Socio-Economic Planning Sciences 71 (2020) 100748

Contents lists available at ScienceDirect

Socio-Economic Planning Sciences

journal homepage: http://www.elsevier.com/locate/seps

The efficiency of Bolsa Familia Program to advance toward the Millennium Development Goals (MDGs): A human development indicator to Brazil

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1. Introduction

Poverty, a constant problem in our history, recently became an important issue in international agenda debates. Considered a great barrier to economic growth, human development and public policy, poverty was the central theme of the Millennium Summit in 2000, organized by the United Nations [1].

From this event, were established, the Millennium Development Goals (MDGs): 1st to eradicate extreme poverty and hunger; 2nd to achieve universal primary education; 3rd to promote gender equality and empower women; 4th to reduce child mortality; 5th to improve maternal health; 6th to combat HIV/AIDS, malaria and other diseases; 7th to ensure environmental sustainability; 8th to establish a global partnership for development, planned to be achieved by 2015 [2].

Despite these established initiatives, in 2015, around 836 million people were living in extreme poverty, with less than $ 1.25 per day, with approximately 57 million children outside an educational system. In 2013, the child mortality rate in the world was 43 deaths per thousand born and the maternal mortality rate was 210 deaths per one hundred thousand births. Thus, even considering the progress made since 2000, promoting quality of life to the poorest population is an enormous world challenge [3,4].

In this context, one of Brazil's great efforts to combat poverty and social inequality was the Bolsa Familia Program (BF), created in 2003. This program is a conditional cash transfer to poor and extremely poor individuals, where beneficiaries must meet conditions related to child and maternal health and education. The main objective of the Program is to promote social inclusion, with immediate relief of poverty and hunger. In addition, it aims to improve education and health care to ameliorate social indicators, and contribute to breaking the intergenerational cycle of perpetuating poverty [5].

Present in all Brazilian municipalities, Bolsa Familia is considered the largest cash transfer program with follow-up in health, education and social assistance in the developing world and has gained significant international attention [6]. In 2013, the International Social Security Association (ISSA) granted Brazil the I Prize for exceptional realization in Social Security due to Bolsa Familia. According to ISSA, the program has helped to reduce poverty and to promote human resources, and provides a model for children in other countries [7].

In 2016, at a cost of 0.45% of Brazilian GDP, Bolsa Familia was granted to more than 13.5 million families, or more than 46.5 million Brazilians, who represent approximately 23% of the total population of the country, according to data from the Brazilian Institute of Geography and Statistics (IBGE) and the Ministry of Social and Agrarian Development [8–10].

Effects of the Bolsa Familia Program have been the subject of several studies and evaluations, both regarding conditionalities and unintended results. According to Santos et al. [11], because it promotes inclusion and social development, BF has been much analysed in the sphere of public policy by government, academic institutions and society.

In the area of health, the application of the Bolsa Familia improved indicators such as access to food [12–14], reduction of malnutrition and child mortality [15–17], reduced anemia [18,19] and advances in maternal health [20]. In the context of education, several studies have verified significant results from BF for the universalization of basic education [21], school performance [22,23], reduction of school dropout [24] and less child labour [25].

These findings represent the tip of the Iceberg, since the effects of Bolsa Familia extended to areas not intended. The program contributed to female empowerment [26–29], reduction of domestic violence [30], reduction of birth rate [31–33], reduction of tuberculosis and leprosy [34], increase of return migration [35], reduction of crime [36] and increased individual autonomy [37,38], that is, an intrinsic transformation in the beneficiaries.

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https://doi.org/10.1016/j.seps.2019.100748
Received 21 January 2019; Received in revised form 30 August 2019; Accepted 17 October 2019
Available online 24 October 2019
0038-0121/

In this way, according to Rego and Pinzani [37], the given income to beneficiaries allows advent of a series of capabilities to ascend to functionings, such as: a) a basic level of individual autonomy, and b) the perception of self as a member of society, or practice of citizenship. Thus, conditional income transfer programs, such as the BF, for the poorest, allow the development of individual autonomy. In this context, Cavalcante [39] emphasizes that the BF, through family commitment to meet the requirements, started to protect the family, not just the individual.

In light of its social relevance, the objective of this paper is to measure the efficiency of the Brazilian Federative Units (FU) in converting government expenditures of the Bolsa Familia Program to advance toward Millennium Development Goals, in the period 2004 to 2014, using Data Envelopment Analysis (DEA) – Slack-Based Measure (SBM) model output-oriented.

For this reason, we chose this topic due the dearth of studies about Bolsa Familia Program through Data Envelopment Analysis (DEA). In the literature many papers analysed the performance of the Bolsa, but we did not find work using DEA. For efficiency of public sector, DEA has been widely applied to measure the efficiency of countries, regions and cities [40–50].

In the context of countries analysis, Ülengin et al. [40] explored the relationship between the competitiveness of a nation and its implications for human development, using DEA to analyse 45 countries. The results showed that the most important criteria affecting a country's efficiency score are per capita GDP and life expectancy.

For regions studies, Poveda [41] investigated economic development and growth through traditional measures (gross domestic product and human development index), applying DEA in Colombian departments over the period 1993–2007. The results demonstrate that economic development and growth could be achieved most effectively through a decrease in poverty, an increase in equality, a reduction in violence, and improved security.

And for cities investigation, Hashimoto, Sugita and Haneda [42] analysed the change in quality-of-life by multiple social-indicators. They applied DEA and Malmquist index to Japan's 47 prefectures for the period 1975–2002. The findings indicated that quality-of-life rose during the so-called "bubble economy years" (second half of the 1980s), and then dropped in the succeeding "lost-decade" (1990s) and, in 2002, fell to approximately the same level as the start year (1975).

Furthermore, this work can contribute academically in an original way, using DEA to evaluate the relative efficiency of the Bolsa Familia Program toward realization of the MDGs. Also, in a practical sense, research about the efficiency of public policies can provide information and indicators that aid in the planning and processing of governmental decision-making.

The paper is organized into six sections. Section 2 provides literature review about the invisibility of the poor and human development and Bolsa Familia Program, section 3 about the about social efficiency. The method description and econometric analysis are shown in Section 4. The results and the pertinent discussions followed by efficiency analysis are presented in Section 5. Finally, Section 6 summarizes the considerations of the paper.

2. Contextualization

2.1. The invisibility of the poor and human development

Poverty, is defined as the condition characterized by severe deprivation of basic human needs, including food, clean water, sanitation, health, housing, education and information [51]. This, not depends only on monetary income, but also on access to services.

From an economic perspective, Rodgers [52] argues that individuals are considered poor when their standard of living, measured in terms of income and consumption, are below a specific standard. Second the World Bank, the line of extreme poverty is US $ 1.90 [53].

From a social context, Simmel [54] argues about the invisibility of the poor, in the sense that they do not have a voice about public policies elaboration. Adorno and Horkheimer [55] point out that in societies characterized by alienation, citizens are not able to criticize their situation. Therefore, individuals in poverty are not fully aware that they are being victimized by some injustice [56].

According to Moore Jr. [57], the responsibility for socially avoidable suffering, such as poverty, should be attributed to individuals and institutions, which in turn could present a duty of redress. Pogge [58] points out that if there were a sense of moral responsibility of the developed countries towards the miserable inhabitants of the underdeveloped countries, this condition of extreme shortage of resources and suffering would not be allowed.

Under a global partnership to combat poverty, Sachs [59] highlights the neglect of developed countries in relation to poor nations, being considered the greatest economic tragedy of our times the fact that 1 billion people are still trapped in poverty. Sachs [59] proposes a new method for development economics, called Clinical Economics, an allusion to clinical medicine, highlighting the similarities of this science to the development economy, such as country specific factors, historical context and even direct experience can be inserted in socioeconomic analyses.

For Sen [60] human development requires the elimination of poverty, tyranny, lack of economic opportunity, neglect of public services and repressive state intervention, factors that leave people with few opportunities to exercise their condition of agent.

The role of development would be to promote instrumental freedoms: (a) political freedoms; (b) economic facilities; (c) social opportunities; (d) guarantees of transparency; and; (e) protective security, as they contribute to the promotion of individuals' overall capacity to effectively shape their destiny [60]. Therefore, in order to face current problems, it is necessary to consolidate individual freedom as a social commitment, considering the importance of public policies to promote human capacities and instrumental freedoms.

Sen [60] and Nussbaum [61] emphasize the importance of material protection for the advent of individuals' autonomy. Therefore, economic measures and government programs are attempts to transform people and help them to leave extreme poverty. As the situation of poverty is a reflection of inadequate access to public health, social security deficiency, lack of social responsibility and serious governance [60].

For Simmel [54] the monetary resources destined to the poor, which do not come from charity, modify the soul of the beneficiary, that is, they dignify it. In the case of Brazil, according to Rego and Pinzani [37], the Bolsa Familia Program did not only allow greater autonomy for the individual, but also signalled a process of transformation not only externally, but also an improvement in living conditions and food, but also an internal character.

2.2. Bolsa Familia Program: a brief review of the literature

Bolsa Familia Program is a conditional income transfer program that fights the poverty cycle and promotes access to basic education and health [62]. In 2017, the beneficiaries were: a) extremely poor families with monthly income of up to 85.00 BRL (25.00 USD)[1] per person; b) poor families with monthly income between 85.01 BRL (25.00 USD) and 170.00 BRL (50.00 USD) per person. Poor families participate in the program, provided they have pregnant women and children or adolescents between 0 and 17 years [63].

In this section, the search filter combined the keywords "Bolsa Familia Program" combined with the words "poverty" and "development", since the year 2010, using the Web of Science and Scopus databases.

Silva [65] studied the BF beneficiary children, analysing

[1] We considered the annual exchange rate to 2017 of 1 USD: 3.3 BRL [64].

anthropometric indicators in the period between 2008 and 2010, in Sergipe. The results showed that there were more overweight and obesity in municipalities with the lowest Human Development Index (HDI), problems in underdeveloped localities with poor populations, demanding public policies to address this condition.

Kiggundu [66] examined the BF and designed possible learning for emerging economies with similar challenges. The findings indicate that Brazil does not offer a "plan" for other countries to copy, but lessons from its experience. In this context, it was identified the need to centralize forces at the Federal level with decentralization at the state, municipal and community levels. Moreover, some difficulties were recognized such as the use of systems approach, information technology, process reengineering, as well as private sector participation, volunteering and empowerment of communities, citizens and employees.

Rasella et al. [67] investigated the impact of Bolsa Familia on child mortality in 2853 (51% of the total) Brazilian municipalities, in the period 2004–2009. As program coverage increased, a sharp drop in child mortality was observed from 21.7% in 2004 to 17.5% in 2009. Therefore, BF contributed significantly to reducing child mortality, in particular, for deaths resulting from poverty such as malnutrition and diarrhea.

Garmany [68] examined the effects of BF for geographical political changes in the Ponta Fina Region, disputed by Piauí and Ceará, in 2013–2014. Bolsa Familia has led to a multitude of changes, including new economic practices, migration patterns, urban growth trends, infrastructure projects, policy strategies, access to education, health, formal markets and transportation networks. Moreover, BF has expanded the ability to choose its beneficiaries, having more freedom to choose where and when to engage in unpaid work.

Lemos et al. [69] investigated how families in north-eastern Brazil took advantage of their generic (income, education, health, political power) and specific (climate) capabilities to reduce vulnerability to drought. Rainfall data were collected in June and July 2012. Although BF has been positive in increasing incomes, it has not been sufficient to manage the risk of food insecurity during the drought. It was identified a "poverty trap" constantly deals with climate adversities. Therefore, to reduce vulnerability to climate, anti-poverty programs, as the BF, should go beyond cash transfer and develop risk management policies.

As exposed, we find in the literature vast content about Bolsa Familia effects. However, we did not find studies that prioritize the efficiency of the Bolsa Familia Program to human development. The next topic discusses the efficiency of social welfare.

3. DEA approach to public sector

3.1. Social efficiency

Social efficiency corresponds to governmental competence to convert economic growth and public spending into human development and quality of life. In this section, the search filter combined the keywords "Welfare" and "DEA" or "Data Envelopment Analysis", since the year of 2010, using the Web of Science and Scopus databases. We selected article about public policy to improve social welfare. In this context, Data Envelopment Analysis (DEA) has been applied widely in works to measure the social efficiency of countries, regions, and cities [70–72].

Lefebvre, Coelli and Pestieau [73] analysed the performance of 15 European countries that promoted social inclusion during the period 1995–2006. They created an index using data about poverty, inequality, unemployment, education and health, applying DEA – Constant Returns of Scale (CRS) model. The results showed that: a) Nordic countries presented the best performance, and b) Mediterranean countries ranked last. In addition, a better diet, a less stressful life, a more flexible labour market, and other independent aspects of social programs, can increase efficiency and can be further explored in future research.

Considering reduction of poverty, Habibov and Fan [74] verified the performance of social welfare programs in all Canadian provinces, in the period 2001–2005, using DEA, CRS model input-oriented. The results indicated that social policy makers of inefficient regions could find benefits using as reference practices adopted in efficient localities. The factors that influence efficiency refer to province size, public expenditures on social programs and management traditions.

González et al. [75] measured the quality of life of 643 Spanish municipalities, considering advantages (health, wealth and education) and disadvantages (unemployment, delinquency and pollution), to 2001. They created an index based on DEA – Variable Returns of Scale (VRS), combined with Value Efficiency Analysis (VEA). The findings showed that the Central and Northern Regions of Spain reached the highest levels of quality of life, while the South Region had markedly lower numbers. The variables that most required improvement were education, health, culture, pollution and crime.

To verify the efficiency of social security, Broersma, Edzes and Van Dijk [76] examined the impact of the Labor and Social Welfare Act (2004) for 443 Dutch municipalities through DEA – VRS model input-oriented, to 2001–2007. They found that the overall level of cost efficiency and social assistance had increased, but that this performance was associated with regional circumstances, such as economic growth and job supply. On the other hand, the efficiency in the Netherlands is quite high, about 95%, with limited margins for improvement.

Lábaj, Luptáčik and Nežinský [77] evaluated the capacity of 30 European countries to convert economic growth into welfare for 2010. They developed six theoretical indicators based on DEA - VRS model output-oriented. The most well positioned countries were Switzerland, Belgium, Norway, Iceland, Denmark, Germany, United Kingdom, Sweden, Finland, Slovenia, France, Malta and Luxembourg. For future research, they suggested intertemporal analysis of the proposed models and evaluation of political scenarios.

Debnath and Shankar [78] measured the happiness quotient of 130 nations, verifying whether good governance is capable of maximizing happiness. They applied DEA - VRS model output-oriented. In developed countries, social and economic problems, such as unemployment, child mortality, crime, and corruption were milder, and public policies were less effective at increasing happiness. On the other hand, Nepal, where a quarter of the populace lives below the poverty line, happiness can increase proportionately, along with changes in governance. Due to the lack of a clear classification of policies and regulations, it is proposed that good governance alone cannot maximize happiness.

Singh [79] analysed the performance of the 2005 Mahatma Gandhi National Rural Employment Guarantee (MGNREGA), considered the world's largest social welfare scheme for poverty alleviation through employment generation in India. They used DEA - CRS and VRS models in 2013–14. The results indicated that of 31 states, only 11 were efficient. The main causes of inefficiency were peculiarities of each region, such as literacy rate, geographic nature, infrastructure, socioeconomic characteristics, political influences and state organizational capacity, which led to a lack of adequate support for women and minority groups. They concluded that if all inefficient states operated at optimal levels, 17.89% of total expenditures could have been saved per year.

In this brief review, we observed a wealth of analysis on various topics such as social inclusion, social programs, quality of life, happiness and public spending. However, we did not find works about specific social programs in Latin America or Brazil.

For this reason, the main contributions of this paper to social efficiency are: (a) analyse the relation between public expenditures and economic growth, to advance toward the Millennium Development Goals (MDGs); (b) study Brazil, a country that has a strong social inequality and encompasses all the challenges related to MDGs, and; (c) investigate a specific social program, Bolsa Familia.

4. Method

4.1. Data Envelopment Analysis (DEA)

To analyse a production system, Production Engineering proposes to determine inputs and outputs. In this context, Operational Research is the key discipline technique to measure efficiency [80]. Among these methods, Data Envelopment Analysis (DEA), developed over 30 years ago, is widely used to calculate efficiency and is a very important tool for strategic planning and decision making [81].

DEA is a non-parametric method, based on mathematical programming, which makes it possible to minimize or maximize functions with or without restrictions. DEA evaluates the relative efficiency of Decision Making Units (DMUs), which are responsible for transforming a set of inputs into outputs.

The DMUs must be homogeneous in their functions, with similarity being a necessary condition for make comparisons and calculating relative efficiency. The efficiency scale is measured from 0 to 1; when it reaches 1, the DMU is considered efficient.

The selection of DMUs and variables, inputs and outputs, makes DEA an instrument applicable to a multitude of problems. For efficiency of public sector and quality of life, DEA has been widely applied to measure the efficiency of countries, regions and cities as exposed in section 3.

There are several variations of DEA models differentiate not only by the type of return of scale (increasing, constant or decreasing) and their orientation (to input or to output), but also respect to efficiency change over time, undesirable outputs and the way to combine the input and output variables [82].

According to Thanassoulis [83], the change in the set of selected variables can significantly impact on the efficiency result. Therefore, as a decision aid instrument, the variables were classified into four types: (a): inputs: controllable resources spent on a production process; (b) outputs: results, being products or benefits generated from inputs; (c) non-discretionary: variables over which the DMU has no control, but are necessary to produce the outputs, and; (d) explanatory: explain the efficiency or inefficiency of a DMU, but they are external to the model, i.e., do not classify neither as inputs nor as outputs.

The model applied to this research was the Slack-Based Measure (SBM). Based on the additive models, SBM uses the slacks to construct an efficiency index that is, with excess inputs and a shortage of outputs. It also reveals the slacks of the system, which ensures the clarity of efficiency by not exposing some false efficient.

For SBM model, efficiency represents an average reduction of inputs and an average increase of outputs to reach the efficiency frontier [84]. In addition, it can be divided into two components, relative to inputs or outputs. Therefore, its overall efficiency is the multiplication of the two components. Thus, to determine the efficiency of a DMU (x_{j0}, y_{j0}), the SBM model in the form of the Envelope with variable returns of scale follows this formulation [78] in Equation (1).

$$Min \frac{1 - \frac{1}{m}\sum_{j=1}^{m}\frac{s_j}{x_{j0}}}{1 + \frac{1}{n}\sum_{i=1}^{n}\frac{s_i}{y_{i0}}} \tag{1}$$

Subject to:

$$\sum_{k=1}^{z} x_{jk}\cdot\lambda_k + s_j = x_{j0} \qquad j = 1,2\ldots,m$$

$$\sum_{k=1}^{z} y_{ik}\cdot\lambda_k - s_i = y_{i0} \qquad i = 1,2\ldots,n$$

$$\sum_{k=1}^{z}\lambda_k = 1$$

$$\lambda_k \geq 0, s_i \geq 0, s_j \geq 0$$

where: λ_k = Participation of DMU k in the goal of the DMU under analysis; x_{jk} = Quantity of input j of the DMU k; y_{ik} = Quantity of output i of the DMU k; x_{j0} = Quantity of input j of the DMU under analysis; y_{i0} = Quantity of i da DMU under analysis; z = Number of analysed units; n = Number of outputs; m = Number of inputs; S_i = Slack of output i and S_j = Slack of input j. The linearized version of Equation (1) follows this formulation [78] in Equation (2):

$$Min\ t - \frac{1}{m}\sum_{j=1}^{m}\frac{S_j}{x_{j0}} \tag{2}$$

Subject to:

$$t + \frac{1}{n}\sum_{i=1}^{n}\frac{S_i}{y_{i0}} = 1$$

$$\sum_{k=1}^{z} x_{jk}\cdot\lambda_k + S_j - t\cdot x_{j0} = 0 \qquad j = 1,2\ldots,m$$

$$\sum_{k=1}^{z} y_{ik}\cdot\lambda_k - S_i - t\cdot y_{i0} = 0 \qquad i = 1,2\ldots,n$$

$$\sum_{k=1}^{z}\lambda_k = t$$

$$\lambda_k \geq 0, S_i \geq 0, S_j \geq 0, t > 0$$

where: t = Linearization variable; $S_j = t\cdot s_j$; $S_i = t\cdot s_i$; $\Lambda_k = t\cdot\lambda_k$; and the other variables and parameters are the same as in Equation (1). And finally the output-oriented SBM model following the formulation [84] in Equation (3) (with the same variables and parameters of Equation (2)):

$$Max\ t + \frac{1}{n}\sum_{i=1}^{n}\frac{S_i}{y_{i0}} \tag{3}$$

Subject to:

$$\sum_{k=1}^{z} x_{jk}\cdot\lambda_k + S_j - t\cdot x_{j0} = 0 \qquad j = 1,2\ldots,m$$

$$\sum_{k=1}^{z} y_{ik}\cdot\lambda_k - S_i - t\cdot y_{i0} = 0 \qquad i = 1,2\ldots,n$$

$$\sum_{k=1}^{z}\lambda_k = t$$

$$\lambda_k \geq 0, S_i \geq 0, S_j \geq 0, t > 0$$

In addition, to measure efficiency, the SBM model will provide the target for each DMU to approximate efficiency. In this research, we chose the Slack Based Model (SBM) model output-oriented with variable returns of scale to measure the efficiency of the Brazilian Federative Units in converting investments in the BF for the achievement of the Millennium Development Goals (MDGs), in the period of 2004–2014.

The orientation to output is justified by the current Brazilian scenario, where public spending in the Bolsa Familia Program is expected to remain constant and social indicators (outputs) to be maximized.

In 2017, Brazil was considered the eighth largest economy on the planet behind the United States, China, Japan, Germany, the United Kingdom, India and France [85]. Despite this, it is a country marked by deep social inequalities between its regions and its inhabitants. Due to heterogeneities of Brazilian Federative Units, we chose the model with Variable Returns of Scale (VRS), which takes into account the scale of the states. According to Cooper, Seiford & Zhu [86], the DEA-VRS model, measures efficiencies whether an increase or decrease in inputs or outputs does not result in a proportional change in the outputs or inputs respectively.

An important factor regarding the DEA is the case of using undesirable outputs, that is, outputs that must be minimized in the model and not maximized. In the present study there are some variables in its scope such as the Gini index and child and maternal mortality rate.

In order to deal with this issue Scheel [87] pointed out three procedures that can be applied to the undesirable outputs: a) inverse additive, b) translated and c) inverse multiplicative. Table 1 illustrates the procedures that can be applied to undesirable outputs and their mathematical transformations.

According to the author, the inverse additive procedure corresponds to considering the values of the undesirable outputs as inputs $f(U) = -U$. This technique was proposed by Koopmans [88], where the undesirable outputs being placed as inputs would be minimized in the DEA model and no longer maximized.

The translated method, suggested by Seiford and Zhu [89], is to add to the values of the undesirable outputs to a scalar vector that transforms them into desirable outputs $f_i^k(U) = -u_i^k + \beta_i$. In this way, the values are converted into outputs, which are intended to be maximized.

The inverse multiplicative process, indicated by Golany and Roll [90], is equivalent to inverting the values of the undesirable outputs $f_i^k(U) = 1/u_i^k$. Observe that the efficiency ranking is maintained when applying the inverse or multiplicative inverse technique, i.e. if a DMU is classified as efficient using the inverse multiplicative procedure, this same DMU will also be efficient applying the inverse additive method.

In order to include the time factor - 2004 to 2014 -, we applied Window Analysis. Initially proposed by Cooper, Seiford and Tone [82] this approach inserts panel data from a DMU distributed over several periods to check the evolution of relative efficiency, considering each DMU of the time series as a distinct unit. According to Camioto, Mariano & Rebelatto [91], this tool is widely used for Data Envelopment Analysis (DEA) when considering different periods.

The analysed periods are separated into windows, i.e. in different data groups. To determine the size of each window and the number of windows to group together, Expressions 4 and 5 are used, where k corresponds to the number of periods and p the amplitude of the window [82].

$$(p) = (k + 1)/2 \tag{4}$$

$$\text{Number of windows} = k - p + 1 \tag{5}$$

The present work will cover the period 2004–2014, so with the application of the exposed formulas, the amplitude of each window will be 5, and the number of windows will be 6.

Finally, to break the tie of efficient DMUs, we used the tie-breaking method, called Composite Index (CI), which can be calculated as proposed by Leta et al. [92] (Equation (6)):

$$CI_k = \frac{\left[Efficiency_k + \left(1 - Inverted_k^{efficiency}\right)\right]/2}{max\left\{\left[Efficiency_k + \left(1 - Inverted_k^{efficiency}\right)\right]/2\right\}} \quad k = 1, 2, 3, \ldots, z \tag{6}$$

where, $Efficiency_k$ is the efficiency of DMU k; $Inverted_k^{efficiency}$ is the inverted efficiency of DMU k; CI_k is the composite index of normalized efficiencies, and z is the number of DMUs. This method consists of calculating the weighted average and normalized (by the maximum value) of the standard and inverted efficiencies.

Table 1
Procedures applied to undesirable outputs and their mathematical transformations.

Procedure	Mathematical transformation
a Reverse additive	$f(U) = -U$
b Translated	$f_i^k(U) = -u_i^k + \beta_i$
c Inverse multiplicative	$f_i^k(U) = 1/u_i^k$

Source: Adapted from Scheel [74].

4.2. Empirical methodological procedures

We organized the empirical methodological procedures of this article in the following stages: a) selection of variables; b) econometric analysis, c) efficiency and Window Analysis between 2004 and 2014; d) Composite Index (CI) results; and e) comparison of efficiency scores, Composite Index and Human Development Index (HDI).

4.2.1. Selected variables

In the first stage we selected variables corresponding to economic growth (GDP per capita), public investing (Expenditures on Bolsa Familia Program, education and health), and the Millennium Development Goals (income of poor people, Gini Index, school attendance, child mortality, maternal mortality and life expectancy), as shown in Table 2.

Table 2 presents the selected variables to econometric validation and to the efficiency model as inputs and outputs. We chose variables corresponding to the Brazilian context for the evaluation in the fulfilment of the MDGs. The MDGs were: 1st MDG: to eradicate extreme poverty and hunger; 2nd MDG: to achieve universal primary education; 3rd MDG: to promote gender equality and empower women; 4th MDG: to reduce child mortality and; 5th MDG: to improve maternal health; 6th MDG: to combat HIV/AIDS, malaria and other diseases. Besides, the variables were based on studies about social efficiency presented in section 3.

The databases consulted were the Ministry of Transparency, Comptroller General of the Union [63], the Brazilian Institute of Geography and Statistics [9,100], the Institute of Applied Economic Research [95–97], Department of Informatics of the Unified Health System [97,98], and Public Sector Accounting and Fiscal Information System [93,94]. The summary dataset is presented at Table 3.

The Bolsa Familia expenditures, GDP per capita, education expenditures, health expenditures and income of poor people are expressed in Brazilian currency (BRL). The Gini index, which measures the degree of inequality in the distribution of per capita household income, ranges from 0 to 1, and the closer to 1, the more intense the inequality [96].

School attendance means the rate of children in elementary school. Child mortality rate corresponds to the number of deaths per thousand live births [93]. Maternal mortality refers to the number in cases where deaths occurred up to 42 days after the termination of pregnancy [94]. Life expectancy at birth is given years [100].

In this period (2004–2014), investments in the Bolsa Familia expanded 480.06% in average, being the lowest at 198.89% in Santa Catarina and the highest at 905.46% in Rio de Janeiro. The GDP per capita increased 176, 28% in average, a maximum value of 273.74% in Piauí and a minimum value of 125.87% in Amazonas.

Table 2
Selected variables.

MDGs	Variable	Source	Theoretical basis in DEA works
1st MDG	Expenditures on Bolsa Familia Program (BF)	[63]	[73–75,78,79]
1st MDG	GDP per capita (GDP)	[9]	[70–72]
2nd MDG; 3rd MDG	Education expenditures (EE)	[93]	[70]
4th MDG; 5th MDG; 6th MDG	Health expenditures (HE)	[94]	Proposal of this research
1st MDG	Income of poor people (IP)	[95]	Proposal of this research
1st MDG; 2nd MDG	Gini Index (GI)	[96]	[73,77]
2nd MDG	School attendance (SA)	[97]	[70,75]
4th MDG	Child mortality (CM)	[98]	[70,72]
5th MDG	Maternal mortality (MM)	[99]	Proposal of this research
1st MDG; 2nd MDG, 3rd MDG 4th MDG; 5th MDG; 6th MDG	Life Expectancy (LE)	[100]	[70,72,73]

Table 3
Descriptive data analysis.

Variables	Obs[a]	Mean	Std. Dev.	Min	Max
BF (BRL)	270	528,350,863.51	430,621,948.99	11,306,147.0	3,522,018,919.0
GDP (BRL)	270	15,734.38	7522.32	3159.44	69,216.80
EE (BRL)	270	2,580,095,999.6	2,273,468,143.02	177,651,667.1	30,405,974,910.6
HE (BRL)	270	1,890,538,448.8	1,513,782,443.2	84,937,618.2	19,994,192,599.14
IP (BRL)	270	139.47	13.58	91.63	194.34
GI	270	0.53	0.03	0.4212	0.6291
SA (%)	270	97.68	0.94	91.41	99.54
CM	270	20.37	5.39	9.6	48.3
MM	270	61.65	44.84	1	339
LE (years)	270	72.22	2.20	66.30	78.40

[a] The year 2010 was excluded, since it refers to the national census that was not standardized with the other databases used.

The income of poor people rose an average of 26.57%, with a minimum of 6.17% in Mato Grosso and a maximum of 72.10% in Roraima. The Gini Index decreased by an average of 10.98% in Brazil, with the least being 1.22% in Amapá and the highest being 17.33% in Paraná.

School attendance increased by an average of 1.91%, falling −0.39% in Espírito Santo and increasing 5.03% in Rondônia. Child mortality decreased by an average of 33.44%, the largest descent in Pernambuco being 57.58% and the most moderate in the Amapá of 10.23%. Moreover, life expectancy expanded 4.95%, from 69.3 years in 2004 to 72.8 in 2014, the highest in Pernambuco with 8.14% and the lowest in Goiás with 2.5%.

4.3. Econometric validation

In the second stage, we developed an econometric modelling to validate the relation of outputs and inputs, using Multiple Linear Regression Analysis. This procedure allowed defining the efficiency model and proving the statistical significance between inputs and outputs.

We estimated linear regressions in order to valid and identify the statistical level of significance between outputs with inputs. The linear regression allowed verifying the degree of explicability between each output with the input and explanatory variables, Equation (7).

$$y^{Output}_{it} = \beta_0 + \beta_1 BF_{it} + \beta_2 GDP_{it} + \beta_3 H_{it} + \beta_4 E_{it} + \varepsilon_{it} \quad (7)$$

where: y^{Output}: dependent variable (output); β_0: intercept; $\beta_1, \beta_2\ \beta_3,\ \beta_4$: variable coefficient; BF: Expenditures on Bolsa Familia Program; GDP: GDP per capita; H: Health expenditures; E: Education expenditures; i: i-th observation (DMUs); t: t-th period studied and ε : random error.

We use ln regression, since it is possible to interpret the parameters as elasticities [101]. Using panel data is common for estimators to present problems of heteroscedasticity, autocorrelation and endogeneity [101,102].

For the purpose, working with panels data, we applied the Hausman test to choose between fixed effects or random effect model [101]. To analyse the presence of heteroscedasticity, we performed the Breusch-Pagan test for random effects and Modified Wald test for fixed effects, as indicated by Hausman test [101]. To detect serial correlation over time, we applied Wooldridge test [103]. The results are summarized in Table 4.

The models were considerate not appropriate, since we identified heteroscedasticity and autocorrelation. For correct these problems we choose the Feasible Generalized Least Squares (FGLS) model, as presented in Moralles and Rebelatto [104]. The econometric estimates are showed in Table 5.

Bolsa Familia and GDP per capita were significant with all variables selected. The Income or poor people showed increase 2.62% in reason of Bolsa Familia at the level of statistical significance of 5%, and 12% because GDP per capita being significant in 1%. This result is in line with Marinho, Linhares and Campelo [105], recognizing that there has been an improvement in the country's income and poverty reduction, but even so, the distance from the economically most excluded has deepened in relation to other social classes and remain in poverty. Other study that converges to this finding is Araújo, Alves and Besarria [106], that argue about the impact of the Bolsa Familia for the reduction of poverty, but emphasizes that there was no evidence that this improvement has altered the enormous income disparities that exist in the social classes of Brazil.

Gini index decrease 0.35% because of Bolsa Familia at significance level of 10%, and 0.40% in reason of GDP per capita. This finding converges with Hoffman [107] which analyses the determinants for the reduction of income inequality in Brazil, among them Bolsa Familia.

The school attendance in elementary school raise 0.17% in consequence of Bolsa Familia and 1.03% because the GDP per capita, both significant at level of 1%. This result was in agreement with some studies that emphasized the importance of this program for the universalization of basic education [21], school performance [22] and reduction of child labour [25].

The infant mortality decrease 1.82% in reason of Bolsa Familia at significance level of 5% and 33.1% because the GDP per capita being significant in 1%. This finding goes according to Rasella et al. [16] that conclude Bolsa Familia contributed significantly to the reduction of infant mortality, for deaths resulting from poverty such as malnutrition and diarrhea.

The maternal mortality increase in consequence of Bolsa Familia, this fact does not necessarily mean that maternal mortality increased due to Bolsa Familia, but before the advent of the program, a large portion of the population lacked health services, which made it difficult to identify the real situation of clinical statistics. With increased access to medical care, statistics have become more accurate. On the other hand, the maternal mortality fall 29.1% in reason of GDP per capita at significance level of 1%.

According to IPEA [108], the 5th MDG is one of the most difficult goals to be fulfilled worldwide. The target for reducing maternal mortality was for countries to reach 35 cases per 100,000 births. The country reduced maternal mortality from 141 cases per 100,000 births in 1990 to 64 in 2011. Brazil faces some challenges to improve maternal health, such as the high percentage of Caesarean, which represented 54% of child-birth in 2011, and the World Health Organization (WHO) recommends not to exceed 15%. This practice increases risks for the mother and child, but also increases the costs of the health system. Women who undergo Caesarean are 3.5 times more likely to get puerperal infections [108].

The life expectancy enlarged 0.45% because the Bolsa Familia and 3.49% in consequence of GDP per capita, both at level of significance of 1%. After the econometric validation, we selected the variables to efficiency model, shown in Table 6.

In order to verify the efficiency of the Brazilian Federative Units in promoting human development, public expenditures with the Bolsa Familia Program and GDP per capita were used as inputs, and as outputs the income of the poor, the Gini index, elementary education, infant mortality, maternal mortality, and life expectancy. For the purpose to

Table 4
Econometric test of outputs in relation to inputs for the Efficiency Model.

Econometric Tests		Outputs (Dependent variables)											
		Income of Poor		Gini Index		School Attendance		Child Mortality		Maternal Mortality		Life Expectancy	
Hausman Test	p-value	0.5959	RE*	0.0799	RE*	0.0007	FE*	0.0145	FE*	0.0000	FE*	0.0001	FE*
Breusch-Pagan Test RE*	p-value	0.0000		0.0000		–		–		–		–	
Modified Wald Test for FE*	p-value	–		–		0.000		0.000		0.000		0.000	
Wooldridge Test for RE* and FE*	p-value	0.2016		0.3434		0.3964		0.000		0.0422		0.000	

RE*: Random effects; FE*: Fixed effects.

Table 5
Econometric estimates of outputs in relation to inputs for the Efficiency Model.

Inputs (Independent variables)		Outputs (Dependent variables)					
		Income of Poor	Gini Index	School Attendance	Child Mortality	Maternal Mortality	Life Expectancy
Bolsa Familia Expenditures	*Coef.*	0.0262**	−0.00355*	0.00178***	−0.0182**	0.460***	0.00464***
	p-value	0.1970	0.0590	0.0000	0.0310	0.0000	0.0000
	Std. Errors	0.0110	0.0019	0.0004	0.0084	0.0420	0.0007
GDP per capita	*Coef.*	0.120***	−0.0401***	0.0103***	−0.331***	−0.291***	0.0349***
	p-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Std. Errors	0.0181	0.0035	0.0009	0.0155	0.0779	0.0013
Health Expenditures	*Coef.*	−0.00159	0.00156	0.000958	−0.0150*	−0.015	0.00115
	p-value	0.1630	0.7100	0.4410	0.0990	0.7890	0.1770
	Std. Errors	0.0127	0.0042	0.0012	0.0091	0.0560	0.0009
Education Expenditures	*Coef.*	−0.00335	−0.00124	−0.000223	0.0155*	−0.0267	−0.00115
	p-value	0.1180	0.7510	0.8500	0.0590	0.6340	0.1410
	Std. Errors	0.0113	0.0039	0.0012	0.0082	0.0561	0.0008
Constant	*Coef.*	3.431***	0.972***	0.830***	6.424***	−1.524	3.857***
	p-value	0.0000	0.0000	0.0000	0.0000	0.1200	0.0000
	Std. Errors	0.2150	0.0402	0.0123	0.1330	0.9800	0.0123
Observations		270	270	270	270	270	270
Number of DMUs		27	27	27	27	27	27

***p < 0.01 **p < 0.05 * p < 0.1.

Table 6
Human development efficiency model.

Human Development Efficiency Model	
Inputs	Outputs
a Public Expenditures on Bolsa Familia Program	1 Average income of the poor
b GDP per capita	2 Gini Index
	3 School attendance rate
	4 Child mortality
	5 Maternal mortality
	6 Life expectancy

deal with the Gini index and child and maternal mortality rates, considered as undesirable outputs, the translation procedure for GI and inverse multiplicative technique for child and maternal mortality, both described in section 5.1, were used. Next section will describe the efficiency scores.

5. DEA analysis and discussion of results

First, we presented the efficiency scores, Window Analysis to include the period 2004 to 2014 and the Composite Index to break the tie of efficient DMUs. In the sequence, we compared these results with the Human Development index (HDI).

5.1. Human Development Indicator

For the elaboration of Human Development Indicator for Brazil, we employed variables that represented the first 6 Millennium Development Goals, as highlighted in Table 2. The DEA-SBM model output-oriented with Variables Returns to Scale presented that the average efficiency of Brazilian Federative Units was 92.96%, as shown in Table 7.

The DMUs considered efficient were: Piauí [PI], Rio Grande do Sul [RS], Ceará [CE], Distrito Federal [DF], Roraima [RR], Rio Grande do Norte [RN], Amapá [AP], Tocantins [TO], Minas Gerais [MG], Santa Catarina [SC] and Acre [AC]. Those with efficiency below 80% were: Goiás [GO] (79.93%), Mato Grosso [MT] (78.61%) and Amazonas [AM] (57.71%).

The cumulative growth rate of efficiency decreased by 0.02%, being highest in Pernambuco [PE] by 19.69% and recording the most significant drop in Goiás [GO] of 29.18%. Fig. 1 shows the map of Brazil and the efficiency ranges.

The efficient Federative Units are those that have the lowest Gini Index, suggesting that in regions where income inequality is lower, efficiency tends to increase, which is in line with Lavabo and Cabanda [109] and Campoli [110]. The targets of each DMU could perform to reaches the efficiency frontier maintaining the same amount of inputs were presented in the Appendix (see Table 10). The life expectancy and universalization of elementary education in the country, these indicators presented the lowest rates to increase efficiency.

The Gini Index, showed a capacity to fall above 6% in 2004 and 2009, especially in the states of Alagoas, Amazonas, Espírito Santo and Sergipe. The income of the poor could increase more than 4% in 2006, 2009 and 2012, especially in Alagoas, Amazonas, Espírito Santo, Goiás, Mato Grosso and Mato Grosso do Sul. The child mortality could decline over 9% in 2004, with more intensity in the states of Alagoas, Amazonas,

[2] Brazil has 26 states and 1 Federal District. The country is divided into 5 Regions: 1) North composed of the states of Acre [AC], Amapá [AP], Amazonas [AM], Pará [PA], Rondônia [RO], Roraima [RR] and Tocantins [TO]; 2) Northwest with Alagoas [AL], Bahia [BA], Ceará [CE], Maranhão [MA], Paraíba [PB], Pernambuco [PE], Piauí [PI], Rio Grande do Norte [RN] and Sergipe [SE]; 3) Midwest with Goiás [GO], Mato Grosso [MT], Mato Grosso do Sul [MS] and Distrito Federal [DF]; 4) Southeast with Espírito Santo [ES], Minas Gerais [MG], Rio de Janeiro [RJ] and São Paulo [SP]; and 5) South with Paraná [PR], Santa Catarina [SC] and Rio Grande do Sul [RS] [111].

Table 7
Efficiency scores - human development efficiency model.

Brazilian Federative Units	Efficiency Scores								
	Window 1	Window 2	Window 3	Window 4	Window 5	Window 6	Average	Ranking	Growth Rate
Piauí [PI]	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	100.00%	1	0.00%
Rio Grande do Sul [RS]	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	100.00%	1	0.00%
Ceará [CE]	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	100.00%	1	0.00%
Distrito Federal [DF]	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	100.00%	1	0.00%
Roraima [RR]	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	100.00%	1	0.00%
Rio Grande do Norte [RN]	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	100.00%	1	0.00%
Amapá [AP]	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	100.00%	1	0.00%
Tocantins [TO]	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	100.00%	1	0.00%
Minas Gerais [MG]	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	100.00%	1	0.00%
Santa Catarina [SC]	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	100.00%	1	0.00%
Acre [AC]	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	100.00%	1	0.00%
Maranhão [MA]	0.9854	0.9980	0.9980	1.0000	0.9998	0.9998	99.68%	2	1.45%
Paraíba [PB]	0.9494	1.0000	1.0000	1.0000	1.0000	1.0000	99.16%	3	5.33%
Rondônia [RO]	1.0000	1.0000	0.9734	0.9734	0.9734	0.9734	98.23%	4	−2.66%
Pernambuco [PE]	0.8355	0.9390	0.9792	0.9942	1.0000	1.0000	95.80%	5	19.69%
São Paulo [SP]	0.9084	0.9084	0.9084	0.9084	0.9084	1.0000	92.37%	6	10.08%
Alagoas [AL]	0.8314	0.9208	0.9208	0.9557	0.9557	0.9557	92.34%	7	14.95%
Bahia [BA]	0.8638	0.8667	0.9991	0.9994	0.8748	0.8748	91.31%	8	1.27%
Espírito Santo [ES]	0.8514	0.8937	0.8937	0.9179	0.9179	0.9179	89.88%	9	7.82%
Pará [PA]	1.0000	0.9941	0.8941	0.8150	0.8144	0.8144	88.87%	10	−18.56%
Rio de Janeiro [RJ]	0.8473	0.8473	0.8473	0.8473	0.9364	1.0000	88.76%	11	18.02%
Paraná [PR]	0.9334	0.8487	0.8487	0.8487	0.8487	0.9153	87.39%	12	−1.95%
Mato Grosso do Sul [MS]	0.9475	0.8522	0.8522	0.8605	0.8137	0.7696	84.93%	13	−18.78%
Sergipe [SE]	0.8484	0.8513	0.8463	0.8463	0.8463	0.8463	84.75%	14	−0.25%
Goiás [GO]	0.9590	0.8736	0.8340	0.7705	0.6792	0.6792	79.93%	15	−29.18%
Mato Grosso [MT]	0.8138	0.7219	0.7219	0.7819	0.8352	0.8419	78.61%	16	3.46%
Amazonas [AM]	0.6030	0.6289	0.6009	0.5288	0.5174	0.5838	57.71%	17	−3.18%
Brazil [BRA]	0.9325	0.9313	0.9303	0.9277	0.9230	0.9323	92.95%	–	−0.02%

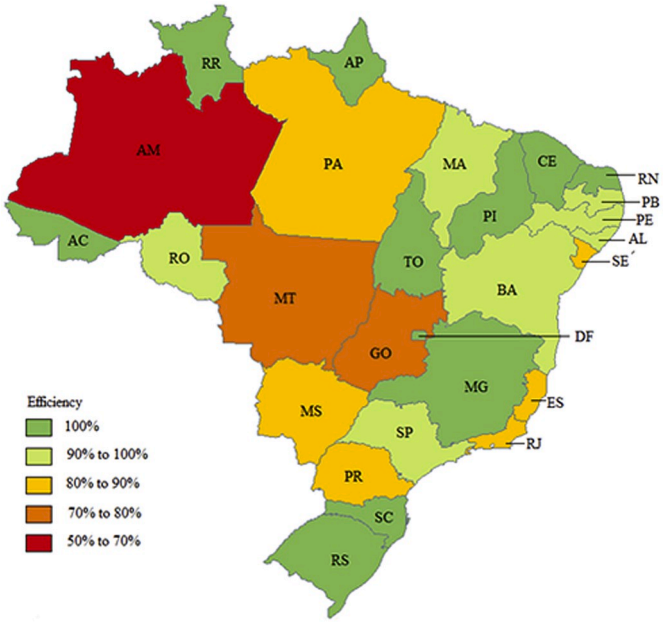

Fig. 1. Map of Brazil[2] – Efficiency ranges.

Espírito Santo, Paraíba and Pernambuco. Finally, the maternal mortality would have the capacity to reduce more than 15% in 2004, 2008 and 2009, mainly in Alagoas, Amazonas, Espírito Santo, Mato Grosso and Paraná in the efficiency model, 11 DMUs showed be efficient: Piauí [PI], Rio Grande do Sul [RS], Ceará [CE], Distrito Federal [DF], Roraima [RR], Rio Grande do Norte [RN], Amapá [AP], Tocantins [TO], Minas Gerais [MG], Santa Catarina [SC] and Acre [AC]. In order to tie break those DMUs, we used the Composite Index (CI), presented in Table 8.

It can be seen that the Composite Index fulfils its role and reveal the efficient DMUs. The results showed that, over the period, no DMU achieved efficiency. Brazil average was 64.74%. However, Santa Catarina [SC] presented the highest average efficiency with 95.01%, followed by Tocantins [TO] (92.92%), Paraíba [PB] (81.49%), Amapá [AP] (78.79%) e Piauí [PI] (78.70%). The DMUs with the lowest Composite Index were Mato Grosso [MT] with 48.48% and Amazonas [AM] with 34.27%, have remained in the last two positions. In order to complement the analysis, we compare the results of the efficiency scores, Composite Index with Human Development Index (HDI), applying Window Analysis, as shown in Table 9.

Human Development Index (HDI) data (2005–2014) was consulted by the IFDM - FIRJAN Municipal Development Index: a study that annually monitors the socioeconomic development of all the more than 5 thousand Brazilian municipalities in three areas of work: Employment & Income, Education and Health [112]. For this study, we applied Window Analysis to evaluate the HDI average.

In this way, we evaluated that of the 11 Brazilian federative units efficient (Piauí, Rio Grande do Sul, Ceará, Distrito Federal, Roraima, Rio Grande do Norte, Amapá, Tocantins, Minas Gerais, Santa Catarina, Acre), only Amapá, Piauí, Rio Grande do Norte and Rio Grande do Sul are among the first positions in the Composite Index ranking. In relation with HDI, only 3 states, Distrito Federal, Santa Catarina and Rio Grande do Sul, were considered efficient and occupied the first positions in the HDI.

We analysed that Bolsa Familia has been shown to be very significant for the evolution of social indicators in the states of Acre, Amapá, Ceará, Piauí, Rio Grande do Norte, Roraima and Tocantins, in the North and Northeast regions. On the other hand, only this social program was not enough to improve the HDI as in the more developed regions such as the South and Southeast of the country.

In this way, we verified the importance of the Bolsa Familia Program, but only this social program, without a more solid medium-term public policy structure, is not enough to change the reality of the millions of Brazilians who still face poverty and extreme poverty and decrease the social and regional inequalities in Brazil.

Table 8
Composite index.

Brazilian Federative Units	Composite Index								
	Window 1	Window 2	Window 3	Window 4	Window 5	Window 6	Average	Ranking	Growth Rate
Santa Catarina [SC]	0.8064	0.9303	0.9641	1.0000	1.0000	1.0000	95.01%	1	3.57
Tocantins [TO]	1.0000	0.9635	1.0000	0.9600	0.8555	0.7963	92.92%	2	17.59
Paraíba [PB]	0.6702	0.8206	0.8099	0.8900	0.8426	0.8561	81.49%	3	−34.34
Amapá [AP]	0.9436	1.0000	0.8286	0.7260	0.6098	0.6196	78.79%	4	2.19
Piauí [PI]	0.6824	0.7603	0.7862	0.8008	0.8393	0.8528	78.70%	5	3.63
Rio Grande do Norte [RN]	0.6809	0.7293	0.7163	0.7420	0.7915	0.7714	73.86%	6	16.09
Rondônia [RO]	0.7544	0.7878	0.7272	0.6902	0.6850	0.6960	72.34%	7	2.40
Paraná [PR]	0.6648	0.6502	0.6112	0.7422	0.6395	0.7472	67.58%	8	4.93
Ceará [CE]	0.6307	0.6684	0.6559	0.6661	0.6745	0.7321	67.13%	9	−38.33
Rio Grande do Sul [RS]	0.7298	0.7118	0.6509	0.6546	0.6351	0.6217	66.73%	10	3.67
Pernambuco [PE]	0.5144	0.6115	0.6384	0.6943	0.7217	0.7337	65.23%	11	5.61
Minas Gerais [MG]	0.6050	0.6682	0.6304	0.6402	0.6354	0.6456	63.75%	12	−32.46
Acre [AC]	0.6050	0.6454	0.6089	0.6184	0.6167	0.6266	62.02%	13	6.71
Distrito Federal [DF]	0.6050	0.6412	0.6049	0.6144	0.6097	0.6195	61.58%	14	−16.61
Roraima [RR]	0.6050	0.6412	0.6049	0.6144	0.6097	0.6195	61.58%	15	27.73
Maranhão [MA]	0.5974	0.6412	0.6049	0.6144	0.6096	0.6194	61.45%	16	12.40
Mato Grosso do Sul [MS]	0.8102	0.6960	0.5667	0.5483	0.5157	0.5472	61.40%	17	42.62
Goiás [GO]	0.7739	0.6770	0.6016	0.5521	0.4923	0.4773	59.57%	18	24.97
Sergipe [SE]	0.5900	0.6272	0.5900	0.5702	0.5422	0.5510	57.84%	19	20.85
Alagoas [AL]	0.5035	0.5909	0.5575	0.5871	0.5827	0.5921	56.90%	20	13.30
São Paulo [SP]	0.5496	0.5825	0.5495	0.5581	0.5539	0.6195	56.89%	21	−14.81
Espírito Santo [ES]	0.5419	0.6014	0.5674	0.5639	0.5597	0.5687	56.72%	22	−7.74
Bahia [BA]	0.5230	0.5560	0.6047	0.6140	0.5334	0.5420	56.22%	23	2.40
Pará [PA]	0.6050	0.6374	0.5408	0.5007	0.4965	0.5045	54.75%	24	24.01
Rio de Janeiro [RJ]	0.5126	0.5433	0.5125	0.5205	0.5709	0.6195	54.66%	25	12.71
Mato Grosso [MT]	0.4940	0.4647	0.4382	0.4810	0.5093	0.5217	48.48%	26	−6.63
Amazonas [AM]	0.3539	0.3917	0.3087	0.3249	0.3155	0.3617	34.27%	27	−20.37
Brazil [BRA]	0.6427	0.6755	0.6400	0.6477	0.6314	0.6468	64.74%	–	0.63

Table 9
Efficiency scores, composite index and human development index.

Brazilian Federative Units	Efficiency Scores Average	Ranking	Growth Rate	Composite Index Average	Ranking	Growth Rate	HDI Average	Ranking	Growth Rate
Acre [AC]	100.00%	1	0.00%	62.02%	13	3.57%	0.4999	23	9.95%
Alagoas [AL]	92.34%	7	14.95%	56.90%	20	17.59%	0.5146	22	18.60%
Amapá [AP]	100.00%	1	0.00%	78.79%	4	−34.34%	0.5227	19	7.46%
Amazonas [AM]	57.71%	17	−3.18%	34.27%	27	2.19%	0.4512	27	13.41%
Bahia [BA]	91.31%	8	1.27%	56.22%	23	3.63%	0.4746	25	21.06%
Ceará [CE]	100.00%	1	0.00%	67.13%	9	16.09%	0.6041	12	15.97%
Distrito Federal [DF]	100.00%	1	0.00%	61.58%	14	2.40%	0.7913	1	−0.46%
Espírito Santo [ES]	89.88%	9	7.82%	56.72%	22	4.93%	0.7027	4	9.51%
Goiás [GO]	79.93%	15	−29.18%	59.57%	18	−38.33%	0.6600	9	9.29%
Maranhão [MA]	99.68%	2	1.45%	61.45%	16	3.67%	0.4826	24	15.80%
Mato Grosso [MT]	78.61%	16	3.46%	48.48%	26	5.61%	0.6482	10	12.49%
Mato Grosso do Sul [MS]	84.93%	13	−18.78%	61.40%	17	−32.46%	0.6604	8	7.25%
Minas Gerais [MG]	100.00%	1	0.00%	63.75%	12	6.71%	0.6431	11	11.76%
Pará [PA]	88.87%	10	−18.56%	54.75%	24	−16.61%	0.4746	26	15.27%
Paraíba [PB]	99.16%	3	5.33%	81.49%	3	27.73%	0.5429	18	17.22%
Paraná [PR]	87.39%	12	−1.95%	67.58%	8	12.40%	0.7021	5	6.65%
Pernambuco [PE]	95.80%	5	19.69%	65.23%	11	42.62%	0.5682	17	17.62%
Piauí [PI]	100.00%	1	0.00%	78.70%	5	24.97%	0.5158	21	18.62%
Rio de Janeiro [RJ]	88.76%	11	18.02%	54.66%	25	20.85%	0.6943	7	7.61%
Rio Grande do Norte [RN]	100.00%	1	0.00%	73.86%	6	13.30%	0.5846	14	13.67%
Rio Grande do Sul [RS]	100.00%	1	0.00%	66.73%	10	−14.81%	0.6998	6	7.63%
Rondônia [RO]	98.23%	4	−2.66%	72.34%	7	−7.74%	0.5788	16	14.03%
Roraima [RR]	100.00%	1	0.00%	61.58%	15	2.40%	0.5217	20	12.59%
Santa Catarina [SC]	100.00%	1	0.00%	95.01%	1	24.01%	0.7189	3	8.07%
São Paulo [SP]	92.37%	6	10.08%	56.89%	21	12.71%	0.7592	2	4.12%
Sergipe [SE]	84.75%	14	−0.25%	57.84%	19	−6.63%	0.5844	15	11.30%
Tocantins [TO]	100.00%	1	0.00%	92.92%	2	−20.37%	0.5970	13	9.79%
Brazil [BRA]	92.95%	–	−0.02%	62.02%	–	3.57%	0.5999	–	10.51%

6. Considerations

The objective of this study was to measure the efficiency of the Bolsa Familia Program to advance toward MDGs of the Brazilian Federative Units in the period from 2004 to 2014.

Overall, the results demonstrated that Brazil has made progress toward MDGs. Efficiency scores were high, evidencing the satisfactory performance and contribution of the Bolsa Familia Program to reduce poverty and promote human development. On the other hand, is necessary to expand expenditures on Bolsa Familia, since if its efficiency

is already high there is little scope to expand its performance without changing its input. In addition, in order to promote human development, it is important to combine public policies in the medium and long term, to expanding social spending to build a solid structure that promotes human development and improves the quality of life of Brazilians.

The low-growth trajectory of cumulative growth rate of efficiency suggests that if a certain level of expenditures on Bolsa Familia Program, if complementary social investments are not made, the outputs may increase, but at a more moderate pace than the input, which causes a downward trend of efficiency.

The models proposed in this research are simplifications of the real scenario of the evolution of quality of life and human development in Brazil. Other factors addressed in the Clinical Economy [59], for a differential diagnosis, such as poverty trap, economic and tax policy structure, physical geography, governance patterns and failures, cultural barriers and geopolitics can influence the efficiency of each Federative Unit. Thus, this is not a study of conclusion, taking into account the economic recession in 2015 and 2016, which may have altered the trajectory of human development in Brazil. Nonetheless, the study was made important by analysing the effects and quantifying the contribution of the Bolsa Familia to progress toward MDGs and we highlight the importance of new methods to evaluate the human development and social programs, as elaborated in this article.

The contribution of this research to science is important, since no other work has analysed the efficiency, through the DEA, of the investments of a program of cash transfer to poor and extremely poor people in the achievement of the Millennium Development Goals, including in Brazil or in Latin America.

For practical purposes, the results obtained in this work may contribute to the design of public policies and governmental decision-making to increase the efficiency of social policies. In this way, efficient Federative Units can serve as benchmarks for those with lower efficiency levels. In addition, based on efficiency scores, policymakers can delve into the causes that drive DMUs to be less efficient.

Among the main limitations and difficulties in the accomplishment of the present work, was that of finding a standardized database with a longer time horizon.

As a proposal for future studies, we suggest using other variables to take into account aspects of Clinical Economics, and even other methods, extending efficiency analysis to Brazilian municipalities and regions or even to other countries. In addition, we suggested evaluating other social programs and other public policies that are essential for the progress of human development in Brazil and in the world.

Acknowledgements

The authors would like to thank CAPES – Coordination for the Improvement of Higher Education Personnel – for their financial support.

Appendix

Table 10
Targets to achieve efficiency.

FU	Targets to achieve efficiency (%)																							
	2004						2005						2006						2007					
	LE	GI	IP	SA	CM	MM	LE	GI	IP	SA	CM	MM	LE	GI	IP	SA	CM	MM	LE	GI	IP	SA	CM	MM
AC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AL	6.96	−35.58	3.97	5.59	−65.07	−93.96	0.00	0.00	0.00	0.00	0.00	0.00	4.83	0.00	7.28	0.34	−41.68	−70.01	0.00	0.00	0.00	0.00	0.00	0.00
AP	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AM	1.83	−104.37	0.00	7.65	−65.23	−99.26	2.22	−18.08	0.00	1.56	−11.02	−86.53	0.00	0.00	0.00	0.00	0.00	0.00	3.93	0.00	11.14	0.41	0.00	−89.10
BA	0.00	0.00	0.00	0.00	−0.09	−7.92	0.00	−3.80	19.29	0.00	−26.92	−97.20	0.00	0.00	0.00	0.00	−0.05	−1.59	0.00	0.00	0.00	0.00	0.00	0.00
CE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DF	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ES	0.00	−17.44	42.44	1.74	−29.37	−92.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	−21.60	39.09	0.45	−7.43	−58.06	0.00	0.00	0.00	0.00	0.00	0.00
GO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	−18.63	19.37	0.00	−15.39	−56.13	0.00	0.00	0.00	0.00	0.00	0.00
MA	0.73	−1.92	1.96	0.40	−7.69	−22.60	0.00	0.00	0.00	0.00	0.00	0.00	0.08	−0.29	0.03	0.04	−1.00	−4.26	0.00	0.00	0.00	0.00	0.00	0.00
MT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	−23.43	32.24	0.00	−14.21	−73.73	0.16	0.00	22.44	0.14	0.00	−73.32
MS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	−22.62	33.98	0.00	−11.57	−67.23	0.00	0.00	0.00	0.00	0.00	0.00
MG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PB	0.00	−18.62	0.00	0.35	−22.87	−68.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PE	5.27	0.00	0.00	1.97	−23.27	−92.83	2.64	−3.55	0.00	1.10	0.00	−64.45	0.07	−0.17	0.00	0.02	−0.14	−34.24	0.09	−1.01	0.00	0.00	−0.26	−14.10
PI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.22	−1.09	0.00	0.68	−19.94	−89.33
RN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SP	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SE	0.00	−5.27	0.00	0.22	−36.24	−92.67	0.00	−13.93	11.00	0.00	−25.97	−65.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BRA	0.55	−6.79	1.79	0.66	−9.25	−21.12	0.18	−1.46	1.12	0.10	−2.37	−11.61	0.18	−3.21	4.89	0.03	−3.39	−13.53	0.31	−0.08	1.24	0.05	−0.75	−9.85

FU																								
	2008						2009						2011						2012					
	LE	GI	IP	SA	CM	MM	LE	GI	IP	SA	CM	MM	LE	GI	IP	SA	CM	MM	LE	GI	IP	SA	CM	MM
AC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AL	0.00	0.00	0.00	0.00	0.00	0.00	2.35	−4.66	8.93	3.77	−27.58	−25.13	0.00	0.00	0.00	0.00	0.00	0.00	0.34	−13.32	2.70	2.41	−18.91	−22.95
AP	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AM	6.84	−5.88	13.76	0.00	−36.24	−78.38	8.90	−3.75	12.43	4.69	0.00	−97.57	0.00	−2.32	24.76	1.99	−21.15	−93.76	4.82	−12.17	3.78	2.22	−42.65	−81.08
BA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	−0.01	−1.09	0.00	−0.01	0.00	0.00	−0.01	−0.77
CE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DF	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ES	0.00	0.00	0.00	0.00	0.00	0.00	0.21	−22.24	15.58	0.17	0.00	−77.55	0.00	0.00	0.00	0.00	0.00	0.00	0.85	−3.60	36.11	1.57	0.00	−23.78
GO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	−30.81	22.96	0.00	−15.48	−87.41	1.11	−12.92	19.57	0.00	−21.48	−54.04	0.00	0.00	67.34	0.00	−31.67	−92.64
MA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MT	0.35	0.00	28.41	0.00	−8.92	−83.39	4.07	−32.97	12.80	0.18	−30.26	−89.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	−16.40	30.77	0.00	−2.48	−90.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	32.40	0.00	−11.98	−63.39
MG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PA	0.00	0.00	0.00	0.00	0.00	0.00	0.27	0.00	0.60	0.79	0.00	−14.55	1.38	−4.78	2.35	0.56	0.00	−92.28	0.38	0.00	4.03	0.93	−9.67	−86.32
PB	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR	0.90	−4.37	6.41	0.02	0.00	−81.42	1.28	−19.61	6.04	1.50	0.00	−87.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

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Table 10 (*continued*)

FU	2008						2009						2011						2012					
	LE	GI	IP	SA	CM	MM	LE	GI	IP	SA	CM	MM	LE	GI	IP	SA	CM	MM	LE	GI	IP	SA	CM	MM
PI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RJ	2.83	0.00	0.00	0.22	−18.08	−79.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.50	−3.11	7.00	1.39	−22.42	−38.89	0.00	0.00	0.00	0.00	0.00	0.00
RR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SP	0.00	−1.29	0.00	0.00	−4.96	−90.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SE	0.00	0.00	0.00	0.00	0.00	0.00	2.12	−31.76	9.85	0.72	0.00	−92.03	0.00	0.00	0.00	0.01	−12.99	−73.83	0.00	0.00	0.00	0.00	0.00	0.00
TO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BRA	0.40	−0.43	1.80	0.01	−2.53	−15.30	0.71	−6.01	4.44	0.44	−2.81	−24.53	0.15	−0.86	1.99	0.15	−2.89	−13.11	0.24	−1.08	5.42	0.26	−4.26	−13.74

FU	2013						2014					
	LE	GI	IP	SA	CM	MM	LE	GI	IP	SA	CM	MM
AC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AP	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AM	0.00	−2.51	18.32	2.60	−20.22	−91.76	0.00	0.00	0.00	0.00	0.00	0.00
BA	0.00	−46.79	6.66	0.70	−7.20	−96.23	0.00	0.00	0.00	0.00	0.00	0.00
CE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DF	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ES	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GO	0.00	−37.19	37.83	0.00	−24.01	−89.06	0.00	0.00	0.00	0.00	0.00	0.00
MA	0.00	−0.04	0.09	0.00	−0.05	−0.48	0.00	0.00	0.00	0.00	0.00	0.00
MT	0.00	0.00	0.00	0.00	0.00	0.00	4.25	−9.43	50.05	0.00	−33.87	−76.52
MS	0.00	−26.21	36.72	0.94	−22.75	−58.55	1.88	−4.74	22.49	0.00	−24.87	−60.74
MG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PA	0.00	0.00	0.01	0.00	−0.03	−1.70	0.00	0.00	0.00	0.00	0.00	0.00
PB	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SP	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BRA	0.00	−4.18	3.69	0.16	−2.75	−12.51	0.23	−0.52	2.69	0.00	−2.18	−5.08

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