and municipalities based on levels of health services provided locally. Municipalities with more health services (e.g. prevention programs) or more sophisticated procedures (inpatient stay) receive more resources. There is also a minimum per capita transfer for all localities. Again, for municipalities, a portion of the health resources comes from MPF transfers. Because of these characteristics (unconditional transfer finance part of fund resources), we do not consider those categorical grants in the analysis. Moreover, we note that categorical grants represent, on average, a small per capita transfer compared with MPF grants.

[9] See Monteiro and Ferraz (2010) and Serra (2005) for a comprehensive discussion of royalties in Brazil.

Regarding income, we briefly describe two subjects as follows: the federal income tax and income inequality. Income taxes in Brazil are collected by the central government. Nominal tax rates are progressive according to income ranges, and there are several tax deductible expenses, such as healthcare and education. Income ranges and deductible expenses values vary frequently. In general, most of the population is below the first tax range cutoff or is tax exempt. The next group is taxed at a 15% tax rate. The richest group encounters a 27.5% tax rate. The main criticism of the Brazilian income tax is that, although progressive, it does not capture income outside formal markets, and those incomes are not necessarily lower than national average.

Finally, Brazil is one of the most unequal countries in the world. Because of this scenario, several research studies have investigated the equality of opportunity and earning inequality in Brazil.[10] Currently, the minimum wage is also significant to explain regional inequality.[11] Silveira Neto and Azzoni (2011) show the importance of real minimum wages increases in the north and northeast regions in Brazil, where most workers (not including the formal workforce) earn less than minimum wage, to the national income convergence. Additionally, certain authors note that minimum wage in Brazil can disincentive workers to seek jobs in the formal sector (Higgins et al 2015). Similarly, our current framework raises concerns regarding the inefficiency impact of grants in the formal sector: workers moving to regions with high formal jobs can obtain a lower NFB because of grants distribution.

We note that Brazilian states are divided into five geographic regions: North, Northeast, Center-West, Southeast and South. Figure A.6 in the Appendix provides a map of Brazil with States and their respective regions. Summarizing, the complexity of grants rules and their impact on wages reinforce the importance of using a methodology to evaluate the equity and efficiency aspect of the unconditional grants in Brazil. In Section 3, we detail our empirical approach for this issue.

2.1 Data

To approach the efficient and equalization aspects of resources distribution from the central government to local communities (municipalities), considering both metropolitan and non-metropolitan areas, we collect information from two different datasets. The Finbra dataset of the Secretary of National Treasure provides detailed information on community public finance such as tax revenues, grants revenues and population. These data include information on grant types such as royalties and data on sales tax in Brazil (ICMS), which is a mix of source and destination tax. Information from Finbra data is used to compound our measure of NFB.

Micro data regarding individual wages are available in PNAD (National Research on Households). PNAD is a sample dataset that contains information regarding socio-economic and demography characteristics of the individuals, such as gender, age, ethnic group, educational level (in years) and whether the individual has migrated. Regarding the labor market, PNAD data provides information regarding raw wages, industry sector and occupation, number of monthly working hours, and whether the worker is formal (an important issue in Brazil) and whether she is self-employed. We note that, to consider full time workers, we select individuals aged from 21 to 59.

In contrast to Finbra data, which provides data annually for each municipality, data on PNAD is available by States and regions (State capitals, metropolitan areas out of capitals, and non-metropolitan areas). It is possible to conciliate information from both data using IBGE (National Bureau of Economic and Geography) classification on States' regions.[12] Thus, information regarding approximately 5,400 municipalities is grouped into three types of regions as follows: metropolitan areas in States' capitals (hereafter MR1); metropolitan areas outside States' capitals (hereafter MR2); and non-metropolitan areas (hereafter R3),

[10] For a discussion on inequality in Brazil and, mainly, for the impact of indirect taxes on inequality see Lustig et. Al (2014).

[11] As a matter of fact, minimum wage has an important influence on wages at urban labor markets, mainly for less educated-workers. For example, in the USA labor market, Easton (2006) concludes that minimum wage has a larger impact on the wages of workers with less than a high school degree than local industry mix.

[12] In fact, it is possible to compose 9 out of 13 Metropolitan areas (non State capitals) as used by IBGE. The remaining four areas are classified as "regions of development" and cannot by merged with PNAD data. Therefore, they are classified as R3 regions. Available at: << http://www.ibge.gov.br/home/estatistica/populacao/censo2010/sinopse/sinopse_tab_rm_zip.shtm>>.

including rural areas. Because of its particular characteristics, we exclude Brazil's capita district (Brasilia) from our sample. With this segmentation, our sample contains 61 different units of observations. This classification allows us to retain the analyses of potential differences between metropolitan and non-metropolitan areas and continue to compound a number of significant observations for a panel data approach.

To compose our panel, we use time data from 2004 to 2009.[13] All monetary values are in Brazilian Reais (R$) and were deflated to the year 2009 value based on the Consumer National Price Index (IPCA) available at IBGE. To estimate the federal tax differential (income tax) originating from location effects, we collect data on the nominal tax rates on wages in the Brazilian Income Revenue System.[14] PNAD data allow us to estimate Federal tax differentials considering workers who are exempt from income taxes.

3. Evaluating Grants in Brazil

3.1 Specification of Location Wage and Net Fiscal Benefit (NFB)

Compared with Buchanan (1950), an important difference in Albouy's (2012) model is that although the first considers individuals with the same nominal wage as identical, independent of where they live, Albouy (2012) maintains that individuals living in the same locality and with the same wage should be treated as equals. In fact, to mitigate efficiency concerns when approaching equalization, one should consider potential earnings instead of nominal wages. Efficiency is an important issue because workers with higher productivity can be discouraged from searching for jobs in higher earning areas due to a federal tax differential or a negative NFB.

To approach potential earnings, Albouy's (2012) models depart from a standard *mincerian* wage function:

$$w_e^{ij} = X_e\beta + \mu^j + \varepsilon_e^{ij}$$

Where w_e^{ij} is the natural logarithm of wages of individual *i* in locality *j*, X_e is the vector of attributes for a worker of type *e*, and the term μ^j represents locality characteristics. Thus, the estimate of average potential earnings from a specific locality j follows function (3):

$$\bar{w}^j = \bar{X}^j\beta + \mu^j \qquad (1)$$

Where the first term ($\bar{X}^j\beta$) is the predicted wage controlling for worker skills and the second term (μ^j) represents the locational effect on wages, independent of the local human capital level. In fact, to obtain wage fitted values, we multiply the estimated covariates coefficients by explanatory variable averages in each locality (see Appendix A.1 for details). We should note that the total fitted wages and their two components, location and composition effects are normalized to obtain a national average of zero. We use the same procedure (normalization) for all components of NFB as in Albouy (2012).

TABLE 1 HERE

Table 1 provides per capita wage differentials compared with the national average as weighted by population. We use three main areas of analysis, as described previously in Section 2: metropolitan areas in States' capitals (hereafter MR1); metropolitan areas outside States' capitals (hereafter MR2) and non-metropolitan areas (hereafter R3). Wage differentials note that the highest nominal wages in Brazil are in the metropolitan areas (MR1 and MR2) of São Paulo State (SP), in the States of the South region such as Paraná (PR) and Rio Grande do Sul (RS), and in the MR1 areas of Rio de Janeiro (RJ) and Santa Catarina (SC).

[13] We note that at the time of data collection, PNAD data were available only until the year 2011. We do not use data for the year 2010 because in census years, household surveys use different population weights.

[14] We collect the respective nominal tax rates and deduction amounts at Brazilian Internal Revenue Service. Available at: http://www.receita.fazenda.gov.br/Pagamentos/PgtoAtraso/tbcalcir.htm#2004. We estimate effective income tax by regions using wages microdata available at PNAD.

Our estimates of location wage in accordance with Function (3) appear robust. According to the results in Table 1, column 2, localities in metropolitan regions with well-known higher living costs present a higher location wage; this is the case in the MR1 areas of de São Paulo, Paraná, Santa Catarina, Minas Gerais (MG), Rio de Janeiro e Goiás (GO).[15] Although they have a lower differential, the same is true for MR2 communities in the Southeast and South regions. Second, communities well known for poor amenities that are also far from the wealthiest areas from the Southeast region also have higher location wage estimates. That is the case for the MR1 areas of Mato Grosso (MT) and Acre (AC) e Rondônia (RO). The remaining localities, primarily in R3 areas, present a negative differential of location wage compared with the average; this appears reasonable with the idea of a lower cost of living outside metropolitan areas, or in certain cases, a higher quality of living, such as lower crime rates.[16] The MR1 areas in Mato Grosso, Paraná, Rio de Janeiro, and São Paulo also encounter difficult commuting; this tends to be compensated for by higher wages.[17]

In contrast, the wage composition effect is associated with worker productivity (e.g., workers sort on localities based on their skill levels, Albouy, 2012 pp. 831). According to our estimates (function 1), a positive composition wage differential is found in localities with higher average years of schooling (see Table A.3 in the Appendix). Thus, a higher wage differential due to higher productivity in the workforce is found in all areas in States in the South region and in São Paulo and Rio de Janeiro. In particular, the differential is higher in the metropolitan areas (MR1 and MR2) than in other areas (R3). Additionally, as expected, localities in regions well known for lower educational levels (and lower worker productivity) present negative differentials on composition wages, as do the States in the Northeast region.

FIGURE 1 HERE

According to our estimates, location and composition effects have similar shares for total wage composition. Considering all areas (MR1, MR2 and R3), location effects represent approximately 47% of total wage earnings, and composition effects represents the remaining 53%. Additionally, we run a regression of composition wage on total raw-wage differences and obtain an estimated coefficient of 0.20 (with robust standard error of 0.019). This positive relation suggests that, in Brazil (in contrast to Canada, Albouy 2012, pp. 831), workers sort significantly across communities: higher paying areas attract workers with higher potential wages and more years of schooling. According to Figure 1, R3 communities are typically lower paying areas.

Interestingly, Figure 2 depicts a regression of the predicted wage differences of minorities (we solely consider the estimated coefficients for independent variables that describe minorities, such as women, immigrants, and individuals with informal jobs, see Appendix A.1) on raw wages and find that higher-paying areas also attract minorities. It is noteworthy to note that five of nine MR2 areas are on the superior right side of Figure 2. This finding suggests that those areas, which are a negative recipient of grants, also attract workers with lower paying characteristics who consider the earnings potential. Thus, metropolitan regions from the South and Southeast (MR1 and MR2) typically pay more to minorities than R3 areas. Considering equity, it is important to comprehend whether areas with more (less) grants than the national average host more (less) individuals with lower paying characteristics.

FIGURE 2 HERE

Regarding efficiency, federal tax rates on wages can influence individuals to move to areas with lower nominal wages. Thus, to avoid distortion of labor force allocations, federal grants should be used to offset this effect by generating fiscal benefits to highly taxed communities. Albouy (2012) develops an analytical set-up in which grants balance the effect of the three main fiscal components as follows: differences in federal fiscal

[15] For example, Rio de Janeiro and São Paulo were ranked as the 19th and 26th most expensive cities in the world in 2010. http://www.citymayors.com/statistics/expensive-cities-world.html.

[16] See Sachsida et Al. (2007) for an analysis of crime rates and urbanization in Brazil.

[17] See Timothy and Wheaton (2001) for a discussion of commuting time and wages variation. For data on commuting in Brazilian metropolitan areas see <http://www.ibge.gov.br/home/presidencia/noticias/imprensa/ppts/00000008414204122012422627539 70.xls>

burden, 'fiscal residuum', and public good externality.[18] The first component approaches the federal tax differential that originated from the wage variation.

The second fiscal component evaluates, compared with the national average, source based revenue differentials and local public expenses. Regarding efficiency, intergovernmental grants should compensate for source-based revenues as royalties. The main idea is that community-based taxes should reflect local costs in a manner that residence taxes work as user fees. Finally, the third fiscal component in Albouy's model is the public good externality. This term reflects the effect of a new residents in the community. Based on the idea of non-rivalness of the public good, the new migrant increases local expenditures by an amount larger than her consumption. However, the literature on externality estimates that its effect is very small (Bergstrom and Goodman 1973).

TABLE 2 HERE

In order to obtain the Net Fiscal Benefit (NFB) for the habitants of each locality, we need first to estimate each component separately. Table 2 provides the per capita differential of the three fiscal components relative to the national average. Per capita values are weighted by population regarding the three main regions of analysis (MR1, MR2 and R3). Table 2 indicates that MR2 is the lowest net recipients of unconditional grants with a negative differential of R$ 43 on average per capita, followed by MR1 areas that receive, on average, R$ 10 less than average. In contrast, R3 regions are net positive recipients of unconditional grants with a positive differential of R$ 103 compared with the national average. Despite those differences, there are also large differences in per capita grants within groups. For example, in area RM1, certain States in the North Region, such as Acre (AC), Roraima (RR) and Tocantins (TO), obtain much more grant resources than the national average, with a positive surplus of approximately R$ 200 to R$ 500 per capita. Other States from the South and Southeast, such as Rio Grande do Sul (RS) and Rio de Janeiro (RJ) e São Paulo (SP), receive less than the national average in both metropolitan areas, MR1 and MR2. In contrast, localities in R3 areas obtain more grants per capita than the average in all States, with the exception of Rio de Janeiro e Roraima.

We should note that there are areas in all regions of Brazil (e.g., North, Northeast, Center-West, Southeast, and South) that are positive recipients of unconditional grants compared with the national average. This is the case for Goiás (GO) and Mato Grosso do Sul (MS) in the Center-West region, Tocantins (TO) in the North region, Rio Grande do Sul (RS) and Paraná (PR) in the South region, Minas Gerais (MG) in the Southeast region and Alagoas (AL), Paraíba (PB), and Piauí (PI) e Rio Grande do Norte (RN) in the Northeast region. Regarding those five Brazilian regions, the North region is the highest net recipient as a whole, and the Northeast is the highest net recipient outside metropolitan areas (R3). Considering the metropolitan regions (MR1 and MR2) solely, the Southeast region is the lowest net recipient of federal block grants.

Table 2 provides the differential of the two remaining components of NFB. Regarding a source-based tax differential, column 2 provides localities with a differential on royalties associated with oil extraction. As previously discussed in Sections 2, sourced-based resources are inefficient because they affect local tax prices and are not associated with any fiscal need. In Brazil, the resources are heavily distributed to municipalities in Rio de Janeiro (refer to Section 2), primarily to non-metropolitan (R3) areas. In fact, the royalties differential is very large compared with the national average as outside Rio de Janeiro, five other areas of 58 (MR1, MR2 and R3) obtain a positive royalties differential.

As expected, metropolitan regions with higher wages and a higher share of formal jobs collect more in federal income tax compared with the national average. In spite of large wage differentials, the income tax differential is not that high; it is higher on the metropolitan areas of Rio de Janeiro and São Paulo (MR1) and lower in R3 areas in the North and Northeast States. Because income tax follows a Federal tax rate, the differential compared with the national average reflects how much the inhabitants of a specific area collect more or less in taxes regarding other areas as a consequence of local labor market characteristics as a share of formal jobs and a share of wages below the first income tax rate threshold.

Importantly, we note that areas outside metropolitan areas have a greater share of workers with earnings below the minimum wage. Column 4 in Table 2 shows that although the metropolitan areas of MR1

[18] See also Appendix A.2 for a brief description of Albouy (2012). In contrast, we disregard potential public provision externality and congestion effects, since they are probably small in most areas. We should note that Albouy's (2012) analysis also includes local cost of living and amenities. However, we do not have this information available in Brazil for our 61 units of observation.

and MR2 have approximately 20% of the workforce earning less than minimum wage, in R3 areas, that share rises to 40%. We also note that although the Gini Index (Column 3 in Table 2) is high in all localities, it is increased in MR1 areas. This finding likely reflects the fact that in metropolitan areas, the range between the highest wages and the lowest wages is higher, although the average wage is not.

We use these three fiscal components to compute the per capita differential or NBF weighted by population as follows: grants, source-based tax and federal income tax. Estimates of the NFB differential are most influenced by grants; therefore, on average, RM1 localities are the most damaged, with a negative gap of R$ 45 in NFB per capita compared with the national average. Similarly, RM2 regions present a negative NFB gap, which is fairly small at approximately R$ 29 per capita. In contrast, R3 areas are the localities, which, on average, benefit most from the current federal grants policy; they present a positive NFB differential of approximately R$ 168 per capita. This scenario is intensified by the income tax differential, because most federal taxes are collected in metropolitan areas (MR1 and MR2) where the nominal wage is higher compared with the national average. Additionally, royalty revenues also accentuate this disequilibria because four R3 areas obtain more than R$ 50 per capita compared with the national average (Sergipe [SE], Rio Grande do Norte [RN] and Espírito Santo [ES] and mainly Rio de Janeiro).

Although incomplete, this analytical framework allow us to evaluate grants distribution in terms of equity and efficiency, and more importantly, to evaluate which trade-offs are involved in grants distribution and how to balance the trade-offs that grants generate (refer also to Boadway and Flatters 1982). In the next section, we present our estimate for the Brazilian case.

3.2 Evaluating Equity and Efficiency

Using our estimates of wages, inequality indexes and data on grants differentials, we analyze NFB in accordance with the analytical framework discussed in Section 3.1. Our main results are presented in Table 3. We conduct regressions of unconditional grants and NFB on variables that are associated to efficiency (location wage and minimum wage), to inequality (Gini index, wage ranking distribution and median wage) and to public cost provisions (density and public sector wages). Regarding efficiency, we would expect that differences in the federal income tax would be offset by federal grants, or that higher-paying areas are not punished by negative NFB. Additionally, we calculate the difference between the mean and median wages, and we rank the ordering of individual wages and obtain the average in each locality compared with the national distribution. If those two indicators are associated with equity, one should expect that municipalities with a higher wage ranking and larger difference between the mean and median wage exhibit negative and positive relations to grants, respectively.

TABLE 3 HERE

As discussed in Albouy (2012), equity criteria for grants distribution considers that communities with lower potential income, because of the composition of the workforce and the mix of economic activities, should obtain more fiscal resources. Thus, location wages describe the effect of the community on wage determination, discarding the effect of human capital. The idea is that the location effect reflects the local cost of living or the amenities and the quality of life. One should expect that firms in communities with higher living costs or lower amenities would pay a higher wage to maintain its workers.

Coefficient estimates of grants regarding location wage suggest that a worker that moves to increase her earnings in one R$ will encounter a 0.04 cent decrease in federal grants and a 0.03 decrease in NFB, such that her gains will rise by slightly less than the total gains, by approximately 0.97 cents. This means that there is a disincentive effect to move workers to higher paying areas because they will obtain less in fiscal benefits. Moreover, because unformal jobs are an important issue in labor market in Brazil, an important boundary on market place is the minimum wage. Regression coefficients of grants regarding individuals with minimum wages suggest that a community that creates formal sector jobs will obtain less grants and less NFB. In fact, this result reinforces the idea that, if individuals move from R3 regions (with a lower share of informal jobs, see Table 1) to metropolitan areas (MR1 and MR2) with a higher share of formal jobs, they will lose fiscal benefits. In other words, municipalities with higher than average location wages will have less resources per

capita for public provision than low-paying areas. Although this difference is significant in most regressions (columns 1 to 3), the magnitude is much lower than those found in Albouy (2012).[19]

The results on predicted earnings for minorities (as women, immigrants, non-white and informal workers) suggest a positive correlation between grants and potential earnings in this group. Although this suggests equality in grants distribution, the higher than average grant benefit for this group is offset by the negative NFB. Overall, this result supports the findings in Figure 2 as follows: if a minority group moves from a low-paying area to a high-paying area, they will encounter a negative NFB; in particular, they will lose approximately 0.04 cents in fiscal benefits for each additional one Real (R$) in formal wages. In this case, the difference between grant and NFB arises from the federal income tax.

Regressions of grants and NFB on inequality indicators present mixed results. The negative coefficient (but not significant) in Column 4 (Table 3) suggests that grants have equity: if workers move to communities with higher (lower) rank ordering for average wage, they obtains fewer (more) grants. However, a higher inequality measure as the difference from mean wage to median wage is negatively associated with grants distribution. The same results are found for the Gini Index: if the worker moves to a community with higher inequality, she receives fewer intergovernmental grants.

Coefficients of NBF regressions on inequality index are similar to the grant results: they are negatively related (although not significant) to the mean to median difference and close to zero in the Gini Index. More surprisingly, because of royalties' effects on NFB, the coefficient on rank ordering on average wage is significant and positive: workers moving to areas with a higher ordinal position in wages obtain more fiscal benefits, which again moves in the opposite direction of equity.[20] The positive association between grants and inequality indicators is surprising because, due to the inverse income criteria on grants distribution, there is widespread belief that grants are positively related to poorer areas (Mendes et al. 2008). Thus, grants distribution in Brazil does not appear to be strongly related to inequality. In fact, this distribution works against the minorities living in higher-paying areas.

Finally, we investigate the association between grants and local public costs to determine whether grants benefit communities with higher public provision costs. The coefficient regression on density suggests that localities with higher density obtain less grants per capita. However, this result reflects much of the situation in which highly populated metropolitan areas (MR1 and MR2) are negative grants recipients. In fact, if we run a separate regression with R3 areas solely, the coefficient estimate is highly insignificant (p-value of 0.82), although it remains negative.

More interestingly, we run a regression of the sum of wages on public administration and health and education workers against total wages. Because a large share of public provision is on health and education services, this variable should provide a suitable comparison between local costs and the national labor cost differential. The coefficient estimate indicates a positive association between the average wage per capita and the average wage on public sector type activities (see also Figure A.5 in the Appendix). This suggests that labor costs in the public sector are associated with private sector wages. The results on density and public sector wages do not provide us with evidence that grants are directed to most needed communities in terms of costs.

FIGURE 3 HERE

In Brazil, there is an additional debate regarding whether grants should equalize part of the revenue differences in State sales tax (see also Shah 1991, Section 3.3; the debate is still present). This discussion also address the issue of residence-based versus source-based tax, because an idiosyncrasy of sales tax in Brazil is that it follows both criteria (refer to the discussion in Section 2). Although data on the sourced or residence-

[19] One possible explanation for the great difference in coefficient magnitudes is that in addition to the differences between Brazil and the Canada Federation System, we run panel data models different from Albouy (2012), who runs a cross-section analysis. Pooling regressions coefficients (reported in Table A.4 in the Appendix) are larger in all regressions and have a different sign for two regressions (for minimum wage and minority wage). We argue that this difference between fixed effects and pooling functions reflects unobserved characteristics that vary across localities, such as institutional and business environments, or local residence tax rates levels that could bias the estimated coefficients.

[20] In fact, if we exclude the R3 area of Rio de Janeiro, which is a great outlier on royalty per capita distribution, we obtain a negative and not significant coefficient for the Gini Index variable.

based share of the tax are not available, we assume that sales taxes have an important relationship with fiscal capacity. We argue that the higher the sales tax per capita, the higher the fiscal capacity. Figure 3 plots the scatter of unconditional grants per capita (vertical axis) against the sum of the sales tax plus royalties and the discounted federal income tax. In this plot, the distance between each community marker (dot) and the solid dark line represents the NFB. More importantly, the distance provides the grants amount that would be needed to offset any fiscal disequilibrium, or to make measurable NFB zero (Albouy 2012).

Thus, communities to the right and superior quadrant of the solid line have a positive NFB; furthermore, communities in the left and inferior quadrant of the solid line have a negative NFB. The slope of the dashed line brings the coefficient of the per capita grant against the set of the other previously described fiscal components (royalties, federal income tax, sales tax). The slightly negative slope of the dashed line suggests that grants distribution does not balance NFB between communities, nor does it address fiscal capacity. More interestingly, we note that approximately two thirds of the localities are below the solid line, which suggests that the actual rule of grants distribution benefits only a few localities.

Overall, we note that the markers more distant from the solid line are primarily from the MR1 and MR2 areas. Close inspection of Figure 3 suggests that RM1 of Rio de Janeiro should obtain approximately R$ 300 more per capita to offset a negative NFB. Several other MR1 localities from all regions, such as Santa Catarina (South), Goias and Mato Grosso do Sul (Center West), Ceará (Northeast) and São Paulo (Southeast) exhibit a high deficit in NBF. Most damaged MR2 localities are in the South (Paraná and Rio Grande do Sul) and Northeast (Ceará, Pernambuco e Bahia). Approximately 44 million inhabitants, or approximately 23.5% of the total population, live in these MR1 and MR2 regions.

With respect to efficiency, a positive or negative NFB affects worker migration because advantageous fiscal communities attract habitants in spite of labor market characteristics (e.g., lower versus higher paying areas). Thus, according to Albouy (2012), workers living in higher wage areas are punished for living in localities with higher productivity. Moreover, grants should be used as a corrective policy to offset the higher tax burdens of workers who live in areas with higher productivity. Regarding equity, fiscal components and NBF do not appear to be associated with fiscal capacity or fiscal need in Brazilian municipalities, which works in the opposite direction of equality. We also find a weak association between the local cost of public provisions and grants.

To summarize, evaluating grants in Brazil based on both equity and efficiency criteria suggests that although the inefficient effect of grants on location wage is low, the current policy of grants distribution works against the formalization of the labor market (as in Higgins et al 2015). For equity, grants do not reach minorities living in higher paying areas, in contrast to minorities living in lower paying communities. More surprisingly, grants distribution is negatively associated with inequality indices on wages, which reinforce the well-known idea that to address inequality, direct cash transfers are more suitable than intergovernmental transfers.

4. Conclusion

This paper approaches equity and efficiency in grants distribution in Brazil. Our analysis utilizes the analytical framework proposed by Albouy (2012). This approach is the first to consider that central government grants should mitigate potential misallocation effects associated with higher federal tax burdens on higher wages. The main implication is that individuals living in higher paying areas because of higher productivity should not be punished with lower net fiscal benefits compared with the national average. In other words, federal grants should offset allocation distortions that stimulate higher paying individuals to migrate lower-paying areas because of lower productivity.

Additionally, this analytical reference allows us to address equity. We investigate how grants are associated to workers with lower-paying characteristics, such as minorities, and more general inequality measures across localities, including the Gini Index, ordinal ranking of average wages and mean-to-median wages differences. Thus, in contrast to Albouy (2012), in addition to inequalities indexes, we group our sample of approximately 5.4 thousand municipalities across 26 Brazilian States into three main areas as follows: metropolitan areas in States capitals, metropolitan areas outside States capitals and non-metropolitan areas. It important to comprehend grants effects on large urbanized areas in contrast to small areas in Brazil because

there is high demand for public services and greater income inequality. Regarding methodology, this empirical strategy led us to 61 units of observation and allowed us to control for fixed effects.

Our estimates of the net fiscal benefit indicate that the unconditional grant policy in Brazil is associated with inefficiency because higher paying areas in metropolitan regions are negative recipients of grants. More interestingly, we find that contrary to conventional wisdom, grants distribution, although positively associated with certain minority characteristics, is negatively related to our measures of inequality. Results suggest that grants distribution in Brazil can be improved in terms of both equity and efficiency. This type of analysis would benefit from additional data on amenities and the local cost of living.

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TABLE 1

Per capita wage differences across localities (total, composition and location effects) and inequality indicators

	Differential Total Wage (level)			*Differential Composition Effect*			*Differential Location Effect*			*Gini Index*			*% workers with earnings below minimum wage*		
	Metropolitan area		Non metropolitan area (R3)	Metropolitan area		Non metropolitan area (R3)	Metropolitan area		Non metropolitan area (R3)	Metropolitan area		Non metropolitan area (R3)	Metropolitan area		Non metropolitan area (R3)
	Capital (MR1)	Non cap. (MR2)		Capital (MR1)	Non cap. (MR2)		Capital (MR1)	Non cap. (MR2)		Capital (MR1)	Non cap. (MR2)		Capital (MR1)	Non cap. (MR2)	
State															
AC	310		-396	0.08		-0.38	0.29		-0.15	0.52		0.44	0.18		0.52
AL	116		-508	0.05		-0.42	0.14		-0.38	0.56		0.43	0.25		0.57
AM	146		-287	0.06		-0.21	0.16		-0.12	0.43		0.42	0.10		0.36
AP	149		-172	0.09		-0.16	0.14		0.01	0.44		0.38	0.13		0.26
BA	82	-142	-480	0.03	-0.05	-0.41	0.13	-0.06	-0.31	0.53	0.48	0.45	0.22	0.29	0.56
CE	-60	-121	-558	0.02	-0.06	-0.38	-0.02	-0.02	-0.56	0.50	0.53	0.50	0.25	0.33	0.68
ES	200		-206	0.13		-0.05	0.14		-0.15	0.49		0.44	0.14		0.31
GO	254		-91	0.13		-0.05	0.19		0.01	0.49		0.46	0.11		0.25
MA	70		-434	0.08		-0.36	0.06		-0.26	0.53		0.51	0.26		0.57
MG	268	164	-164	0.15	0.18	-0.03	0.19	0.06	-0.10	0.50	0.48	0.46	0.13	0.14	0.29
MS	283		-7	0.16		0.00	0.19		0.06	0.51		0.48	0.16		0.24
MT	405		-7	0.16		-0.06	0.29		0.12	0.50		0.45	0.11		0.25
PA	-27	-46	-288	0.02	-0.04	-0.28	0.02	0.05	-0.05	0.49	0.49	0.43	0.24	0.30	0.39
PB	41		-408	0.08		-0.29	0.04		-0.27	0.54		0.50	0.25		0.54
PE	1	-165	-508	0.10	-0.05	-0.35	-0.03	-0.08	-0.45	0.52	0.48	0.44	0.23	0.33	0.57
PI	73		-575	0.04		-0.50	0.11		-0.49	0.57		0.58	0.30		0.72
PR	476	492	-37	0.28	0.28	0.09	0.23	0.24	-0.06	0.48	0.51	0.46	0.10	0.12	0.26
RJ	356	145	-51	0.24	0.18	0.11	0.18	0.05	-0.09	0.50	0.47	0.42	0.10	0.13	0.16
RN	129		-451	0.14		-0.26	0.07		-0.38	0.53		0.44	0.20		0.52
RO	224		-207	0.09		-0.17	0.22		-0.03	0.49		0.46	0.16		0.38
RR	101		-360	0.07		-0.24	0.11		-0.24	0.48		0.48	0.18		0.50
RS	395	327	-90	0.29	0.26	0.12	0.15	0.13	-0.15	0.49	0.50	0.44	0.11	0.18	0.29
SC	586		171	0.36		0.21	0.23		0.05	0.46		0.43	0.07		0.17
SE	103		-421	0.07		-0.31	0.11		-0.27	0.52		0.44	0.21		0.50
SP	528	573	159	0.25	0.32	0.22	0.30	0.26	0.02	0.49	0.49	0.43	0.09	0.10	0.12
TO	239	-301		0.15		-0.16	0.16		-0.19	0.50		0.48	0.15		0.44
Total										**0.50**	**0.49**	**0.45**	**0.17**	**0.21**	**0.40**

Obs: Number of observations 61, with 26 metropolitan areas in States' capitals, 9 metropolitan areas outside States' capitals and 26 non metropolitan areas. Averaged values from 2004 to 2009 measured in2009 Brazilian Reais (R$). Composition and Location effects are expressed in logarithmic terms.

TABLE 2

Differential in per capita fiscal components - relative to national average in 2009 Brazilian Reais (R$)

	Population (year 2009)			*Federal tax (1)*			*Royalties (2)*			*Grants (3)*			*Net Fiscal Benefit (1+2+3)*		
	Metropolitan area		Non metropolitan area (R3)	Metropolitan area		Non metropolitan area (R3)	Metropolitan area		Non metropolitan area (R3)	Metropolitan area		Non metropolitan area (R3)	Metropolitan area		Non metropolitan area (R3)
	Capital (MR1)	Non cap. (MR2)		Capital (MR1)	Non cap. (MR2)		Capital (MR1)	Non cap. (MR2)		Capital (MR1)	Non cap. (MR2)		Capital (MR1)	Non cap. (MR2)	
State															
AC	370,809		320,323	4		-10	-27		-23	194		24	53		109
AL	1,160,393	595,148	1,362,625	4		-10	-14		-5	34		145	9		261
AM	2,042,185		1,331,300	1		-8	-10		25	-130		68	-183		163
AP	463,704		155,103	-7		-11	-25		-24	23		38	-76		59
BA	3,866,004	367,061	10,339,889	8	-5	-9	-7	-20	-16	-101	4	93	-177	27	118
CE	3,655,259	560,325	4,332,225	-2	-1	-10	-21	-26	-19	-36	21	109	-71	83	151
ES	1,686,045		1,801,154	10		-7	-7		51	-113		81	-139		214
GO	3,198,918		2,723,702	2		-7	-27		-7	-73		173	-78		117
MA	1,439,021	334,899	4,521,769	5		-9	-26		-25	3		74	-33		123
MG	5,750,522	615,117	13,637,847	13	4	-5	-18	-24	-10	-96	61	122	-97	14	90
MS	755,107		1,605,391	4		-7	-29		-12	-135		154	-30		204
MT	823,831		2,177,861	3		-5	-25		-20	-99		101	-99		117
PA	2,161,191	479,714	4,484,599	-2	-3	-8	-27	-20	11	-80	-60	21	-154	-101	48
PB	1,156,745	687,545	1,905,021	-3		-9	-23		-24	73		207	45		241
PE	3,768,902	360,283	4,677,963	5	-7	-10	-22	-27	-21	-82	-22	97	-182	-79	95
PI	984,931		2,135,862	0		-10	-26		-23	29		180	65		224
PR	3,307,945	1,359,498	6,014,623	21	8	-5	-26	-27	-14	-99	-58	141	-143	-74	89
RJ	11,863,799	772,013	3,347,721	22	9	-3	8	259	770	-185	-91	-34	-218	193	763
RN	1,322,984		1,798,173	3		-10	-7		52	-30		231	-18		347
RO	382,829		1,121,099	-2		-9	-25		-24	63		15	-23		8
RR	278,843		142,656	-8		-11	-20		-26	515		-25	479		39
RS	4,064,186	1,408,160	5,441,782	16	11	-6	-25	-19	-15	-105	-127	190	-123	-162	139
SC	977,370	3,878,800	1,262,573	16		0	-27		-17	-32		66	-149		74
SE	794,475		1,225,204	3		-10	16		55	-13		144	34		316
SP	19,777,129	4,439,290	17,154,385	37	28	2	-28	-27	-18	-192	-114	18	-292	-160	-7
TO	309,353		982,698	-2		-10	-13		-18	409		248	439		272
Total	**76,362,480**	**15,857,853**	**96,003,548**	**6**	**5**	**-8**	**-18**	**8**	**23**	**-10**	**-43**	**103**	**-45**	**-29**	**168**

Obs: Number of observations 61, with 26 metropolitan areas in States' capitals, 9 metropolitan areas outside States' capitals and 26 non metropolitan areas. Averaged values from 2004 to 2009, weighted by population.

TABLE 3 - Relating grants and net fiscal benefit to efficiency and equity criteria

Panel Regressions (independent variables)	Nominal Location Wage	Share of workers with minimum wage	Predicted earnings - Minorities	Gini Index	Wages Distribution - rank ordering	Difference mean-median wage	Population density	Total wages per capita
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Per capita Block Grant	-0.042***	-0.066*	0.149*	-0.077	-0.179	-0.023	-0.001***	
	(-5.241)	(-1.784)	(1.820)	(-1.328)	(-0.704)	(-1.008)	(-6.562)	
Net Fiscal Benefit (NFB)	-0.033***	-0.022	-0.155	0.004	0.178**	-0.013	-0.001***	
	(-3.294)	(-0.572)	(-1.540)	(0.156)	(2.275)	(-1.105)	(-5.766)	
Public sector services wage								0.173
								(1.192)

Obs: Number of observations is 305. Panel regressions using 61 localities from year 2005 to 2009, weighted by population. In parentheses are robust t-statistics.
∗Significant at 10%; ∗∗significant at 5%; ∗∗∗significant at 1%.

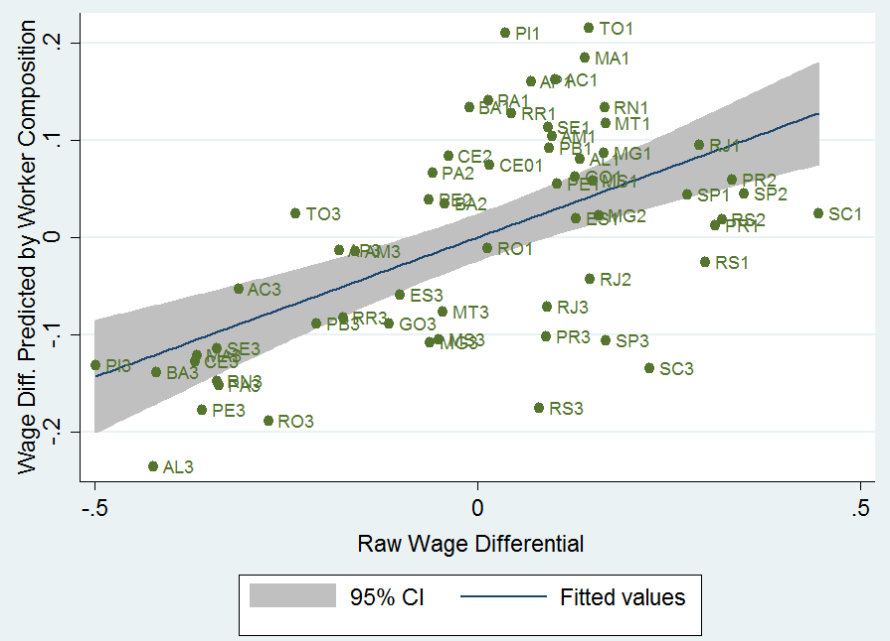

FIGURE 1
Wage levels across localities - Composition effect

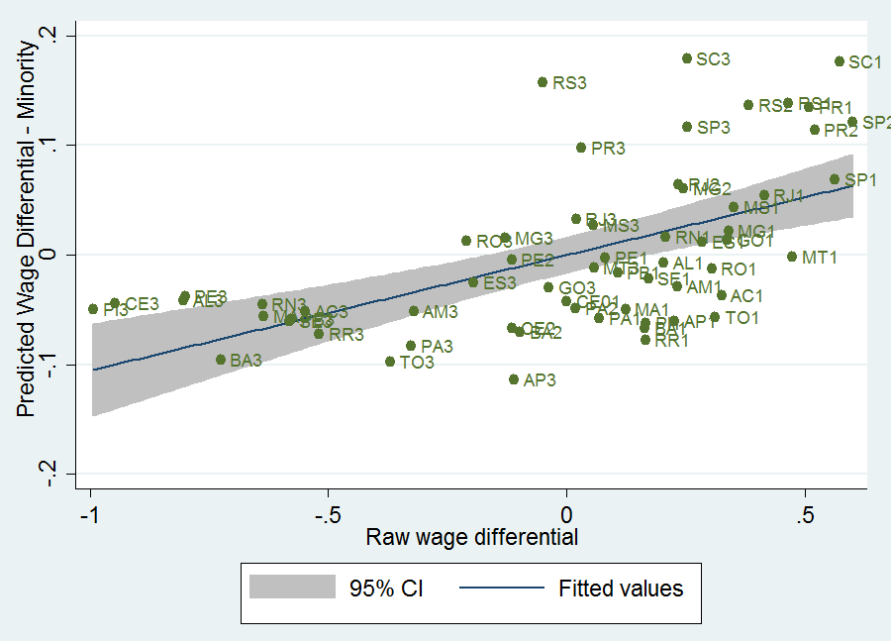

FIGURE 2

Wage levels across localities - Minority

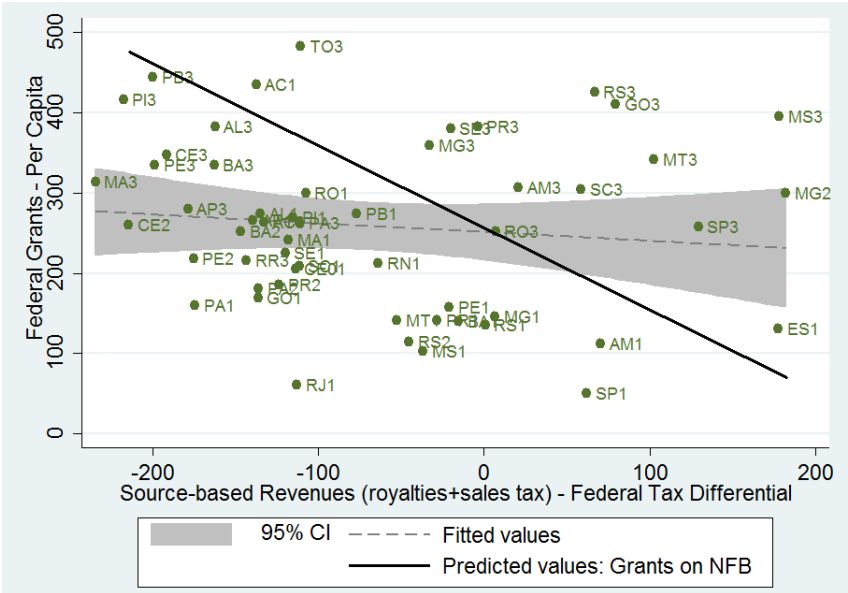

FIGURE 3

Grants relative to Federal taxes and source-based revenues (per capita)

Supporting Information

Appendix A.1

We estimate composition and location effects using our Function (1) with individual microdata extracted from the PNAD dataset. The household sample is different for each year; therefore, we run separate regressions yearly in accordance with Function (1). We use information on individual characteristics, such as education, gender, age, ethnic group, immigrant status (lives in the city in which he/she was born), and occupation, such as weekly working hours, whether the individual works in a formal market and whether the individual is self-employed. We interact most indicators with gender. The estimated composition wage is obtained multiplying each coefficient (estimated on yearly individual data) by the location average of the respective independent variable. As in Albouy (2012), the average wage level in each locality follows the sum of the location and composition wage. In accordance with Function (1), the location wage is obtained by the difference between the fitted wage and the predicted worker composition. The descriptive analysis (average from 2004 to 2009) on independent variables by locality is available in Table A.1 below. We split independent variables based on the use to estimate location and composition wage, respectively. Coefficient estimates on wage for our five year period of analysis are available in Tables A.2.

Appendix A.2

In Albouy's model, the sum of these three components plus intergovernmental grants provide the communities' Net Fiscal Benefit (NFB). Thus, Function (1) provides the relation between grants (F) and the three terms of fiscal components to evaluate a fiscal policy in terms of efficiency and equalization: [21]

$$\bar{F}^j = \tau_W^F\left(\bar{w}^j - \bar{w}^{j,F}\right) - \frac{\tau_L^j r^j L^j + \tau_K^j i^j K^j}{N^j} + (1-\alpha)\frac{p_G^i G^j}{N^j} + \bar{F}_e^j \qquad (1)$$

Where:

Households provide labor markets with different types of individuals (different skills) indexed by e = 1,...,E; who can live in any locality J, indexed by j = 1,...,J. Population composition on locality j follows: $N^j = (N_1^j, \ldots\ldots, N_E^j)$. Sourced based taxes on land and capital, plus destination based taxes on wages are represented by $\tau_L^j, \tau_K^j, \tau_W^j$; respectively. Local communities expenses for public goods follow the term $p_G^i G^j$. Moreover, the term (1-α) designates public goods externalities (e. g. in the case in which individuals contributes to the public goods in a ratio larger than they consume them, we have α<1). The mean of grants that region F obtains from central government follows:

$$\bar{F}^j = \frac{1}{N^j}\sum_e N_e^j F_e^F$$

As emphasized by Albouy (2012), a larger positive federal-tax differential drives wage employees to migrate to regions where the fiscal burden is smaller and the net fiscal benefit is larger, considering that individuals pay for the former and benefit from the latter. Based on this framework, efficiency policies should refund workers that hold a tax burden larger than average to avoid tax differential distortions in geographic location choices. In short, inefficient redistribution of resources distorts migration decisions.[22] The same idea can be used to address source-based tax, because the tax price should be associated with the public provision local cost.

Re-arranging terms in function (1), one obtains:

$$\bar{F}^j - \tau_W^F\left(\bar{w}^j - \bar{w}^{j,F}\right) + \frac{\tau_L^j r^j L^j + \tau_K^j i^j K^j}{N^j} = (1-\alpha)\frac{p_G^i G^j}{N^j} + \bar{F}_e^j \qquad (2)$$

Where the terms in the left summarize the effect of the NFB. It is important to note that all terms on the left can be estimated empirically. This relation, as developed by Albouy (2012), is the basis for our methodological approach detailed in Section 4.[23] In this approach, an efficient grant policy should work to mitigate larger fiscal needs differences. In fact, the optimal level of grants (term F_e^{Fj} in function 2) considers the same level of NFB between regions.

[21] For the model's complete set-up and description, refer to Albouy (2012) pp. 825-827.

[22] Most models assume that governments ignore the effect of their decisions over migration.

[23] In Boadway and Flatters (1982) for example, the net fiscal benefit follows source based tax differential and net fiscal benefit supported by federal income tax.

Table A.1

Coefficients estimates on Wage - Cross Section

	Dependent variable: Ln wage	2005	2006	2007	2008	2009
	Gender (D=1 if female)	0.090	-0.226	0.140	-0.160	0.142
		(0.486)	(-1.129)	(0.612)	(-0.678)	(0.603)
	Age (Ln)	0.811***	0.778***	0.826***	0.791***	0.693***
		(26.709)	(23.362)	(22.305)	(20.519)	(17.697)
	Ethnic group (D=1 if white)	0.251***	0.277***	0.271***	0.292***	0.270***
		(15.050)	(15.646)	(14.142)	(14.717)	(13.016)
	Migrant (D=1 if lives in na city different from where was born)	0.045***	0.037**	-0.048**	0.009	0.062***
		(2.691)	(2.092)	(-2.475)	(0.457)	(2.998)
	Schooling (Ln)	0.457***	0.455***	0.470***	0.439***	0.447***
		(38.075)	(37.454)	(35.666)	(30.636)	(30.827)
Industry sector	Agriculture (D=1, zero otherwise)	-0.424***	-0.167***	-0.083**	-0.388***	-0.479***
		(-11.898)	(-5.734)	(-2.530)	(-9.200)	(-11.338)
	Retail Trade (D=1, zero otherwise)	-0.275***	0.076***	0.084***	-0.151***	-0.222***
		(-8.796)	(2.764)	(2.933)	(-4.125)	(-5.901)
	Construction (D=1, zero otherwise)	-0.287***			-0.219***	-0.283***
		(-8.110)	.	.	(-5.387)	(-6.788)
	Manufacturing (D=1, zero otherwise)	-0.314***	0.041	0.039	-0.197***	-0.240***
		(-10.110)	(1.501)	(1.346)	(-5.451)	(-6.361)
	Government (D=1, zero otherwise)		0.336***	0.403***		
		.	(8.908)	(9.999)	.	.
	Education and Health Care (D=1, zero otherwise)	-0.295***	0.024	0.047	-0.285***	-0.309***
		(-9.242)	(0.712)	(1.304)	(-7.871)	(-8.032)
	Others	-0.214***	0.172***	0.191***	-0.089***	-0.143***
		(-7.274)	(6.396)	(6.756)	(-2.662)	(-4.193)
	Informal sector job	-0.537***	-0.587***	-0.530***	-0.544***	-0.495***
		(-15.955)	(-15.545)	(-13.227)	(-13.125)	(-11.841)
	Formal sector job	-0.225***	-0.287***	-0.245***	-0.345***	-0.253***
		(-7.009)	(-7.781)	(-6.533)	(-9.288)	(-6.469)
	Self-employed	-0.339***	-0.370***	-0.217***	-0.222***	-0.218***
		(-9.665)	(-9.242)	(-5.232)	(-5.053)	(-4.980)
	Working time less than 40 hours weekly (D=1, zero otherwise)			-0.375***	-0.366***	-0.423***
		.	.	(-17.771)	(-16.552)	(-18.977)
	Working time between 40-48 hours weekly (D=1, zero otherwise)	0.381***	0.415***	-0.008	0.027	0.033*
		(21.562)	(22.518)	(-0.506)	(1.631)	(1.911)
	Working time more than 48 hours weekly (D=1, zero otherwise)	0.406***	0.438***			
		(22.758)	(24.222)	.	.	.
	Mother with any child under 14 age (D=1, zero otherwise)	-0.079***	-0.014	-0.025	0.001	-0.058*
		(-3.424)	(-0.535)	(-0.798)	(0.040)	(-1.791)
	Executive or managerial occupations (D=1, zero otherwise)	0.824***	0.951***	0.986***	1.029***	1.039***
		(23.945)	(24.624)	(23.912)	(24.579)	(23.885)
Interactions	Ethnic group (D=1 if white) * Gender (D=1 if female)	0.008	-0.015	-0.035	-0.011	0.023
		(0.315)	(-0.587)	(-1.214)	(-0.357)	(0.740)
	Age (Ln) * Gender (D=1 if female)	-0.180***	-0.123**	-0.193***	-0.120**	-0.213***
		(-3.839)	(-2.439)	(-3.334)	(-2.053)	(-3.601)
	Migrant * Gender (D=1 if female)	-0.046*	-0.034	-0.001	-0.022	-0.055*
		(-1.846)	(-1.305)	(-0.021)	(-0.746)	(-1.778)
	Schooling (Ln) * Gender (D=1 if female)	0.005	0.051***	0.013	0.015	0.024
		(0.298)	(2.791)	(0.616)	(0.648)	(1.096)
	Informal sector job * Gender (D=1 if female)	0.060	0.065	0.032	0.066	0.012
		(1.421)	(1.408)	(0.639)	(1.272)	(0.227)
	Formal sector job * Gender (D=1 if female)	0.237***	0.285***	0.266***	0.259***	0.251***
		(5.638)	(6.207)	(5.501)	(5.486)	(5.035)
	Self-employed * Gender (D=1 if female)	-0.027	-0.029	-0.074	-0.036	0.028
		(-0.551)	(-0.557)	(-1.320)	(-0.594)	(0.464)
	Executive or managerial occupations * Gender (D=1 if female)	0.106**	-0.011	-0.102*	-0.048	0.052
		(2.135)	(-0.214)	(-1.808)	(-0.828)	(0.867)
	Adjusted R^2	0.101	0.096	0.076	0.068	0.068
	Number of observations	143,681	147,165	144,738	146,385	150,116

Obs: In parentheses are robust t-statistics. ∗Significant at 10%; ∗∗significant at 5%; ∗∗∗significant at 1%.

Table A.2

Descriptive Statistics (Mean) - Cross Section	2005	2006	2007	2008	2009
Dependent variable: Ln wage	6.60	6.70	6.81	6.89	6.95
Gender (D=1 if female)	0.41	0.41	0.41	0.42	0.42
Age (Ln)	3.57	3.57	3.57	3.58	3.58
Ethnic group (D=1 if white)	0.48	0.48	0.47	0.46	0.46
Migrant (D=1 if lives in na city different from where was born)	0.53	0.52	0.51	0.51	0.50
Schooling (Ln)	2.00	1.88	1.90	1.93	1.95
Agriculture (D=1, zero otherwise)	0.11	0.10	0.10	0.10	0.10
Retail Trade (D=1, zero otherwise)	0.19	0.18	0.19	0.18	0.18
Construction (D=1, zero otherwise)	0.07	0.08	0.08	0.08	0.08
Manufacturing (D=1, zero otherwise)	0.15	0.15	0.15	0.15	0.15
Government (D=1, zero otherwise)	0.06	0.06	0.06	0.06	0.06
Education and Health Care (D=1, zero otherwise)	0.11	0.11	0.11	0.11	0.11
Others	0.30	0.31	0.31	0.32	0.32
Informal sector job	0.24	0.23	0.23	0.22	0.22
Formal sector job	0.36	0.37	0.38	0.39	0.40
Self-employed	0.24	0.24	0.24	0.22	0.22
Working time less than 40 hours weekly (D=1, zero otherwise)	0.21	0.22	0.21	0.21	0.21
Working time between 40-48 hours weekly (D=1, zero otherwise)	0.37	0.38	0.41	0.42	0.44
Working time more than 48 hours weekly (D=1, zero otherwise)	0.41	0.40	0.38	0.37	0.35
Mother with any child under 14 age (D=1, zero otherwise)	0.06	0.06	0.05	0.05	0.05
Executive or managerial occupations (D=1, zero otherwise)	0.13	0.14	0.14	0.14	0.14
Ethnic group (D=1 if white) * Gender (D=1 if female)	0.21	0.21	0.21	0.20	0.20
Age (Ln) * Gender (D=1 if female)	1.45	1.47	1.48	1.49	1.51
Migrant * Gender (D=1 if female)	0.22	0.22	0.21	0.22	0.21
Schooling (Ln) * Gender (D=1 if female)	0.88	0.83	0.84	0.86	0.88
Informal sector job * Gender (D=1 if female)	0.12	0.12	0.11	0.11	0.11
Formal sector job * Gender (D=1 if female)	0.13	0.13	0.14	0.14	0.14
Self-employed * Gender (D=1 if female)	0.08	0.08	0.08	0.08	0.08
Executive or managerial occupations * Gender (D=1 if female)	0.07	0.07	0.07	0.07	0.07