The efficiency of Bolsa Familia Program to eradicate extreme poverty

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One of Brazil's great efforts to combat poverty and social inequality was the implementation of the Bolsa Família Program (BF) in 2003. Present in all Brazilian municipalities, BF is considered the largest cash transfer program with health, education and social assistance in the developing world. At a cost of 0.45% of the Gross Domestic Product (GDP), the program serves more than 46.5 million Brazilians, who represent approximately 23% of total population. Due its social relevance, the objective of this paper is to measure the efficiency of the BF to eradicate extreme poverty and to identify the determining factors efficiency. We elaborated an indicator through Data Envelopment Analysis (DEA). Overall, the results showed that Brazil has made progress to reduce poverty The efficiency scores were high, evidencing the satisfactory performance and the contribution of the Bolsa Família to eradicate extreme poverty On the other hand, we identify the need to expand investments destined to the BF, since efficiency levels are high, there is little scope to expand its performance. In addition, to promote human development, it is important to combine public policies in the medium and long term, as well as to increase social spending to build a solid structure that promotes human development and improves the quality of life of Brazilians.

Palavras-chave: Efficiency, Poverty, Bolsa Família Program, DEA, SBM.

1. Introduction

Poverty, according to the United Nations (1995), was defined as the condition characterized by severe deprivation of basic human needs, including food, clean water, sanitation, health, housing, education and information. This not only depends on monetary income, but also on access to services.

The poverty situation, therefore, goes beyond the lack of monetary resources, expanding to the needs of social assistance, such as health and education, which, according to the United Nations Development Program (UNDP), focus on human development and the expansion of individuals to have the skills and opportunities to be what they want to be (UNDP, 2017).

From an economic perspective, based on Rodgers (1995), the International Labor Organization (ILO) argues that individuals and households are considered poor when their standard of living, measured in terms of income and consumption, are below a specific standard. For the World Bank, the line of extreme poverty is US $ 1.90 (WORLD BANK, 2015).

In this context, even applying the Millennium Development Goals (MDGs), according to MDG Report, in 2015, around 836 million people were living in extreme poverty, with less than $ 1.25 per day, and around 57 million children outside 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, promote quality of life to the poorest population is a great world challenge (UN, 2015; UN 2013).

One of Brazil's great efforts to combat poverty and social inequality was the Bolsa Família Program (BF), created in 2003. This program is a conditional cash transfer to poor and extremely poor individuals, where beneficiaries must comply conditionalities related to child and maternal health and education dimensions. The main objective of the Program is to promote social inclusion, with immediate relief of poverty and hunger. In addition, it aims to improve educational and health care to improve social indicators and contribute to breaking the intergenerational cycle of reproducing poverty (MDS, 2017).

Present in all Brazilian municipalities, Bolsa Família 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 visibility. In 2013, the International Social Security Association (ISSA) granted Brazil the I Prize for the exceptional realization in Social Security due to Bolsa Família. According to ISSA, the program has contributed to reduce poverty and promote of human resources, as a model for children in countries (Inter-American Development

Bank, 2015).

In 2016, at a cost of 0.45% of Brazilian GDP, Bolsa Família 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, 2017a, 2017b) and the Ministry of Social and Agrarian Development (MDS, 2017b).

In view of its social relevance, the objective of this paper is to measure the efficiency of the Bolsa Família Program to eradicate extremely poverty and to identify the determinants of efficiency to Brazilian Federative Units, in the period 2004-2009 and 2011-2014, using Data Envelopment Analysis (DEA) – Slack-Based Measure (SBM) model output-oriented.

We justify the choice of this topic due the gap of studies about Bolsa Família Program through Data Envelopment Analysis (DEA). Furthermore, to academic area this work can contribute in an original way, using DEA to evaluate the relative efficiency of the Bolsa Família Program to reduce poverty. In addition, to practical area, researches about efficiency of public policies, can provide information and indicators to aid in the planning and processing of governmental decision-making.

2. Methods

2.1 Econometric Validation

We developed an econometric modeling validate the relation of outputs and input, as well as the explanatory variables, using Multiple Linear Regression Analysis. In the case of pre-efficiency analysis, the dependent variable is one of the outputs of efficiency model, while the set of independent variables is the input, as well as explanatory variables. The linear regression allowed verifying the degree of explicability between each output with the input and explanatory variables Eq. (1).

$$\boldsymbol{ln\, OUT_{it} = \alpha_0 + \alpha_1\, ln\, IN_{it} + \alpha_2\, ln\, E1_{it} + \alpha_3\, ln\, E2_{it} + \alpha_4\, ln\, E3_{it} + \varepsilon_{it}} \quad (1)$$

Where:

$ln\, OUT$: dependent variable (output); α_0: intercept; α_1, α_2, α_3, α_4 : variable coefficient; IN: independent variable (*input*); E1, E2, E3: independent variables (explanatory); *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 (Greene, 2011). Using panel data is common for estimators to present problems of heteroscedasticity autocorrelation and endogeneity (Greene 2011; Wooldridge 2002). To correct the problems of heteroscedasticity, autocorrelation and endogeneity, we chose for the present research apply Feasible Generalized Least Squares (FGLS).

2.2 Efficiency Analysis

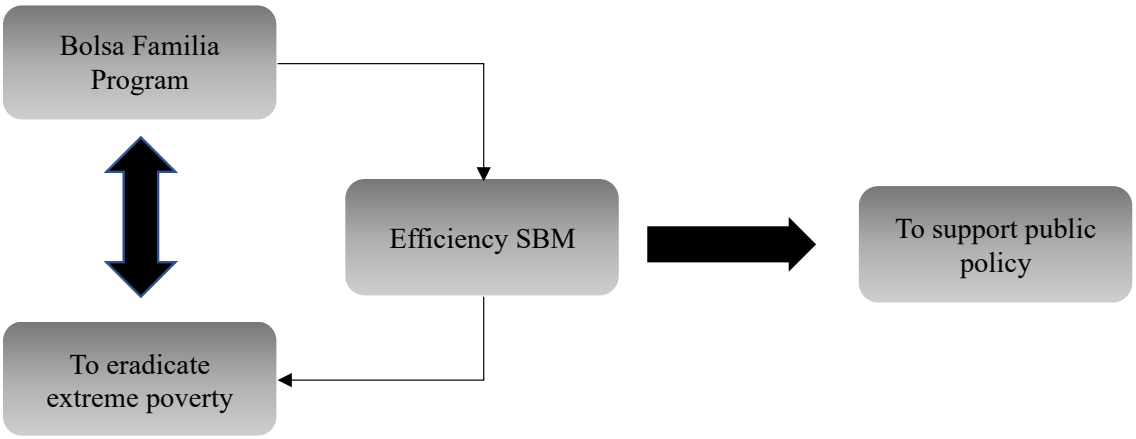
To analyze a production system, Production Engineering proposes determine inputs and outputs. In this context, Operational Research is the key discipline techniques to measure efficiency (CHARNES; COOPER; RHODES, 1981). Among these methods, Data Envelopment Analysis (DEA) is widely used to calculate efficiency and a very important tool because to strategic planning and decision making (ALMEIDA et al. 2006).

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

The DMUs must be homogeneous in their functions, with similarity being a necessary condition for make comparisons and calculate relative efficiency. The efficiency scale is measured from 0 to 1, when it reaches 1, the DMU is considered efficient. In the sequence, is generated a ranking of the DMUs, being efficient those DMUs that can reduce their inputs proportion without reducing the quantity of outputs (COELLI et al., 2005).

In this research, we evaluated Brazilian Units Federative to verify the relative efficiency of the Bolsa Família Program to advance toward MDGs. Figure 1 presents the study model.

Figure 1 – Study model



Source: Elaborated by the authors

Figure 1 highlighted the Bolsa Família Program (BF) that its main objective is to promote social inclusion, with immediate relief of poverty. Moreover, efficiency analysis can provide information and indicators to aid in the planning and processing of governmental decision-making and public policies.

We chose the Slack Based Model (SBM) model output-oriented with variable returns of scale to analyze the efficiency of Bolsa Família to eradicate extreme poverty.

The orientation to output is justified by the current Brazilian scenario, where public spending in the BF is expected to remain constant and social indicators (outputs) be maximized. Due to heterogeneities of Brazilian UFs, we chose the model with variable returns of scale, which takes into account the scale of the states.

For the SBM model, efficiency represents average reduction of inputs and average increase of outputs to reach efficiency frontier, being the efficiency relative to inputs or outputs (Tone, 2001). The objective function of the SB model with variable returns of scale, to determine the efficiency of a DMU (x_0, y_0), is replaced by:

$$Min \quad \frac{1 - \frac{1}{m}\sum_{j=1}^{m}\frac{S_j}{x_{j0}}}{1 + \frac{1}{n}\sum_{i=1}^{n}\frac{S_i}{y_{i0}}} \qquad (3)$$

Subject to:

$$\sum_{k=1}^{z} x_{jk}.\lambda_k + S_j = x_{jo}, \qquad j = 1,2\ldots n \qquad (4)$$

$$\sum_{k=}^{z} y_{ik}.\lambda_k - S_i = y_{io} \qquad i = 1,2\ldots n \qquad (5)$$

$$\sum_{k=1}^{z} \lambda_k = 1 \qquad (6)$$

$$\lambda_{k,} S_j e S_i \geq 0 \qquad (7)$$

Where: $\lambda_{k,}$ = DMU k share in DMU target under analysis; x_{jk}= Quantity of input j of DMU k; y_{ik} = Quantity of output i of DMU k; x_{j0}= Quantity of input j DMU under analysis; y_{i0}= Amount of output i of DMU under analysis; z = Number of analyzed units; m = Number of outputs; n = Number of inputs; S_j= Output i slack; S_i= Input j slack.

SBM model will provide efficiency, based on the relative slacks of each DMU. In addition, it is possible to determine the target for each DMU to approximate efficiency.

To include the time factor, we applied window analysis. Initially proposed by Charnes et al. (1985) 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 and Rebelatto (2014), this tool is widely used for Data Envelopment Analysis (DEA) when considering different periods.

2.3 Data and Selection of variables

The databases consulted were the Ministry of Transparency, Comptroller General of the Union (CGU), the Ministry of Social and Agrarian Development (MDS), the Brazilian Institute of Geography and Statistics (IBGE), the Institute of Applied Economic Research (IPEA) and Public Sector Accounting and Fiscal Information System (SICONFI).

The choice of the analysis period, 2004-2009 to 2011-2014, was due to the availability of data, giving preference to consider the most updated periods with a standardized database. The year 2010 was excluded, since it refers to the national census that was not standardized with the other databases used. Table 1 shows the dimension, variable, source, and theoretical basis of the variables used for this research.

Table 1 – Selected variables

Dimension	Variable	Source	Theoretical basis	Type
Social	Expenditures on Bolsa Família Program	CGU	Habibov and Fan (2010), Singh (2016)	*Input*
Social	Number of beneficiary families	IPEA, 2017a	Proposal of this research	*Output*
Social	Percentage of poor and extremely poor individuals	IPEA, 2017b	Habibov and Fan (2010), Singh (2016)	*Output*
Economic	Average income of extremely poor individuals	IPEA, 2017c	Proposal of this research	*Output*
Economic	Average income of poor individuals	IPEA, 2017d	Proposal of this research	*Output*
Economic	Average value of Bolsa Família	MDS, 2017a	Proposal of this research	*Output*
Social	Bolsa Família coverage rate	MDS, 2017b	Proposal of this research	*Output*
Economic	Gini Index	IPEA, 2017e	Proposal of this research	*Output*
Economic	GDP per capita	IBGE, 2017c	Giménez et al. (2016)	*Independent Explanatory*
Social	Education expenditures	SICONFI, 2017a	Lavado and Cabanda (2009)	*Independent Explanatory*
Social	Health expenditures	SICONFI, 2017b	Lavado and Cabanda (2009)	*Independent Explanatory*
Economic	GDP per Federative Units	IBGE, 2017a	Proposal of this research	*Explanatory*
Economic	Formal Work	IBGE, 2017d	Proposal of this research	*Explanatory*
Social	Percentage of urbanization	IBGE, 2017e	Proposal of this research	*Explanatory*
Economic	Household income per capita	IPEA, 2017f	Proposal of this research	*Explanatory*

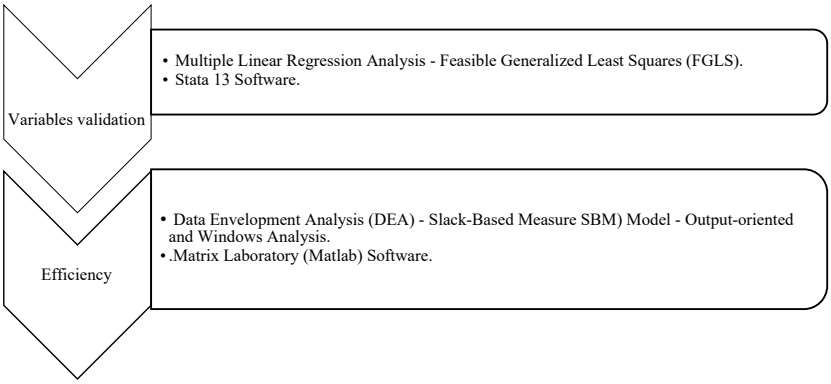
Source: Elaborated by the authors

Table 1 presents the variables to econometric validation and to the efficiency model as input, output, independent and explanatory. The dimensions of these variables were social, economic, health and educational. We chose for variables corresponding to the Brazilian context for the evaluation in the First Millennium Development Goal: to eradicate extremely poverty and hunger.

3. Results and discussions

In this section, we will present the variables validation to the efficiency model to eradicate extremely poverty in Brazil as well as their results. Figure 2 presents these procedures

Figure 2 – Efficiency analysis procedures



Source: Elaborated by the authors

For the efficiency analysis, we applied the statistical software Stata 13, using multiple linear regression analysis - Factorial Generalized Least Squares Method (MQGF).

Regarding the efficiency analysis, we used Data Envelopment Analysis - Slack-Based Measure Model Output-oriented and Window Analysis, through MATLAB software.

3.1 Indicator to eradicate extreme poverty

The econometric equations for this model took the following forms:

$$\ln PEP_{it} = \alpha_0 + \alpha_1 \ln EBF_{it} + \alpha_2 \ln Y_{it} + \alpha_3 \ln H_{it} + \alpha_4 \ln E_{it} + \varepsilon_{it} \quad (8)$$

$$\ln B_{it} = \beta_0 + \beta_1 \ln EBF_{it} + \beta_2 \ln Y_{it} + \beta_3 \ln H_{it} + \beta_4 \ln E_{it} + \varepsilon_{it} \quad (9)$$

$$\ln IEP_{it} = \gamma_0 + \gamma_1 \ln EBF_{it} + \gamma_2 \ln Y_{it} + \gamma_3 \ln H_{it} + \gamma_4 \ln E_{it} + \varepsilon_{it} \quad (10)$$

$$\ln IP_{it} = \delta_0 + \delta_1 \ln EBF_{it} + \delta_2 \ln Y_{it} + \delta_3 \ln H_{it} + \delta_4 \ln E_{it} + \varepsilon_{it} \quad (11)$$

$$\ln C_{it} = \theta_0 + \theta_1 \ln EBF_{it} + \theta_2 \ln Y_{it} + \theta_3 \ln H_{it} + \theta_4 \ln E_{it} + \varepsilon_{it} \quad (12)$$

$$\ln V_{it} = \vartheta_0 + \vartheta_1 \ln EBF_{it} + \vartheta_2 \ln Y_{it} + \vartheta_3 \ln H_{it} + \vartheta_4 \ln E_{it} + \varepsilon_{it} \quad (13)$$

$$\ln G_{it} = \varphi_0 + \varphi_1 \ln EBF_{it} + \varphi_2 \ln Y_{it} + \varphi_3 \ln H_{it} + \varphi_4 \ln E_{it} + \varepsilon_{it} \quad (14)$$

Where: α_n, β_n, γ_n e δ_n $(n = 0, \dots, 3)$ are the estimated coefficients, PEP is the percentage of poor and extremely poor, B is number of beneficiary families, IEP is the average income of the extremely poor individuals, IP is the average income of poor individuals, C is the Bolsa Família coverage rate, V is the average value of Bolsa Família and G is Gini index, EBF are expenditures on Bolsa Família Program, , Y is GDP per capita, H are health expenditures, E are education expenditures and ε is the random error. Regression analysis results are summarized in Table 2.

Table 2- Linear Regression: coefficients and p-value of outputs in relation to input and explanatory variables for the Efficiency Model

		Independent variables			
Dependent variables		***EBF***	***Y***	***H***	***E***
PEP	**Coef,**	0.00390	-0.232***	0.00244	0.00133
	p-value	0.386	0.000	0.779	0.864
B	**Coef,**	0.797***	-0.510***	0.0490	-0.0498*
	p-value	0.000	0.000	0.112	0.082
IEP	**Coef,**	0.0285	-0.0973**	0.0231	-0.0483*
	p-value	0.289	0.042	0.451	0.088
IP	**Coef,**	0.0262**	0.120***	-0.00159	-0.00335
	p-value	0.017	0.000	0.901	0.767
C	**Coef,**	0.0628***	0.000814	0.0382	-0.0214
	V p-value	0.000	0.971	0.279	0.53
V	**Coef,**	-0.135***	0.766***	-0.0781***	0.0718***
	p-value	0.002	0.000	0.000	0.000
G	**Coef,**	-0.00355*	-0.0401***	0.00156	-0.00124
	p-value	0.059	0.000	0.710	0.751

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

Source: Elaborated by the authors

The regression showed that the number of beneficiary families, the coverage rate and the average value of Bolsa Família presented statistical significance of 1% with the expenditures on Bolsa Família Program. Since the DEA determines that in the set of inputs it is desirable that the variables be independent of the outputs, we chose to exclude from the efficiency model those variables.

The income of poor individuals presented statistical significance of 5% and the Gini index of 10% with the input EBF. These variables are statistically significant and instead the variables that depend on the BF (number of beneficiary families, the coverage rate and the average value of BF) demonstrate the broader effects of this program for the progress in achieving the 1st Development Objective of the Millennium: to eradicate extreme poverty, which converges with the findings of Barros et al. (2006).

The percentage of poor and extremely poor individuals and the income of the extremely poor we took from the efficiency model because they were not significant.

On the other hand, the results showed that all the variables presented a significance with GDP per capita. GDP per capita contributed to the fall of the percentage of poor and extremely poor and the Gini index, in addition to collaborating to increase the income of poor individuals, being significant at 1%.

Moreover, GDP per capita, which went from R$ 10,781.70 (around US$ 3,684.91) in 2004 to R$ 28,500.24 (around US$12,110.24) in 2014, contributed to the fall in the income of extremely

poor individuals, that is, this part of the population does not reach the benefits of the increase of the country's economic growth.

This economic growth was favorable for the capital increase of other social classes and not necessarily for the most excluded of Brazilian society, which is in line with Marinho et al. (2011), recognizing that there may have been an improvement in income, but even so, this part of Brazilians still remains in poverty. Araújo et al. (2013) argues that BF contributed to poverty reduction, but there is no evidence that this improvement has altered the huge income disparities that exist in Brazilian social classes.

The investments with education corroborate with these findings, since they presented statistical significance at the level of 10% for the fall of the income of the extremely poor. Access to education by this part of population did not reflect a significant increase in income and, consequently, a progress in the quality of life. Still, according to Marinho et al. (2011), if GDP growth and education policies contribute to income concentration, their effects may be moderate or even intensify poverty. Table 15 demonstrates the selected variables and highlights those employed for the model to eradicate extreme poverty.

Table 3 – Efficiency model to eradicate extreme poverty

Efficiency model to eradicate extreme poverty	
Input	Outputs
a) Public Expenditures on Bolsa Família Program	1) Average income of poor individuals 2) Gini Index

Source: Elaborated by the authors

After econometric analysis, we calculated the efficiency scores outlined in Table 4.

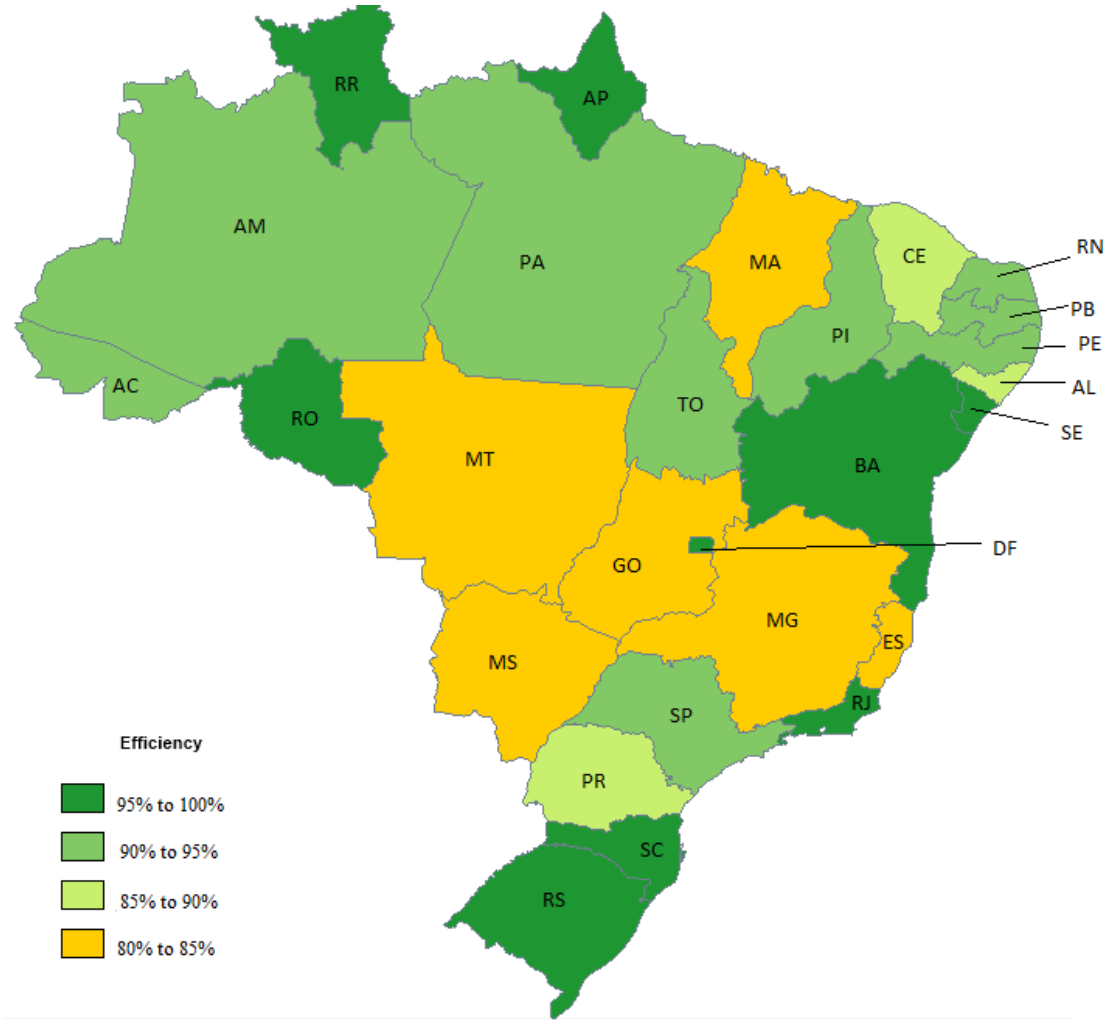
Table 4 – Efficiency Scores - Efficiency model to eradicate extreme poverty

Federative Units	Efficiency Scores								
	Window 1	Window 2	Window 3	Window 4	Window 5	Window 6	Average	Ranking	Growth Rate
Rondônia (RO)	0.978	0.9898	0.9939	0.9968	0.9976	0.9816	98.96%	1	0.37%
Amapá (AP)	1	1	0.9829	0.9829	0.9711	0.9711	98.47%	2	-2.89%
Rio Grande do Sul (RS)	0.9618	0.9618	0.9873	0.9873	0.9948	1	98.22%	3	3.97%
Rio de Janeiro (RJ)	0.9947	0.9827	0.9827	0.9779	0.9733	0.9764	98.13%	4	-1.83%
Sergipe (SE)	0.9822	0.9822	0.9939	0.9829	0.9591	0.9499	97.5%	5	-3.29%
Santa Catarina (SC)	0.9795	0.9795	0.9845	0.965	0.965	0.9444	96.97%	6	-3.58%
Roraima (RR)	0.9566	0.9566	0.9688	0.9782	0.9888	0.966	96.92%	7	0.98%
Bahia (BA)	0.9997	0.9997	0.9838	0.9551	0.918	0.903	95.99%	8	-9.67%
Distrito Federal (DF)	0.9454	0.9454	0.9676	0.9874	0.954	0.9425	95.7%	9	-0.31%
Tocantins (TO)	0.9382	0.9263	0.9448	0.9581	0.9512	0.9308	94.16%	10	-0.78%
Pernambuco (PE)	9221	0.9216	0.9294	0.9366	0.9376	0.9255	92.88%	11	0.37%
São Paulo (SP)	0.9329	0.9132	0.9367	0.9307	0.9177	0.9218	92.55%	12	-1.19%
Amazonas (AM)	0.9030	0.9323	0.9302	0.9193	0.9212	0.9408	92.45%	13	4.19%
Rio Grande do Norte (RN)	0.8979	0.9063	0.9163	0.935	0.9452	0.9428	92.39%	14	5,00%
Acre (AC)	0.8968	0.9055	0.9132	0.9322	0.9464	0.9267	92.01%	15	3.34%
Piauí (PI)	0.8803	0.8845	0.8948	0.9199	0.9442	0.9539	91.29%	16	8.36%
Pará (PA)	0.8934	0.909	0.9116	0.9218	0.9121	0.9006	90.81%	17	0.8%
Paraíba (PB)	0.8635	0.8798	0.9022	0.918	0.9271	0.9257	90.27%	18	7.2%
Paraná (PR)	0.8372	0.8395	0.8787	0.9043	0.9289	0.9244	88.55%	19	10.42%
Alagoas (AL)	0.8724	0.8827	0.8911	0.8951	0.8954	0.8709	88.46%	20	-0.17%
Ceará (CE)	0.8622	0.8696	0.8894	0.8829	0.8553	0.8557	86.92%	21	-0.76%
Goiás (GO)	0.8901	0.8659	0.8552	0.8564	0.8152	0.81	84.88%	22	-9,00%
Mato Grosso do Sul (MS)	0.8525	0.8548	0.8534	0.8638	0.847	0.8194	84.85%	23	-3.88%
Minas Gerais (MG)	0.8537	0.8378	0.8311	0.8743	0.833	0.8123	84.04%	24	-4.85%
Maranhão (MA)	0.8276	0.8296	0.8277	0.8413	0.8461	0.81	83.04%	25	-2.13%
Mato Grosso (MT)	0.8237	0.8436	0.8225	0.8244	0.8101	0.7873	81.86%	26	-4.42%
Espírito Santo (ES)	0.8201	0.8131	0.8195	0.8187	0.7916	0.7815	80.74%	27	-4.71%
Brazil	0.9098	0.9116	0.9183	0.9239	0.9166	0.9065	91.44%	-	-0.37%

Source: Elaborated by the authors

The average efficiency of Brazilian Federative Units for this model was 91.44%. Figure 3 shows the map of Brazil and the efficiency ranges from 80% to 85%, from 85% to 90%, from to 90% to 95% and from 95% to 100%.

Figure 3 – Map of Brazil – Efficiency ranges



Source: Elaborated by the authors

The Federative Units that achieved efficiency above 95% were: Rondônia (98.96%), Amapá (98.47%) and Roraima (96.92%) in the North, Rio Grande do Sul (98.22%) and Santa Catarina (96.97%) in the South, Rio de Janeiro (98.13%) in the Southeast, Distrito Federal (95.97%) in the Midwest, and Bahia (95.99%) and Sergipe (97.50%) in the Northeast.

On the other hand, the states with efficiency below 85% were: Goiás (84.88%), Mato Grosso do Sul (84.85%) and Mato Grosso (81.86%) in the Midwest, Minas Gerais (84.04%) and Espírito Santo (80.74%) in the Southeast and Maranhão (83.04%) in the Northeast.

The first placed in the ranking, can serve as benchmarks for their Regions and to other Federative Units improve their performance. We observed that over time the efficiency accumulated decrease of 0.37%. Paraná was the state where efficiency increased the most, in 10.42%, in contrast to Bahia was the UF, which suffered a sharp decrease of 9.67%.

This trend of lowering the efficiency level reveals that after reaching a certain point of investments in the Bolsa Família Program, the efficiency decreased, that is, the outputs even increased, but in a smaller proportion than the input.

In this period (2004-2014) it is observed that the investments in the Bolsa Família accumulated a growth rate of 480.06% in the country, minimum of 198.89% in Santa Catarina and maximum of 905.46% in Rio de Janeiro. The income of poor individuals grew by an average of 26.57%, a minimum of 6.17% in Mato Grosso and a maximum of 72.10% in Roraima. The Gini index reduced on average 10.98% in Brazil, a minimum of 1.22% in Amapá and a maximum of 17.33% in Paraná.

In addition, according to the IPEA (2014a, the Bolsa Família, Food Acquisition Program, Brazil Without Poverty, Brazil Carinhoso and PRONATEC programs contributed to the country's progress towards meeting the 1st MDG.

The SBM model also allowed us to determine the goals for each DMU to achieve efficiency. That is, to verify how inefficient Federative Units could increase their outputs without changing the number of inputs used.

In 2004, the income of poor individuals could have grown by an average of 18.59% in Brazil, this potential increase would be 53.97% in Maranhão, 45.27% in Alagoas, and more than 43% in Minas Gerais and Ceará. In 2013, this capacity would rise by an average of 20.02%, with a highlight of 111.88% in Mato Grosso, 79.29% in Espírito Santo, 59.62% in Minas Gerais and 56.30% in Mato Grosso do Sul and in 2014, this growth could have been increased by an average of 22.16%, with 70.07% in Minas Gerais, 60.55% in Mato Grosso do Sul and 56.34% in Espírito Santo.

Regarding the Gini index, in 2005, this indicator could have been reduced by an average of 10.44%, presenting a reduction of 19.73% in Piauí and around 15% in Maranhão, Mato Grosso do Sul and Rio Grande do Norte. In 2006, this fall could have been on average 11.07%, with space to be more accentuated in the Distrito Federal (24.97%), Espírito Santo (23.96%), Goiás (22.62%), Maranhão and Mato Grosso (25.54%), Mato Grosso do Sul (26.05%) and Minas Gerais (22.54%). And in 2014, this decrease would average 13.45%, with Bahia being able to reduce 31.14%, the Distrito Federal with 27.35% and Mato Grosso do Sul with 25.79%.

4. Conclusions

Efficiency scores were high, evidencing the satisfactory performance and contribution of the Bolsa Família Program to reduce poverty. On the other hand, is necessary to expand

expenditures on Bolsa Família, 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.

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 analyzing the effects and quantifying the contribution of the Bolsa Família to eradicate extremely poverty.

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

REFERENCES

ALMEIDA, M. R., MARIANO, E. B., REBELATTO, D. A. N. Análise Envoltória De Dados - Evolução e Possibilidades de Aplicação. In: IX SIMPOI - Simpósio de Administração de Produção, Logística e Operações Internacionais, São Paulo, 2006.

ANDREOLI, A. C. **Eficiência do Programa Minha Casa Minha Vida em gerar benefícios sociais**: uma Análise Envoltória de Dados das Unidades Federativas Brasileiras no período de 2009 a 2012. Bauru: UNESP, 2016. 115p. Dissertação (Mestrado) Programa de Pós-Graduação em Engenharia de Produção, Faculdade de Engenharia de Bauru, Universidade Estadual Paulista, Bauru, 2016.

ARAÚJO, J. M.; ALVES, J. A.; BESARRIA, C. N. O impacto dos gastos sociais sobre os indicadores de desigualdade e pobreza nos estados brasileiros no período de 2004 a 2009. **Rev. Econ. Contemp**., v. 17, n. 2, p. 249-275, 2013.

BARROS, R.; FOGUEL, M. N.; ULYSSEA, G. **Desigualdade de renda no Brasil**: uma análise da queda recente. Brasília: IPEA, 2006.

BRAZILIAN INSTITUTE OF GEOGRAPHY AND STATISTICS (IBGE). **GDP per capita**. 2017c. Avaliable at: <https://www.ibge.gov.br/estatisticas-novoportal/economicas/contas-nacionais/2021-np-contas-regionais-do-brasil/9054-contas-regionais-do brasil.html?edicao=9055&t=resultados.>

BRAZILIAN INSTITUTE OF GEOGRAPHY AND STATISTICS (IBGE). **GDP per Federative Unit** 2017a. Avaliable at: <https://www.ibge.gov.br/estatisticas-novoportal/economicas/contas-nacionais/2021-np-contas-regionais-do-brasil/9054-contas-regionais-do-brasil.html?edicao=9055&t=resultados.>

BRAZILIAN INSTITUTE OF GEOGRAPHY AND STATISTICS (IBGE). **Percentage of people in formal work.** 2017d. Avaliable at: <https://sidra.ibge.gov.br. >

BRAZILIAN INSTITUTE OF GEOGRAPHY AND STATISTICS (IBGE). **Percentage of urbanization.** 2017e. Avaliable in: <https://sidra.ibge.gov.br. >

BRAZILIAN INSTITUTE OF GEOGRAPHY AND STATISTICS (IBGE). **Resident population by Federative Unit.** 2017b. Avaliable at: <https://www.ibge.gov.br/estatisticas-novoportal/economicas/contas-nacionais/2021-np-contas-regionais-do-brasil/9054-contas-regionais-do-brasil.html?edicao=9055&t=resultados.>

CAMIOTO, F. C.; MARIANO, E. B.; REBELATTO, D. A. N. Efficiency in Brazil's industrial sectors in terms of energy and sustainable development. **Environmental Science & Policy**, v.37, p. 50-60, 2014.

CHARNES, A.; COOPER, W.W.; GOLANY, B.; SEIFORD, L. **Foundation of data envelopment analysis for Pareto- Koopmans efficient empirical production functions. J.**1985.

CHARNES, A.; COOPER, W. W.; RHODES, E. Evaluating program and managerial efficiency: an application of data envelopment analysis to program follows through. **Management science**, v.276, n. 8, p. 668-697, 1981.

COELLI, T. J.; RAO, D. S. P.; O`DONELL, C. J.; BATTESE, G. E. **An introduction to efficiency and productivity analysis**. Springer Science & Business Media, 2005.

GREENE, W. H. **Econometric analysis**. India: Pearson Education, 2011.

INTER-AMERICAN DEVELOPMENT BANK. **How does Bolsa Familia work?** 2015. Avaliable at: <https://publications.iadb.org/bitstream/handle/11319/7210/How_does_Bolsa_Familia_Work.pdf?sequence>

INSTITUTE OF APPLIED ECONOMIC RESEARCH (IPEA). **Average income of extremely poor individuals**. 2017c. Avaliable at: <http://www.ipeadata.gov.br.>

INTER-AMERICAN DEVELOPMENT BANK. **Average income of poor individuals**. 2017d. Avavliable at: http://www.ipeadata.gov.br.

INSTITUTE OF APPLIED ECONOMIC RESEARCH (IPEA). **Gini Index.** 2017e. Avaliable at: <http://www.ipeadata.gov.br.>

INSTITUTE OF APPLIED ECONOMIC RESEARCH (IPEA). **Household income per capita**. 2017f. Avaliable at: <http://www.ipeadata.gov.br.>.

INSTITUTE OF APPLIED ECONOMIC RESEARCH (IPEA). **Number of beneficiary families**. 2017a. Avaliable at: <http://www.ipeadata.gov.br. >

INSTITUTE OF APPLIED ECONOMIC RESEARCH (IPEA). **Percentage of poor and extremely poor individuals**. (2017b). Avaliable: <http://www.ipeadata.gov.br. >.

MINISTRY OF SOCIAL AND AGRARIAN DEVELOPMENT. **Beneficiaries of the Bolsa Família Program**. 2017a Avaliable at: <http://aplicacoes.mds.gov.br/sagi-data/misocial/tabelas/mi_social.php.>

MINISTRY OF SOCIAL AND AGRARIAN DEVELOPMENT. **Conheça o Bolsa Família**. 2017b. Avaliable at: <https://mds.gov.br/assuntos/bolsa-familia/o-que-e>.

PUBLIC SECTOR ACCOUNTING AND FISCAL INFORMATION SYSTEM (SICONFI). **Annual accounts – Education Expenditures**. 2017a. Avaliable at: <https://siconfi.tesouro.gov.br/siconfi/pages/public/consulta_finbra/finbra_list.jsf. >

PUBLIC SECTOR ACCOUNTING AND FISCAL INFORMATION SYSTEM (SICONFI). **Annual accounts – Helath Expenditures**. 2017b. Avaliable at: <https://siconfi.tesouro.gov.br/siconfi/pages/public/consulta_finbra/finbra_list.jsf. >

TONE, K. A slacks-based measure of efficiency in data envelopment analysis. **European Journal Of Operational Research**, v.130, n.3, p. 498-509, 2001.

UNITED NATIONS (UN). **Millenium Declara**tion. New York, 2000.

UNITED NATIONS (UN). **Road Map towards the implementation of the United Nations Millenniun Declaration** - Report of the Secretary-General. Fifty-sixth session. New York, 2001.

UNITED NATIONS (UN). **The Copenhagen Declaration and Programme of Action**. Organização das Nações Unidas. New York, 1995.

UNITED NATIONS (UN). **The Millennium Development Goals Report**. (2013). Avaliable at: <http://www.un.org/millenniumgoals/pdf/report-2013/mdg-report-2013-english.pdf.>

UNITED NATIONS (UN). **The Millennium Development Goals Report**. (2015). Avaliable at: <http://www.un.org/millenniumgoals/2015_MDG_Report/pdf/MDG%202015%20rev%20(July%201).pdf. >

UNITED NATIONS DEVELOPMENT PROGRAM (UNDP). **What is Human Development? United Nations Development Program,** 2017. Available at: <http://www.br.undp.org/content/brazil/en/home/idh0/conceitos/o-que-e-desenvolvimento-humano.html>

Wooldridge, J. M. **Introductory Econometrics – A Modern Approach**. 3 ed. Thomson South-Western, 2006.

WORLD BANK. FAQS: **Global Poverty Line Update**. 2015. Avaliable at: <http://www.worldbank.org/en/topic/poverty/brief/global-poverty-line-faq>.