Economía Sociedad y Territorio

ISSN 2448-6183

Vol. 24, núm. 75, 2024, e2033
http://dx.doi.org/10.22136/est20242033

Artículo científico

Alternative approach to measure the Brazilian municipal development: the Relative Municipal Development Index

Abordagem alternativa para mensurar odesenvolvimento municipal brasileiro: o Índice Relativo de Desenvolvimento Municipal

FRANCIS RÉGIS GONÇALVES MENDES BARBOSA, https://orcid.org/0000-0003-4462-7668
Universidade Estatal de Mato Grosso do Sul, Brasil, francisbarbosa@uems.br

MADALENA MARIA SCHLINDWEIN, https://orcid.org/0000-0002-4387-9786
Universidade Federal da Grande Dourados, Brasil, madalenaschlindwein@ufgd.edu.br

MARCELO CORRÊA DA SILVA*, https://orcid.org/0000-0002-7599-1967
Universidade Federal da Grande Dourados, Brasil, marcelo-correadasilva@hotmail.com
*Autor de correspondencia

Abstract

Amartya Sen's theory of Development as Freedom states the prediction of development by evaluating the expansion of individual freedoms. This study operationalizes this theory and its instrumental freedoms through the construction of a development index and multivariate statistics. Spatiality of municipal development provides empirical evidence for interrelations between instrumental freedoms defended by this theory. The determinants of development related mainly to income and its distribution, but also housing conditions and social vulnerabilities. The findings unmask the geographic structure of (under) development in a frontier in Mid-West Brazil, marked by higher deprivation of opportunities, precarious services and greater economic stagnation.

Keywords: *economic freedom, instrumental freedoms, index measurement, regional disparities, socioeconomic indicators.*

Resumo

A teoria do desenvolvimento como liberdade de Amartya Sen estabelece a previsão do desenvolvimento avaliando a expansão das liberdades individuais. Este estudo operacionaliza a teoria e suas liberdades instrumentais por meio de um índice de desenvolvimento e estatística multivariada. A espacialidade do desenvolvimento municipal evidencia as inter-relações entre as liberdades instrumentais defendidas por essa teoria. Os determinantes do desenvolvimento estiveram relacionados principalmente à renda e sua distribuição, mas também às condições de moradia e às vulnerabilidades sociais. Os resultados mostram uma condição do interior do Brasil marcada por maior privação de oportunidades, precariedade de serviços e estagnação econômica.

Palabras clave: liberdade econômica, liberdades instrumentais, medição de índices, disparidades regionais, indicadores socioeconómicos.

Received: March 8th, 2022 / Accepted: July 10th, 2023 / Published: June 18th, 2024

CÓMO CITAR: Gonçalves Mendes Barbosa, Francis Régis; Schlindwein, Madalena Maria; Corrêa da Silva, Marcelo (2024). Alternative approach to measure the Brazilian municipal development: the Relative Municipal Development Index. *Economía, Sociedad y Territorio*, *24*(75): e2033. http://dx.doi.org/10.22136/est20242033

http://dx.doi.org/10.22136/est20242033

Introducción

The traditional view in international economy considers economic growth as synonymous with the standard of living. From the very concept of growth, some flaws emerge in the measurement of the wealth produced by a country in a given period. In addition, the concept does not distinguish the value generated by activities that are desirable and undesirable from the point of view of social well-being. Moreover, studies such as the ones by Nobel Prize in Economics Amartya Sen (1999; 2000) and Navarro (1968; 2000) highlight that economic growth is not a necessary and sufficient condition to improve the living standards and welfare in society. These studies demonstrated that high economic growth indicators measured by GDP or GNP growth rates, or per capita equivalents, coexisted with indicators of poor basic living conditions and precarious survival. Simultaneously, countries showing low economic growth presented good living conditions.

There is some consensus regarding the need of a novel and comprehensive measure of progress and global prosperity, capable of informing whether people are in a better situation (O'Donnell, 2014). The theme relates to a problem that reaches a considerable part of society, especially in developing countries.

Some indices created in this regard are the Human Development Index, the Gross National Happiness Index (Bates, 2009), the Inclusive Wealth Index (Roman and Thiry, 2016; Yamaguchi *et al.*, 2019) and the Calvert-Henderson Quality of Life Index (Malkina Pykh and Pykh, 2008). Specifically on development indices, the Pakistani economist Mahbub ul Haq, in association with Amartya Sen, developed the Human Development Index in 1990 (United Nations Development Program (UNDP) Brazil, 1990). This index is adopted worldwide by the United Nations and calculated from the longevity, education, and income dimensions. In terms of Brazilian initiatives, public institutions, and representative entities many indexes stand out (Ferreira and Norris, 2007; Instituto Brasileiro de Geografia e Estatística (IBGE, 2023); Federação das Indústrias do Estado do Rio de Janeiro (FIRJAN, 2014); Fundação de Economia e Estatística Siegfried Emanuel Heuser (FEE, 2017); Instituto Paranaense de Desenvolvimento Econômico e Social (IPARDES, 2017); Superintendência de Estudos Econômicos e Sociais da Bahia (SEI, 2017).

In addition to the institutional initiatives, there are indices created by scholars (Soares *et al.*, 1999; Shikida, 2009; Arruda, 2010; Silva *et al.*, 2012; Melo, 2007; Stege, 2011; Barbosa, 2013;

Barbosa, 2017; Lima and Maia, 2015). Many indexes were built using multivariate statistics which denotes the acceptability and potential contribution of this approach to handle complex phenomena, such as development dimensions. Still, there is limited contribution of these using the Senian approach (Martinetti, 2000; Laderchi *et al.*, 2003; Krishnakumar, 2014; Baujard and Gilardone, 2017; Barbosa, 2017).

Given the interest to build multidimensional development indexes, this study attempts to operationalize Senian approach and its instrumental freedoms through the construction of an index, useful as management parameter, to rank municipalities and put development in geographical perspective.

Fine detail on each stage of factor analysis and the operationalization of Sen's TDF (Sen, 1999) is made available. The index proposed is designed to capture wellbeing trends for the sake of enhancing awareness and encouraging social action based on empirical evidence. This is supported by adopting temporal coordinates, defined according to availability of disaggregated data, which overlapped with a period of considerable economic growth and advancement of Brazilian social policies (Fahel *et al.*, 2014; Alonso, 2017; Maiorano and Manor, 2017; Martins and Palacio, 2020).

The research scope was focused on the municipalities of the State of Mato Grosso do Sul, Brazil, from 2000 to 2010. The region of the case study embraces an international border strip known for contraband and drug trafficking, intensive agricultural production, conflicts for land involving indigenous communities and for being a setting to the Paraguayan war, the deadliest inter-state war in the Latin America's history fought from 1864 to 1870.

This research is divided into four sections; the theoretical reference covers the **variability of municipal development** having Sen's theory of development as freedom as the theoretical framework. The data collection, sampling, selected and analyzed variables are presented in the methodology. The results are presented, followed by the conclusion.

1. Development as freedom

From the perspective of Sen's Theory of Development as Freedom (TDF) (Sen, 1999; 2000), development could be evaluated as a process of expanding the real freedoms that people enjoy. In this theory, economic growth or wealth is a facilitator (instrument) of the process of obtaining

freedoms, not an end in itself of the development process. Sen (1999) listed five main types of instrumental freedoms within the development process, which was described with detail in Andrade *et al.* (2016). The instrumental freedoms considered are: *Political freedoms; Economic facilities; Social opportunities;* G*uarantees of transparency; Protective security*.

According to the Senian approach, instrumental freedoms are interrelated and could reinforce each other. Hence, economic growth (economic facilities) not only contributes to the increase of private incomes but also enables the State to take a more active policy, capable of financing the expansion of the social security network, including protective security devices. Similarly, the creation of social opportunities (public education, health services, freedom of the press) contributes to reducing mortality rates, which may help reduce birth rates and strengthen the influence of women's basic education related to fertility.

Regarding the role of income in obtaining freedoms, there is a range of public or semi-public goods and services offered to the population whose access is free (Sen, 1999; 2000). Five groups of conversion factors influence the conversion of income and personal resources into the quality of life and well-being: *i) Personal heterogeneity; ii) environmental diversities*; *iii) variation in the social climate*; *iv) differences in relative perspectives; v) income distribution within the family*.

In TDF, institutions are crucial since they influence and are influenced by people's instrumental freedoms, as well as affecting factors for converting income into well-being. In this sense, the State, market structures, the legal system, democratic systems, political parties, the provision of education and health services, the media and other communication vehicles, public interest groups and public discussion forums, NGOs, cooperative entities, among others, are analyzed according to their respective contributions to the expansion of freedoms.

2. Methodology

The Relative Municipal Development Index (RMDI) was estimated using multivariate factor analysis (FA) (Cooper, 1983; Melo, 2007) similar to Soares *et al.* (1999), Melo and Parré (2007), Shikida (2009), Arruda (2010), Stege (2011), Silva *et al.* (2012), Barbosa (2013; 2017) and Lima and Maia (2015). The equations used were:

$$Z = \beta F + \varepsilon \quad (1)$$

Where Z represents the vector of standardized variables (Z_is), β is the matrix of loadings or factor loads, F is the vector of common factors, and ε the vector of random errors. The factors F_j, j = 1,2,..., m, were represented by a linear combination of the standardized variables Z_i, i = 1,2,..., p, as in (2):

$$\widehat{F_j} = w_{j1}Z_{1k} + w_{j2}Z_{2k} + \cdots + w_{jp}Z_{pk} \quad (2)$$

Where (Z_{1k}, Z_{2k} ... Z_{pk}) are the observed values of the Z_i standardized variables for the k-th sample element and the w_{ji}, i=1,2,...,p coefficients are the weights of each variable Z_i in the factor F_j, called factor scores (Mingoti, 2005). From (2) we can build the Gross Relative Municipal Development Index (GRMDI). One of the advantages of FA in index construction is that the weights of each variable in the index and the factors are not arbitrary, determined by the linear relationship structure of the variables.

$$GRMDI_i = \frac{\sum_{j=1}^{m} f_j w_{ij}}{\sum_{j=1}^{m} f_j} \quad (3)$$

Where f_j is the proportion of the total variance explained (in decimal scale) by the factor F_j, with j = 1, 2,..., m, w_{ij} are the factor scores of the i-th sample element in the factor F_j, with i = 1,2,..., 78, representing the 78 municipalities, $GRMDI_i$ is the value of the GRMDI for the i-th city, $GRMDI_{min}$ is the lowest observed GRMDI value, and $GRMDI_{max}$ is the highest observed value.

Finally, from the interpolation of the GRMDI values, considering the highest unit (1) and the lowest (0), the Relative Municipal Development Index (RMDI) for each the i-th city was obtained, to which ordination was attributed (equation 4).

$$RMDIi = \left(\frac{GRMDI_i - GRMDI^{min}}{GRM^{max} - GRMDI^{min}}\right) * 100 \quad (4)$$

The definition of municipal development levels was based on the value of the average (M) and the standard deviation (σ) of the RMDI of each year considered. From adapting the classifications proposed by Melo (2007), Stege (2011), and Barbosa (2013; 2017), three levels of development were defined based on average (M) and Standard deviation (σ): High: (RMDI ≥(M+1σ)); Medium (M≤ RMDI <(M+1σ)); Low (RMDI <M). The use of the term 'relative' in the designation of RMDI is justified because it is not possible to use RMDI values for comparisons with other indexes and locations, given the differences in index periods and variables used. The level of development and ranking for the municipalities for 2000 and 2010 were established separately (high, medium and low). The data was explored regarding the changes in ranking from both years.

From the standardized variables (Z_is), the sample correlations matrix was obtained (P_{pxp}). The FA adjustment validation tests were performed based on Kaiser and Rice (1974) and Mingoti (2005), the *Measure of Sampling Adequacy* (MSA) based on Hair Junior *et al.* (2005) and the quantity *m* of factors to be extracted from the FA, was defined based on Kaiser (1958) and Hair Junior *et al.* (2005). The number of factors *m,* the loadings matrix and the diagonal matrix of specific variances were estimated via the main component's method. The communalities were obtained through the main diagonal of the estimated matrix and represents the sum of the square of loadings of each variable; the estimated diagonal matrix provides the unicity (specific variances) of each variable and represents the proportion of the variability associated with the random error (Mingoti, 2005).

The loadings (β_{ij}, i, j = 1,2,..., p) are the coefficients of the factors that measure the correlation between the variables and the extracted m factors. The variables that have the highest loadings become representative of the factor (Mingoti, 2005).

The rotation performed was varimax (Hair Junior *et al.*, 2005). For each sample element k, k = 1,2,..., n, the Least Weighted Square method was used to estimate the factor scores. Statistical procedures were performed in R software, using the packages Rundr, psych and matrix calc (R Core Team, 2018).

2.1. Study area and data source

The study area consisted of 78 municipalities of the State of Mato Grosso do Sul, Midwest Brazil. Currently, agribusiness accounts for majority of gross domestic product in the State. The data used were obtained from the Atlas of Human Development in Brazil, of the United Nations Development Program for the years of 2000 to 2010, built from the Demographic Census of the Brazilian Institute of Geography and Statistics (IBGE).

2.2. Instrumental freedoms and development dimensions: selected variables for the RMDI in Mato Grosso do Sul

The selection of the 24 variables for the composition of the RMDI, which contemplated different dimensions of development and the Senian instrumental freedoms, was based on the literature focused on development indices (Melo, 2007; Arruda, 2010; Stege, 2011; Silva *et al.*, 2012; Barbosa, 2013; Barbosa, 2017; Lima and Maia, 2015) and the TDF of Sen (2000). In table 1, the descriptive statistics of all variables assigned to the development dimensions and instrumental freedoms are shown.

In general, the evolution of indicators was favorable in the established temporal coordinates (table 1), suggesting an improvement in development conditions. Still, in some variables the variation coefficient (CV) increased, suggesting the increase of development disparities among the municipalities.

Compared to Municipal Human Development Index - MHDI[1] (UNDP Brazil, 2013) and other indices identified in the literature, the RMDI contemplated a wider range of development dimensions and all Senian instrumental freedoms (the only one that operationalized the five major ones). The RMDI methodology is more flexible, making it possible to cover local and regional particularities and characteristics. Moreover, from the factor analysis, the weights of both variables

[1] The Municipal Human Development Index, from de United Nations Organization, encompasses only two types of Senian instrumental freedoms (Economic Facilities and Social Opportunities), distributed in three development dimensions and their respectives indicators: *longevity* (life expectancy at birth), *education* (% of the pop. ≥18 years with complete elementary education, % of children 5 to 6 years old attending school, % of 11- to 13-year-olds in final grades of elementary education, % of young people aged 15 to 17 with complete higher education) and *income* (per capita municipal income) (UNDP Brazil, 2013; Barbosa, 2017).

and factors of the RMDI were statistically determined, not arbitrarily, as occurs in the MHDI and other indexes (Barbosa, 2017).

Table 1

Instrumental freedoms, development dimensions, and variables selected for the RMDI

Instrumental Freedoms	*Dimensions*	*Variables*	*Average*		*Median*		*CV (%)*	
			2000	2010	2000	2010	2000	2010
Social opportunities	Health and longevity	Z_1: Life expectancy at birth	69.7	74.3	69.8	74.4	2.3	1.9
		Z_2: Child mortality (up to 1 year old). per 1000 live births	26.5	19.2	26.2	18.8	17.9	13.8
		Z_3: Probability of survival up to 60 years	78.3	82.0	78.3	82.3	2.9	2.5
	Education	Z_4: Gross attendance rate to basic education (%)	94.2	96.3	93.9	96.8	6.4	5.3
		Z_5: Gross attendance rate to elementary education (%)	110.0	110.8	110.0	110.2	5.8	4.6
		Z_6: % of the pop. ≥18 years with complete secondary education	15.1	26.7	13.8	26.7	33.2	23.8
		Z_7: % of the pop. ≥25 years with complete higher education	3.5	7.8	3.0	7.3	51.5	31.6
Economic facilities	Income and labor market	Z_8: Natural logarithm (LN) of per capita income	6.0	6.4	6.0	6.4	5.0	4.0
		Z_9: LN of per capita income. except null income	6.0	6.4	6.0	6.4	4.8	3.8
		Z_{10}: % of the pop. 25-64 years in relation to total population	19.4	48.8	19.5	49.6	4.2	7.3
	Income distribution	Z_{11}: LN of the maximum per capita income of the 1/5 poorest	4.1	5.1	4.2	5.2	10.8	8.9
		Z_{12}: LN of the minimum per capita income of the 1/10 wealthiest	6.6	7.0	6.6	7.0	4.7	3.4
		Z_{13}: Ratio of income per capita of the 10% wealthiest /40% poorest	20.3	15.3	18.2	13.7	42.4	48.6
		Z_{14}: LN per capita income of the 1/5 poorest	4.1	4.6	4.2	4.8	10.8	13.3
		Z_{15}: LN per capita income of the 1/10 wealthiest	7.5	7.8	7.5	7.8	5.2	3.8
Social opportunities	Housing condition	Z_{16}: % of the pop. in households with bathroom and piped water	78.8	91.8	83.4	95.6	15.6	9.9
		Z_{17}: % of the pop. in households with electricity	91.0	97.3	93.2	99.2	9.6	5.0

http://dx.doi.org/10.22136/est20242033

Table 1 (*continuation)*

Instrumental freedoms	*Dimensions*	*Variables*	*Average*		*Median*		*CV (%)*	
			2000	2010	2000	2010	2000	2010
Political freedoms	Social vulnerability	Z_{18}: Dependency ratio (% of pop. <15 e ≥65 years/pop. of 15-64 years)	59.4	50.3	58.1	48.1	11.9	15.8
		Z_{19}: % extremely poor (per capita household income ≤R$ 70 monthly)	10.7	5.9	9.4	3.8	61.4	112.5
Social opportunities		Z_{20}: % of children (≤14 years) extremely poor (per capita household income ≤R$ 70 monthly)	16.1	9.1	15.1	5.7	59.1	104.6
Economic facilities		Z_{21}: % of children (≤14 years) vulnerable to poverty (per capita household income ≤R$ 255 monthly)	71.2	51.1	70.8	52.2	15.6	25.6
Transparency guarantees		Z_{22}: Average per capita income of those vulnerable to poverty (≤R$ 255 monthly)	136.57	156.84	137.05	163.71	10.63	13.49
		Z_{23}: % of the pop. in households density >2 people per dormitory	36.8	26.1	36.0	23.9	23.9	36.2
Protective security		Z_{24}: % of people in households vulnerable to poverty and no one has complete elementary education.	41.1	18.3	40.6	17.2	23.7	45.5

Note: CV (variation coefficient).
Source: authors' own elaboration based on data from AtlasBR (2013).

The variables that represent the dimension of development Health and Longevity (Z_1 to Z_3), Education (Z_4 to Z_7), and Housing Condition (Z_{16} and Z_{17}) correspond to the instrumental freedom *social opportunities.* These dimensions denote basic capabilities directly related to quality of life and the provision of well-being, the basis for developing and strengthening other types of instrumental freedoms (Sen, 1999). In the Brazilian case, the provision of this freedom is strongly dependent on the provision of the State and some institutions' performance, considering the social rights guaranteed by the Brazilian Federal Constitution (1988) especially in the dimensions of Health, Longevity and Education.

The variables representing the Income and Labor Market dimension (Z_8 to Z_{10}) and Income Distribution (Z_{11} to Z_{15}) correspond to the instrumental freedom *economic facilities*. This freedom not only increases the generation and distribution of private income, but also allows more budgetary space for social policies, contributing to the improvement of social opportunities and the reduction of social vulnerabilities (Sen, 1999).

The variables representing the dimension of development Social Vulnerability (Z_{18} to Z_{24}) represent all five main instrumental freedoms proposed by Sen (2000). Likely, vulnerabilities

associated with income and its distribution, housing, and educational condition are the result of the country's own economic, productive, social, political, and institutional structure. These are influenced by changes in these development components over time, changes that are also responsive to the agency. As an example, the Bolsa Família Program, an institutional mechanism of conditional income transfer in Brazil, which was able to reduce poverty and inequality in the 2000s (Paes Souza and Santos, 2009), alleviating social vulnerability of beneficiaries (*protective security)*.

3. Results

3.1. Validation of the multivariate tool: adherence of the TDF and its instrumental freedoms

The adjustment tests of the FA (2000 and 2010) showed that variables were not mutually independent (Barlett's sphericity test: 3797.05; 4690.95 (p-values < 0.001). The models were consistent (KMO: 0.84; 0.88) (Kaiser and Rice, 1974), and Mean Error (0.0012; -0.0019) and Square Root Mean Square Error (0.0255; 0.0255) were close to zero, indicating suitable adjustment of the FA models. In the Measure of Sampling Adequacy (MSA), all variables had acceptable values from the FA source (above 0.5), except for variables Z_4 and Z_5 in the model for 2010. Variables Z_4 and Z_5 in 2010 did not show other adjustment problems (communalities) nor compromised the adjustment, therefore, they were maintained in the proposed model. Based on the Kaiser (1958) criterion, six factors (m=6) were retained for the year 2000 and four factors (m=4) for the year 2010, corresponding to eigenvalues higher than the unit (1). Overall, the factors retained, accounted for more than 90% of the total variability of the data (table 2).

Table 2

Eigenvalues, individual variance explained, and accumulated variance (2000 and 2010)

Eigenvalues (λ_i)		*% Explained variance*		*% Accumulated variance*	
2000	2010	2000	2010	2000	2010
13.349	**15.266**	**55.621**	**63.609**	55.62	63.61
2.955	**3.037**	**12.311**	**12.652**	67.93	76.26
2.184	**2.114**	**9.101**	**8.810**	77.03	85.07

Table 2 (*continuation)*

Eigenvalues (λ_i)		*% Explained variance*		*% Accumulated variance*	
2000	2010	2000	2010	2000	2010
1.237	**1.339**	**5.155**	**5.578**	82.19	**90.65**
1.118	0.495	**4.660**	2.064	86.85	92.71
1.001	0.467	**4.171**	1.946	**91.02**	94.66
0.532	0.301	2.216	1.256	93.24	95.92
0.426	0.214	1.775	0.890	95.01	96.81
0.325	0.178	1.352	0.743	96.36	97.55
0.207	0.162	0.862	0.675	97.23	98.22
0.144	0.118	0.601	0.493	97.83	98.72
0.117	0.086	0.487	0.357	98.31	99.07
0.106	0.070	0.441	0.290	98.75	99.36
0.076	0.062	0.318	0.260	99.07	99.62
0.061	0.026	0.252	0.109	99.32	99.73
0.056	0.021	0.232	0.088	99.56	99.82
0.034	0.018	0.143	0.075	99.70	99.90
0.026	0.009	0.109	0.036	99.81	99.93
0.021	0.007	0.088	0.028	99.90	99.96
0.016	0.005	0.067	0.023	99.96	99.98
0.005	0.003	0.019	0,011	99.98	99.99
0.003	0.001	0.010	0.005	99.99	99.998
0.002	0.000	0.007	0.001	99.999	99.999
0.000	0.000	0.001	0.001	100	100

Source: authors' own elaboration.

3.2. The determinants of municipal development explored

The output of FA for year 2000 and 2010 is presented in table 3 and table 4, respectively.

Table 3

Unrotated loadings, after rotation, communalities, unicities, and total variance (2000)

Variables	*Loadings*												*Communalities*	*Unicities*	*Total Variance*
	Unrotated (F)						After rotation (Fr)								
	F1	F2	F3	F4	F5	F6	Fr1	Fr2	Fr3	Fr4	Fr5	Fr6			
Z_1	0.70	0.19	-0.38	0.50	0.01	-0.15	0.30	0.15	0.14	0.26	**0.86**	-0.04	0.94	0.06	1
Z_2	-0.70	-0.18	0.38	-0.51	0.00	0.15	-0.29	-0.16	-0.13	-0.25	**-0.87**	0.05	0.95	0.05	1
Z_3	0.65	0.02	-0.24	0.42	0.02	-0.38	0.25	0.20	0.25	0.00	**0.79**	0.09	0.80	0.20	1
Z_4	0.43	-0.10	0.75	0.13	0.34	-0.20	0.05	0.28	0.25	0.07	0.03	**0.89**	0.93	0.07	1
Z_5	0.24	-0.28	0.71	0.25	0.51	0.02	0.10	0.14	-0.10	0.03	-0.04	**0.96**	0.96	0.04	1
Z_6	0.69	0.44	0.11	-0.28	-0.12	-0.39	0.13	0.25	**0.86**	0.27	0.21	0.02	0.93	0.07	1
Z_7	0.65	0.38	0.12	-0.38	-0.02	-0.45	0.18	0.16	**0.90**	0.17	0.14	0.07	0.92	0.08	1
Z_8	0.88	0.40	-0.02	-0.03	0.10	0.22	0.48	0.20	0.38	**0.69**	0.29	0.09	0.99	0.01	1
Z_9	0.85	0.44	-0.01	-0.03	0.12	0.22	0.46	0.16	0.39	**0.71**	0.28	0.09	0.98	0.02	1
Z_{10}	0.76	-0.30	0.37	0.12	-0.26	-0.01	0.32	**0.79**	0.15	0.09	0.18	0.31	0.89	0.11	1
Z_{11}	0.90	-0.29	-0.19	-0.07	0.16	0.12	**0.86**	0.32	0.16	0.13	0.28	0.12	0.97	0.03	1
Z_{12}	0.86	0.23	-0.15	-0.20	0.21	-0.04	**0.62**	0.09	0.54	0.37	0.29	0.07	0.90	0.10	1
Z_{13}	-0.06	0.84	0.31	0.23	-0.15	0.29	-0.55	-0.03	0.08	**0.81**	0.02	0.00	0.97	0.03	1
Z_{14}	0.88	-0.33	-0.18	-0.06	0.05	0.12	**0.81**	0.41	0.13	0.10	0.27	0.07	0.93	0.07	1
Z_{15}	0.72	0.58	0.08	0.03	0.03	0.33	0.26	0.17	0.32	**0.85**	0.22	0.06	0.98	0.02	1
Z_{16}	0.88	-0.19	0.07	-0.02	-0.16	0.14	0.58	**0.62**	0.19	0.24	0.20	0.10	0.86	0.14	1
Z_{17}	0.67	0.07	0.29	-0.13	-0.35	0.04	0.20	**0.63**	0.37	0.30	0.02	0.06	0.68	0.32	1
Z_{18}	-0.83	0.25	-0.34	-0.14	0.21	-0.06	-0.38	**-0.76**	-0.15	-0.18	-0.21	-0.32	0.93	0.07	1
Z_{19}	-0.85	0.39	0.23	0.15	-0.04	-0.06	**-0.85**	-0.39	-0.17	0.01	-0.23	-0.01	0.96	0.04	1
Z_{20}	-0.83	0.40	0.23	0.15	-0.10	-0.07	**-0.87**	-0.34	-0.16	0.01	-0.21	-0.05	0.94	0.06	1
Z_{21}	-0.82	-0.03	0.16	0.20	-0.35	0.03	**-0.73**	-0.03	-0.42	-0.23	-0.25	-0.17	0.86	0.14	1
Z_{22}	0.84	-0.30	-0.09	0.04	-0.09	0.21	**0.68**	0.53	0.04	0.18	0.25	0.05	0.85	0.15	1
Z_{23}	-0.63	0.39	-0.24	-0.07	0.44	0.08	-0.25	**-0.83**	-0.12	0.09	-0.15	-0.10	0.81	0.19	1
Z_{24}	-0.90	-0.26	-0.13	0.10	0.09	0.12	-0.36	-0.42	**-0.60**	-0.40	-0.29	-0.13	0.93	0.07	1
Explained var. (%)	55.62	12.31	9.10	5.15	4.66	4.17	25.77	6.91	13.68	3.37	12.81	8.47			
Accumulated var. (%)	91.01						91.01								

Source: authors' own elaboration.

Each rotated factor (Fr) was named (labeled) in accordance to the variables that showed the most distinct loading values using data from year 2000 (table 3) and data from 2010 (table 4). The detailed rationale and interpretation of the first two rotated factors (Fr1 and Fr2 in year 2000; Fr1b and Fr2b in year 2010) are described further. Description of additional rotated factors and unrotated factors is not stressed in the present study, although they referred to basic education, income and its distribution. Thus, they werestrongly related to Senian instrumental freedoms *social opportunities* and *economic facilities*.

In the rotated factors (Fr) of year 2000 (table 3), the variables Z_{11}, Z_{12}, $Z_{14,}$ Z_{19}, Z_{20}, Z_{21} and Z_{22} were strongly correlated with the Fr1 factor. The Fr1 explained 25.77% of the model's variability, the main determinant of development in the municipalities in year 2000. Given the characteristics of the variables with distinct loadings, factor Fr1 was named *Income and its Distribution*. Positive loadings were observed in variables Z_{11}, Z_{12}, Z_{14} and Z_{22}, all of them related to *Income and its distribution*. This suggests contribution of these variables to the municipal development (the increase in these variables increases the level of development). The variable Z_{12} also contributed positively to the development despite representing an aspect of income concentration.

The Neokaleckian literature, specifically the economic growth models with income distribution, support these results. Considering an investment function dependent on the share of profit in income (or the rate of profit), literature shows that, in profit-led growth regimes, a transfer of income towards profits (capitalists) pulls economic growth (Dutt, 1984; Bhaduri and Marglin, 1990; Hein, 2014). Although these models operate with functional distribution of income (Z_{12} refers to the personal distribution of income), we considered that the argument remained valid, and we assumed that mainly capitalists formed the upper strata of the distribution. In a profit-led regime, greater concentration of income leads to greater growth by increasing the share of profits in aggregate demand.[2] Although not consensual, there is empirical evidence that the economic growth in Brazil during the 2000s (considering the participation of the external sector), occurred mostly under a profit-led regime (Araujo and Gala, 2012; Azevedo *et al.*, 2022). This likely corroborates our arguments. In the Senian approach, economic growth increases personal

[2] See Carvalho and Rezai (2016) for detail on the role of personal income distribution in a Kaleckian approach.

opportunities to enjoy economic resources for consumption, production, or exchange purposes. In turn, this contributes to the promotion of development via economic facilities.

The variables that presented loadings with negative coefficients and were more strongly correlated with the Fr1 factor in 2000 were Z_{19}, Z_{20} and Z_{21}, which all related to the social vulnerabilities associated with the destitution of income of the total population and children. The negative coefficient of loadings shows that the increase in the value of these variables contributed negatively to the promotion of development in the municipalities, a fact expected by the TDF. Sen (1999) argued that despite the problems of converting income into economic entitlements, the availability of financial resources for consumption purposes, production or exchange is a constituent part of the instrumental freedom *economic facilities*, which contributes to increasing economic entitlements and promoting development.

The Fr2 factor explained 16.91% of the total variability and was the second main determinant of municipal development in 2000. The variables whose loadings were more strongly correlated with Fr2 were Z_{10}, Z_{16}, Z_{17}, Z_{18} and Z_{23}. The loadings with positive coefficient were Z_{10}, Z_{16} and Z_{17}, therefore, factor Fr2 was named *Demographic-Housing*. The growth of the population in active age (25 to 64 years old) represents a potential for significant economic growth and increased labor productivity, a phenomenon known as the demographic bonus (IPEA, 2010). This circumstance increases economic entitlements and expands *economic facilities*. The improvement of housing conditions, on the other hand, increases well-being and reflects the influence of social arrangements and institutions focused on services and infrastructure of a social nature (Andrade *et al.*, 2016). This promotes the expansion of freedoms and development through the expansion of *social opportunities*.

Table 4

Unrotated loadings, after rotation, communalities, unicities, and total variance (2010)

Variables	*Loadings*								*Communalities*	*Unicities*	*Total Variance*
	Unrotated (Fb)				After rotation						
	F1b	F2b	F3b	F4b	Fr1b	Fr2b	Fr3b	Fr4b			
Z_1	0.58	0.57	-0.47	0.34	0.18	0.27	**0.94**	-0.05	0.99	0.01	1
Z_2	-0.58	-0.57	0.47	-0.34	-0.18	-0.27	**-0.94**	0.05	0.99	0.01	1

Table 4 *(continuation)*

Variables	*Loadings*								*Loadings*	*Unicities*	*Total Variance*
	Unrotated (Fb)				Not rotated						
	F1b	F2b	F3b	F4b	Fr1b	Fr2b	Fr3b	Fr4b			
Z_3	0.58	0.57	-0.47	0.34	0.18	0.26	**0.94**	-0.05	1.00	0.00	1
Z_4	0.03	0.27	0.81	0.42	-0.08	0.19	-0.05	**0.92**	0.90	0.10	1
Z_5	0.00	0.12	0.76	0.56	0.01	0.00	-0.05	**0.95**	0.91	0.09	1
Z_6	0.71	0.43	0.25	-0.31	0.25	**0.87**	0.17	0.08	0.86	0.14	1
Z_7	0.64	0.43	0.24	-0.41	0.17	**0.88**	0.10	0.01	0.82	0.18	1
Z_8	0.92	0.27	0.14	-0.15	0.54	**0.77**	0.29	0.07	0.97	0.03	1
Z_9	0.90	0.31	0.14	-0.17	0.50	**0.79**	0.30	0.06	0.96	0.04	1
Z_{10}	0.89	-0.23	-0.04	0.12	**0.86**	0.27	0.23	0.01	0.87	0.13	1
Z_{11}	0.97	-0.19	0.02	-0.02	**0.88**	0.43	0.17	-0.02	0.98	0.02	1
Z_{12}	0.87	0.31	0.12	-0.19	0.47	**0.77**	0.29	0.04	0.90	0.10	1
Z_{13}	-0.69	0.58	0.06	-0.12	**-0.91**	0.03	0.03	0.06	0.83	0.17	1
Z_{14}	0.97	-0.21	0.01	0.05	**0.89**	0.37	0.20	0.02	0.98	0.02	1
Z_{15}	0.72	0.49	0.19	-0.15	0.25	**0.79**	0.33	0.15	0.82	0.18	1
Z_{16}	0.88	-0.33	0.00	0.12	**0.91**	0.22	0.15	0.03	0.90	0.10	1
Z_{17}	0.84	-0.32	0.04	0.03	**0.85**	0.27	0.07	0.00	0.81	0.19	1
Z_{18}	-0.94	0.23	0.01	-0.04	**-0.88**	-0.35	-0.18	0.01	0.93	0.07	1
Z_{19}	-0.94	0.28	0.00	-0.11	**-0.92**	-0.28	-0.19	-0.03	0.97	0.03	1
Z_{20}	-0.93	0.28	0.00	-0.14	**-0.92**	-0.26	-0.21	-0.05	0.97	0.03	1
Z_{21}	-0.90	-0.06	-0.03	0.16	**-0.65**	-0.61	-0.21	0.06	0.84	0.16	1
Z_{22}	0.92	-0.22	-0.03	0.08	**0.87**	0.31	0.21	0.00	0.90	0.10	1
Z_{23}	-0.75	0.38	0.08	0.08	**-0.81**	-0.21	-0.02	0.17	0.72	0.28	1
Z_{24}	-0.96	0.02	-0.05	0.04	**-0.77**	-0.54	-0.24	-0.03	0.94	0.06	1
Explained var. (%)	63.61	12.65	8.81	5.58	44.27	24.18	14.50	7.71			
Accumulated var. (%)	90.65				90.65						

Source: authors' own elaboration.

The variables strongly correlated with the Fr2 factor, with negative loading coefficients (Z18 and Z23), show that the increase in their values contributed adversely to municipal development. The increase in the dependency ratio represents an increase in the population that is not in the active age in relation to those in the other age group, a phenomenon that acts in the opposite direction of the demographic bonus and reduces the potential for economic growth and

labor productivity. The variable Z23, on the other hand, is associated with a vulnerability factor of home infrastructure, which compromises the well-being.

For 2010, the main determinant of development of municipalities (Fr1b), explained 44.27% of the total variability (table 4). Factor Fr1b was named Income and its Distribution-Housing-Vulnerability. This is empirical support for what Sen (1999) called the empirical interrelationships between instrumental freedoms, which supplement each other and could reinforce each other, contributing to the expansion of personal freedoms and the promotion of development. Factor Fr1b represented the instrumental freedoms economic facilities (Z10, Z11, Z13 and Z14) and social opportunities (Z16 and Z17). It also represented all five main Senian instrumental freedoms in the variables of the social vulnerability dimension (Z18 to Z24), as well as the two already mentioned, the political freedoms, transparency guarantees and protective security, and the institutional influences that these freedoms reflect.

The loadings of variables Z10, Z11, Z14 and Z22 (related to income and the employment market), as well as Z16 and Z17 (housing condition), suggests a direct contribution to the development of the cities in 2010. The increase in the values of the variables related to income represents the increase in economic facilities, mainly the expansion of the coverage of water supply services, electricity, and the presence of bathrooms in the residences, increasing social opportunities, contributing to people's well-being and development. The negative loadings suggest an adverse contribution to municipal development. The variable Z13 is an indicator of income concentration, which economic theory predicts to be negative for the country's development, which would reduce economic facilities, despite the New-Kaleckian theory indicating that such concentration could promote economic growth if it originated from increased profits in a profit-led regime. The variable Z18 represents a reduction in the population in active age, which reduces the potential for economic growth. The variables Z19 to Z21 represent vulnerabilities associated with low family income, which decreases economic facilities. The variables Z23 and Z24 reflect the deterioration of several Senian instrumental freedoms.

The Fr2b factor was named Educational-Income and its Distribution (positive loadings of Z6, Z7, Z8, Z9, Z12 and Z15). The education variables have been mentioned as the associated positive externalities, which increase social opportunities. The other variables reflect the increase in economic facilities.

Notably, several dimensions of development and other instrumental freedoms appeared simultaneously, in year 2000 and 2010. In year 2000 (table 3) and year 2010 (table 4), rotated factors related to the income and its distribution contributed most to explaining municipal development, with the emergence of the importance of the instrumental freedom economic facilities in expanding personal freedoms.

Still, income contributed together with distribution of income, education, health, longevity, housing and vulnerability. In turn, another crucial instrumental freedom for development was social opportunities. The influence of institutions on the freedoms discussed is strategic in the TDF and appealing for the promotion of development.

Overall, the association of the loadings with the rotated factors was straightforward, reinforcing the empirical interrelationships between instrumental freedoms and supporting the adherence of the TDF and its instrumental freedoms in explaining the determinants of municipal development.

3.3. Geographic structure of (under) development in the Midwest of Brazil

In 2000, 17 cities (21.79%) were considered to have a high level of development, 28 (35.89%) a medium level of development, and 33 municipalities (42.33%, the largest percentage) had a low level of development. The levels of development defined for year 2000 were: high: RMDI≥72.22; medium: 60≤RMDI<72.22; low: RMDI<60. The threshold established for the lowest level was RMDI below 60, the average of RMDI for 2000.

In 2010, only six municipalities (7.69%) were classified with high level development. The levels of development defined for 2010 were: high: RMDI≥92.36; medium: 76.15≤RMDI<92.36; low: RMDI<76.15. The municipalities classified as having medium level of development were 44 (56.41%), 10 of which declined from high to medium level in 2010, 24 remained at a medium level, and 10 rose from low to medium level in 2010. The number of municipalities classified as having low level of development in 2010 were 28 (35.89%). There was a reduction in the proportion of municipalities with low and high development levels towards a medium level of development from 2000 to 2010.

The ranking of municipalities, putting the Relative Municipal Development Index (RMDI) in geographic perspective, is presented in figure 1. This showed a geographic structure (contiguity or corridor) of depressed municipalities in both years considered, configuring poorly developed subregions in Midwest Brazil, facing economic stagnation and the perpetuation of precarious services related to individual well-being.

A total of 20 cities were associated to this corridor, out of 33 with a low development level (60.60%) and 25.64% of the total municipalities in the state. Notably, there was an involution of three municipalities, from 31st in 2000 to 60th in 2010, 3rd in 2000 to 58th in 2010, and 8th in 2000 to 65th in 2010 (labels 36, 69 and 56 in figure 1, respectively). The corridor is located within the Brazilian Border Strip with Paraguay[3], extending from municipalities in the south of the state, close to the state of Paraná, to municipalities located in the West, close to the region bathed by the Paraguay River (figure 1).

The geographical structure of depressed municipalities persisted from 2000 to 2010, differentiated from 2000 by incorporating the four cities and cutting off one (36, 38, 56, 61 and 46 in figure 1). Twenty-two municipalities (28.20% of the state's total) were located in this corridor.

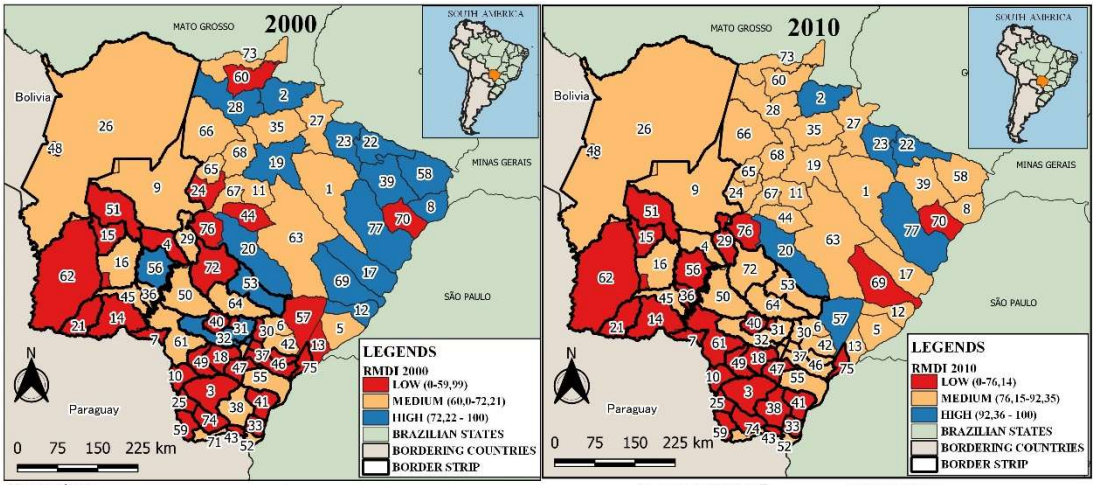
In general, the cities within the corridor have low population density, low contingent and low population growth rates, low real GDP and per capita GDP, low dynamism of income and employment generation and formalization of the labor market, as well as precarious human development indicators compared to other municipalities in the state. Weaknesses in human development and human capital retention, characteristic of border regions, hinder innovation generation, industrialization, the formation of a developmental mindset, political engagement, collective learning, leadership and entrepreneurship. Together, these contribute to explaining the maintenance of poverty and low levels of development over time. It likely mirrors a rather perverse and vicious circle of poverty and underdevelopment that impairs better living conditions, expansion of freedoms and opportunities (Nurkse, 1957; Myrdal, 1968; Sen, 2000; Pelinski Raiher and

[3] The Brazilian Border Strip includes the municipalities located within a 150-kilometer-wide internal strip entering the national territory, parallel to its international land dividing line. This division contemplates Law No. 6,634 of May 2, 1979, regulated by Decree No. 85,064 of August 26, 1980, approved by the 1988 Federal Constitution (IBGE, 2023).

Ferrera de Lima, 2018; Ferrera de Lima, 2020), despite advances in economic growth, the labor market, and social policies in the 2000s.

Figure 1

Contiguity of depressed municipalities revealed by ranking municipalities with the proposed Relative Municipal Development Index (RMDI)



Municipalities
1. ÁGUA CLARA
2. ALCINÓPOLIS
3. AMAMBAI
4. ANASTÁCIO
5. ANAURILÂNDIA
6. ANGÉLICA
7. ANTÔNIO JOÃO
8. APARECIDA DO TABOADO
9. AQUIDAUANA
10. ARAL MOREIRA
11. BANDEIRANTES
12. BATAGUASSU
13. BATAYPORÃ
14. BELA VISTA
15. BODOQUENA
16. BONITO
17. BRASILÂNDIA
18. CAARAPÓ
19. CAMAPUÃ
20. CAMPO GRANDE
21. CARACOL
22. CASSILÂNDIA
23. CHAPADÃO DO SUL
24. CORGUINHO
25. CORONEL SAPUCAIA
26. CORUMBÁ
27. COSTA RICA
28. COXIM
29. DOIS IRMÃOS DO BURITI
30. DEODÁPOLIS
31. DOURADINA
32. DOURADOS
33. ELDORADO
34. FÁTIMA DO SUL
35. FIGUEIRÃO
36. GUIA LOPES DA LAGUNA
37. GLÓRIA DE DOURADOS
38. IGUATEMI
39. INOCÊNCIA
40. ITAPORÃ
41. ITAQUIRAÍ
42. IVINHEMA
43. JAPORÃ
44. JARAGUARI
45. JARDIM
46. JATEÍ
47. JUTI
48. LADÁRIO
49. LAGUNA CARAPÃ
50. MARACAJU
51. MIRANDA
52. MUNDO NOVO
53. NOVA ALVORADA DO SUL
54. NOVO HORIZONTE DO SUL
55. NAVIRAÍ
56. NIOAQUE
57. NOVA ANDRADINA
58. PARANAÍBA
59. PARANHOS
60. PEDRO GOMES
61. PONTA PORÃ
62. PORTO MURTINHO
63. RIBAS DO RIO PARDO
64. RIO BRILHANTE
65. RIO NEGRO
66. RIO VERDE DE MATO GROSSO
67. ROCHEDO
68. SÃO GABRIEL DO OESTE
69. SANTA RITA DO PARDO
70. SELVÍRIA
71. SETE QUEDAS
72. SIDROLÂNDIA
73. SONORA
74. TACURU
75. TAQUARUSSU
76. TERENOS
77. TRÊS LAGOAS
78. VICENTINA

Source: authors' own elaboration in the ArcGIS program - Environmental Systems Research Institute (ESRI) (2011). ArcGIS Desktop: Release 10. Redlands, CA: Instituto de Pesquisa de Sistemas Ambientais.

Notably, the threshold (cutting value) of the RMDI for a high level of development increased from 72.22 in 2000 to 92.36 in 2010, due to the increase in the average of the RMDI. Furthermore, fixing a global value of mean and standard deviation, instead of handling two different sets of parameters (year 2000 and 2010, respectively) did not change the disclosure of a prevailing corridor of depressed municipalities. In average, it portraited an expansion of human freedoms.

The observed increase in the average level of development of the municipalities in the period considered is likely due to several conditions in Brazil. The pro-poor economic growth experienced by Brazil was fundamental for the improvement of development indicators in the decade of 2000. Among other reasons, this is due to the increase in government revenues for

http://dx.doi.org/10.22136/est20242033

financing social spending (health, education, social assistance, and employment programs) (Maiorano and Manor, 2017) and the generation and formalization of jobs (Amuka *et al.*, 2019). The increase of development points to the determining role of state and municipal social spending on human capital and the growth of the service sector (essentially by the Public Administration) to reduce poverty and prompt development (Martins and Palacio, 2020).

Furthermore, in much of the 2000s, Brazilian economic growth was stimulated by the "commodities cycle", marked by the higher prices of agricultural commodities, oil, animal protein and other Brazilian export products, generating a commercial surplus and exchange rate valuation (Pelinski Raiher and Ferrera de Lima, 2018; Pelinski Raiher *et al.*, 2017).

Several Brazilian social programs have likely contributed to the expansion of freedoms and promotion of development, among them: i) Bolsa Familia Program, conditional on direct income transfer under the requirement of vaccination and school attendance of children, designed to break the vicious circle of poverty (Paes Souza and Santos, 2009; Tiburcio, 2018); ii) expansion of primary health care services through the Brazilian Unified Health System (SUS) (Maiorano and Manor, 2017); iii) Fome Zero Program, successful in reducing poverty and food insecurity, especially in rural areas (De Mattos and Bagolin, 2017); iv) Mais Medicos Program, the Fund for the Maintenance and Development of Basic Education (Fundeb), Minha Casa Minha Vida Program and the National Policy for Regional Development (Fahel *et al.*, 2014; Alonso, 2017). In addition to these, there are the Social Security Continuous Cash Benefit, Employment, Income and Insurance policies, and the National Program for Strengthening Family Farming (Pronaf) (BNDES, 2024); Ministério do Desenvolvimento e Assistência Social, Família e Combate à Fome (MDS, 2024); Ministério do Trabalho e Emprego (MTE, 2024).

The decline in poverty and social inequality in Brazil is likely a reflection of income growth, education, the formalization of labor, and the effects programs such as Bolsa Familia (Góes and Karpowicz, 2017; Leite, 2020). It reflects the reduction of wage differentials between groups of workers, the real increase in wages and the minimum wage (reference for the formal and informal job market, for social security and social assistance benefits). Likewise, it reflects the demographic transition (reduction of children up to 14 years, an age group significantly affected by poverty, the increase in the proportion of older people and groups that are more protected against poverty) and

http://dx.doi.org/10.22136/est20242033

reflects the reduction of dependency ratio (Departamento Inter-sindical de Estadística y Estudios Socio-Económicos (DIEESE, 2010; Paiva, 2016; Sotomayor, 2019).

In the region considered, data from the Brazilian Institute of Geography and Statistics (IBGE, 2017) shows that the Gini coefficient of the area of agricultural establishments was 0.856 in 1996, which increased to 0.867 in 2017, besides showing a reduction in the period for only 24 municipalities. Likely, this relates to high land concentration. One of the historical conditions of income inequality in Brazil is the unequal ownership of physical goods. Typically, this refers to real estate, such as land, with expected effects on intergenerational social mobility (Ondetti, 2016).

Currently, much of the economic growth in the Midwest of Brazil is marked by commodity driven structures linked to large rural properties that adopt intensive agricultural production. These structures operate close to smallholders, mainly family-based agriculture, rural settlements and indigenous communities. Typically, these regions have lower levels of urbanization and configure subsistence agriculture, thus, presenting little expressiveness of their industrial or agroindustrial activities (Barbosa *et al.*, 2020; Secretaria de Estado de Meio Ambiente e Desenvolvimento Econômico do Mato Grosso do Sul SEMADE/MS, 2023).

Conclusions

The technique, alongside to the proposition of a development index, allowed operationalizing Amartya Sen's theory of Development as Freedom and its instrumental freedoms. This was demonstrated through the extraction of factors, the main determinants of development. The creation of the RMDI index was built from variables that captured all five main Senian instrumental freedoms, in addition to the institutional influences that these freedoms reflect. Thus, one of the main criticisms of the literature to the referred approach was overcome: the difficulty of conceptual operationalization.

The main determinant of development in 2000 covered essentially variables related to income and its distribution. This suggests that income and the productive structure, which influences the distribution of income, were fundamental to the understanding of the process of municipal development that year. However, in 2010 the main determinant of development covered not only the variables related to income and its distribution but also housing conditions and social vulnerabilities. This reinforces the function attributed to income in Amartya Sen's theory, placing

it as an important instrument to expand human freedoms without disregarding the function of other dimensions of development in the expansion of these freedoms.

Our study was able to bridge some concepts related to individual´s freedoms and well-being to the appreciation of municipal heterogeneity, revealing geographical structure of municipal development. We encourage the usage of this alternative approach and theory to reveal and indicate spatial specificities that may facilitate decision making for private and state intervention. Alone, Brazil has over 15,000 km of terrestrial frontiers and shares land boundaries with nine countries. Perhaps future studies should work to unmask continental-sized corridors of underdevelopment.

The outstanding questions are: are the corridors a consequence of the modus operandi of productive structures that prevail? Do corridors prevail and persist from income leaking or because of asymmetric benefits coming from governmental agendas? In the figurative sense, one could picture corridors as the materialization of inequality, corruption, lack of dignity and the ability of people to choose.

The indicators that composed the main determining factors of development pose as valuable guidelines for research and politic agendas interested on mapping, capturing and operating tensions, poverty and levels of violence in territorial boundaries. We defend that the private initiative and public policymakers should break the circular and cumulative causes that reproduce underdevelopment by addressing solutions to deal with problems that reach a considerable part of society. No doubt, there is a long road to travel given the current Brazilian situation of economic and political crisis, tax restriction and limited budgetary resources, aggravated by the covid-19 Pandemic.

Finally, our study also instigates research about the inherent culture and values that still echo from the historic Paraguayan war, and its effect on regional development. The study reinforces practical and theoretical justification to encourage innovative cross-border cooperation, leadership and governance agendas for peripheral regions. The formation and retention of human capital in these regions are key elements to enable the reduction of regional development disparities, to discuss socio-environmentally sustainable and culturally diverse development models, to foster industrialization, creativity, technological innovation, entrepreneurship, a sense of belonging, and social capital, especially in border regions that have structural elements that feed poverty and social

inequalities. Freedoms and well-being of people could potentially increase, and citizens could benefit from this.

References

Alonso, Juan (2017). Las escalas de experiencia de inseguridad alimentaria como perspectiva de la pobreza en Brasil [Doctoral thesis, Universidade Estadual de Campinas]. Repositório da Produção Científica e Intelectual da Unicamp. https://acortar.link/Dm9hzS

Amuka, Joseph; Asogwa, Fredrick; Agu, Anthony and Ugwu, Chukwuma (2019). The Determinants of pro-poor growth: evidence from Brazil. *American International Journal of Business and Management Studies*, *1*(2), 10-17. https://doi.org/mjr9

Andrade, Sarah; Pires, Mônica; Ferraz, Marcelo and Pinheiro, Maurício (2016). Índice de desenvolvimento como liberdade: uma proposta teórico-metodológica de análise. *Desenvolvimento em questão*, *14*(34), 5-59. https://doi.org/mjsb

Araujo, Eliane and Gala, Paulo (2012). Regimes de crescimento econômico no Brasil: evidências empíricas e implicações de política. *Estudos avançados*, *26*(75), 41-56. https://doi.org/mjsd

Arruda, Caroline (2010). Índice de desenvolvimento sustentável e agronegócio: uma análise multivariada [Master thesis, Universidade Federal de Goiás]. Biblioteca Digital de Teses e Dissertações. https://acortar.link/ghZuBE

AtlasBR (2013). Atlas do Desenvolvimento Humano no Brasil. Instituto de Pesquisa Econômica Aplicada-Fundação João Pinheiro. http://www.atlasbrasil.org.br

Azevedo, Laís; Fonseca, Pedro and Missio, Fabricio (2022). Distribuição de renda e regime de crescimento econômico no Brasil. *Brazilian Journal of Political Economy*, *42*(1), 25-47. https://doi.org/mjsf

Barbosa, Francis (2017). Índice de Desenvolvimento Relativo, IDH-M e IFDM: em busca da operacionalização das liberdades instrumentais de Amartya Sen. *Ensaios FEE*, *38*(2), 295-327. https://acortar.link/K2x6QY

Barbosa, Francis (2013). Índice de desenvolvimento dos municípios da microrregião de Dourados-MS: uma aplicação da análise fatorial [Master thesis, Universidade Federal da Grande Dourados], Repositório Institucional da UFGD. https://acortar.link/NURaIZ

Barbosa, Francis; Balsalobre, Cristiane y Sonaglio, Claudia (2020). Índice de pobreza humana municipal para Mato Grosso do Sul. *Economia & Região, 8*(1), 47-65. https://doi.org/mjsg

http://dx.doi.org/10.22136/est20242033

Bates, Winton (2009). Gross national happiness. *Asian-Pacific Economic Literature*, *23*(2), 1-16. https://doi.org/cjwb2t

Baujard, Antoinette and Gilardone, Muriel (2017). Sen is not a capability theorist. *Journal of Economic Methodology*, *24*(1), 1-19. https://doi.org/mjsh

Bhaduri, Amit and Marglin, Stephen (1990). Unemployment and the real wage: the economic basis for contesting political ideologies. *Cambridge Journal of Economics*, *14*(4), 375-393, https://acortar.link/YgEqpv

BNDES (Banco Nacional de Desenvolvimento) (2024). Programa Nacional de Fortalecimento da Agricultura Familiar (Pronaf). BNDES. https://l1nk.dev/pcQxd

Carvalho, Laura and Rezai, Armon (2016). Personal income inequality and aggregate demand. *Cambridge Journal of Economics*, *40*(2), 491-505. https://doi.org/f8dp9d

Constituição da República Federativa do Brasil (October 5th, 1988). *Diário Oficial*, Congresso Nacional. https://acortar.link/0oQ8yb

Cooper, John (1983). Factor analysis: an overview. *The American Statistician*, *37*(2), 141-147. https://doi.org/mjsj

De Mattos, Ely José and Bagolin, Izete Pengo (2017). Reducing poverty and food insecurity in rural Brazil: the impact of the Zero Hunger Program. *EuroChoices*, *16*(1), 43-49. https://doi.org/mjsk

DIEESE (Departamento Inter-sindical de Estadística y Estudios Socio-Económicos) (2010). *Salário-mínimo: instrumento de combate à desigualdade*, DIEESE.

Dutt, Amitava Krishna (1984). Stagnation, income distribution, and monopoly power. *Cambridge Journal of Economics*, *8*(1), 25-40, https://acortar.link/PH5imG

ESRI (Environmental Systems Research Institute) (2011). ArcGIS Desktop (version 10). http://www.esri.com/software/arcgis/

Fahel, Murilo; Leite, Guilherme and Teles, Letícia (2014). Pobreza multidimensional no estado de Minas Gerais: uma mensuração para além da renda. *Revista Brasileira de Monitoramento e Avaliação, 8,* 51-69. https://acortar.link/fnozDa

FEE (Fundação de Economia e Estatística Siegfried Emanuel Heuser) (2017). Índice de Desenvolvimento Socioeconômico (IDESE). Departamento de Economia e Estatística do Rio Grande do Sul. https://acortar.link/qDHPq0

Ferreira, Francisco and Norris, Gisele (2007). BNDES lança Índice de Desenvolvimento Social. *BNDES Visão do Desenvolvimento*, 29, 1-8. https://acortar.link/SorBgv

Ferrera de Lima, Jandir (2020). Desenvolvimento regional fronteiriço: elementos para reflexão, *Núcleo de Desenvolvimento Regional da Unioeste*, 07-14. https://acortar.link/hXPBkM

FIRJAN (Federação das Indústrias do Estado do Rio de Janeiro) (2014). *Índice FIRJAN de desenvolvimento municipal: nota metodológica*, FIRJAN.

Góes, Carlos and Karpowicz, Izabela (2017). Inequality in Brazil: a regional perspective. *International Monetary Fund Working Paper*, *17*(225), 1-31. https://acortar.link/SCrvGD

Hair, Joseph; Black, William; Babin, Barry; Anderson, Rolph and Tatham, Ronald (2005). *Análise multivariada de dados*. Bookman.

Hein, Eckhard (2014). *Distribution and growth after Keynes: a post-Keynesian guide*. Edward Elgar Publishing.

IBGE (Instituto Brasileiro de Geografia e Estatística) (2023). Municípios da faixa de Fronteira e Cidades Gêmeas. *IBGE*, https://acortar.link/Tk7fyr

IBGE (Instituto Brasileiro de Geografia e Estatística) (2017). Censo Agropecuário [1995 a 2017]. *IBGE*, https://acortar.link/JCem5n

Ipardes (Instituto Paranaense de Desenvolvimento Econômico e Social) (2017). Índice Ipardes de Desempenho Municipal (IPDM), *IPARDES*. https://acortar.link/p9dTsS

IPEA (Instituto de Pesquisa Econômica Aplicada) (2010). Estrutura etária, bônus demográfico e população economicamente ativa no Brasil: cenários de longo prazo e suas implicações para o mercado de trabalho. In IPEA (org.), *Macroeconomia para o desenvolvimento: crescimento, estabilidade e emprego* (Livro 4, pp. 373-402), IPEA. https://acortar.link/XSdXu1

Kaiser, Henry and Rice, John (1974). Little Jiffy, mark IV. *Educational and Psychological Measurement*, *34*(1), 111-117. https://doi.org/ftb8rg

Kaiser, Henry (1958). The varimax criterion for analytic rotation in factor analysis. *Psychometrika*, *23*, 187-200. https://acortar.link/WtnSuA

Krishnakumar, Jaya (2014). Quantitative methods for the capability approach, *Encyclopedia of Life Support Systems*. Encyclopedia of Life Support Systems UNESCO. https://acortar.link/kf2c2k

Laderchi, Caterina; Saith, Ruhi and Stewart, Francis (2003). Does it matter that we don't agree on the definition of poverty? A comparison of four approaches. *Oxford Development Studies*, *31*(3), 243-274. https://doi.org/bcrwqs

Leite, Ivonaldo (2020). Brazilian perspectives: society, stratification and income distribution. *Asian Journal of Applied Sciences*, *8*(1), 61-66. https://doi.org/mjsn

Lima, Vinícius and Maia, Katy (2015). Índice de desenvolvimento socioeconômico dos municípios sul-mato-grossenses para 2010. *Brazilian Journal of Business Economics*, *15*(2), 83-103. https://acortar.link/C1xNrz

Maiorano, Diego and Manor, James (2017). Poverty reduction, inequalities and human development in the BRICS: policies and outcomes. *Commonwealth & Comparative Politics*, *55*(3), 278-302. https://doi.org/mjsp

Malkina-Pykh Irina and Pykh, Yuri (2008). Quality-of-life indicators at different scales: theoretical background. *Ecological Indicators*, *8*(6), 854-862. https://doi.org/cbwg2w

Martinetti, Enrica (2000). A multidimensional assessment of well-being based on Sen's functioning approach. *Rivista Internazionale di Scienze Sociali*, *108*(2), 207-239, https://acortar.link/YlsajT

Martins, Igor and Palacio, Andrés (2020). What caused poverty reduction in Brazil during the 2000s: sectoral growth or public expenditures? *Oasis*, 31, 185-213. https://doi.org/mjsq

Melo, Cármem (2007). Índice relativo de desenvolvimento econômico e social dos municípios da região sudoeste paranaense. *Análise Econômica*, *25*(47), 149-164. https://doi.org/mjsr

Melo, Cármem and Parré, José Luiz (2007). Índice de desenvolvimento rural dos municípios paranaenses: determinantes e hierarquização. *Revista de Economia e Sociologia Rural*, *45*(2), 329-365. https://doi.org/b22tf9

Mingoti, Sueli (2005). *Análise de dados através de métodos de estatística multivariada: uma abordagem aplicada*, Editora UFMG.

MTE (Ministério do Trabalho e Desemprego) (2024). Abono Salarial. MTE. https://acesse.one/CSNcy

Myrdal, Gunnar (1968). *Teoría económica y regiones subdesarrolladas*, Fondo de Cultura Económica.

Navarro, Vicente (2000). Development and quality of life: a critique of Amartya Sen's development as freedom. *International Journal of Health Services*, *30*(4), 661-674. https://doi.org/fgnvvp

Navarro, Vicente (1968). Un analisis del Milagro Brasileno. *Revista de Economia Política*, *34*(5), 23-34.

Nurkse, Ragnar (1957). *Problemas da formação de capital em países subdesenvolvidos*. Civilização Brasileira.

O'Donnell, Gus (2014). Bem-estar interno bruto. *Valor Econômico*. https://acortar.link/jRjSlm

Ondetti, Gabriel (2016). The social function of property, land rights and social welfare in Brazil. *Land Use Policy*, *50*, 29-37. https://doi.org/f76c84

Paes-Souza, Rômulo and Santos, Leonor (2009). Measuring the impact of Bolsa Família Program based on data from health and nutrition days (Brazil), Working Paper n. 7. Food and Agricultural Organization from the United Nations.

Paiva, Luis (2016). Poverty and inequality reduction in Brazil – a parenthesis in history or the road ahead? *Iberoamericana*, *45*(1), 37-50. https://doi.org/mjss

R Core Team (2018). The R Project for Statistical Computing (version 4.0.2). https://www.R-project.org

Raiher, Augusta and Ferrera de Lima, Jandir (2018). Human development and underdevelopment in Brazil. *Economía, Sociedad y Territorio*, *18*(56), 77-105. https://doi.org/10.22136/est0939

Raiher, Augusta; Ferrera de Lima, Jandir and Ostapechen, Leandra (2017). Crescimento econômico no Sul do Brasil. *Revista de Economia e Agronegócio*, *15*(2), 224-249. https://doi.org/10.25070/rea.v15i2.446

Roman, Philippe and Thiry, Géraldine (2016). The inclusive wealth index: a critical appraisal. *Ecological Economics*, *124*, 185-192. https://doi.org/f8hk3q

SEI (Superintendência de Estudos Econômicos e Sociais da Bahia) (2017). Índice de desenvolvimento dos municípios. SEI. https://acortar.link/N8rA0d

SEMADE/MS (Secretaria de Estado de Meio Ambiente e Desenvolvimento Econômico do Mato Grosso do Sul) (2023). Banco de Dados do Estado (BDE web). SEMADE, https://acortar.link/HdAt05

Sen, Amartya (2000). *Desenvolvimento como liberdade*. Companhia das Letras.

Sen, Amartya (1999). *Development as freedom*. University Press.

Shikida, Pery (2009). Crimes violentos e desenvolvimento socioeconômico: um estudo para o Estado do Paraná. *Revista Brasileira de Direitos Fundamentais & Justiça, 2*(5), 144-161. https://doi.org/10.30899/dfj.v2i5.509

Silva, Tatiane; Muniz, Meiresangela; Pereira, Benedito; Bari, Mamadu and Joseph, Lazaro (2012, July 22- 25). Índice de desenvolvimento rural: contraste entre os municípios do Vale do Rio Cuiabá e os demais municípios mato-grossenses: 2000 e 2008 [paper] 50.º Congresso da Sociedade Brasileira de Economia Administração e Sociologia Rural, Vitória, Brazil.

Soares, Ana; Gosson, Annúzia; Madeira, Maria and Teixeira, Vírgina (1999). Índice de Desenvolvimento Municipal: hierarquização dos municípios do Ceará no ano de 1997. *Revista Paranaense de Desenvolvimento*, 97, 71-89. https://acortar.link/jXI7cP

Sotomayor, Orlando (2019). Growth with reduction in poverty and inequality: did Brazil show the way? *The Journal of Economic Inequality*, *17*(4), 521-541. https://doi.org/grv5s2

Stege, Alysson (2011). Desenvolvimento rural nas microrregiões do Brasil: um estudo multidimensional [Master thesis, Universidade Estadual de Maringá, Maringá]. Institutional Repository - State University of Maringá (RI-UEM). http://repositorio.uem.br:8080/jspui/handle/1/3428

Tiburcio, James (2018). Bolsa Família and Brazil: a non-systematic literature review. *Revista de Estudos e Pesquisas Avançadas no Terceiro Setor*, *5*(1), 60-100. https://doi.org/10.31501/repats.v5i1.9771

UNDP Brazil (United Nations Development Programme) (2013). O Índice de Desenvolvimento Humano Municipal Brasileiro. Instituto de Pesquisa Econômica Aplicada-Fundação João Pinheiro. https://encurtador.com.br/mxNQ9

UNDP Brazil (United Nations Development Programme) (1990). Atlas BR. PNUD no Brasil, Instituto de Pesquisa Econômica Aplicada (IPEA) and Fundação João Pinheiro (FJP). http://www.atlasbrasil.org.br

Yamaguchi, Rintaro; Islam, Moinul and Managi, Shunsuke (2019). Inclusive wealth in the twenty-first century: a summary and further discussion of Inclusive Wealth Report 2018. *Letters in Spatial and Resource Sciences*, *12*(2), 101-111. https://doi.org/gjkgmr

Curricular reviews

Francis Régis Gonçalves Mendes Barbosa. PhD in Regional Development and Agribusiness from the Universidade Estadual do Oeste do Paraná. He is a professor and researcher of the Bachelor's degree in Economic Sciences at the Universidade Estatal de Mato Grosso do Sul, Ponta Porã

campus. His current lines of research include: Multidimensional Poverty, Resilience to Multidimensional Poverty, Regional Development, Agribusiness and its interdisciplinarities. Among his recent publications, the following stand out, co-authored: Land-Use Dynamics for Agricultural and Livestock in Central-West Brazil and its Reflects on the Agricultural Frontier Expansion. *Cleaner and Circular Bioeconomy*, *4,* e100033 (2023); Fontes de crescimento da produção agrícola no estado de Mato Grosso do Sul entre 2006 e 2017. *Desenvolvimento Regional em debate*, *12*, 380-404 (2022); O gasto social do governo de Mato Grosso do Sul (2013-2017). *Interações*, *22*(2), 453-468 (2021). E-mail: francisbarbosa@uems.br

Madalena Maria Schlindwein. PhD in Sciences, with a concentration in Applied Economics, from the Escola Superior de Agricultura Luiz de Queiroz da Universidade de São Paulo. Professor and Researcher at the Universidade Federal da Grande Dourados at the Faculty of Administration, Accounting Sciences and Economics. Permanent Professor of the Postgraduate Program in Agribusiness at UFGD. Main lines of research focused on the themes of: Regional Development in Brazil, Analysis of public policies, Variables of population growth in municipalities in the Center-West of Brazil, Bioeconomy, Circular Economy and Sustainable Development. Here most recent publications include co-authored: Análise da competitividade das exportações brasileiras de etanol de 2004 a 2018: uma abordagem de constant market share. *Organizações Rurais & Agroindustriais*, *25*, e1918 (2023); The type of development promoted by Brazilian National Biofuels Policy. *Renewable & Sustainable Energy Reviews*, *182*, 113368 (2023); Indicadores socioeconômicos na agricultura familiar: uma avaliação da aplicação do PRONAF. *Revista Econômica do Nordeste*, *53*(3), 186-205 (2022). E-mail: madalenaschlindwein@ufgd.edu.br

Marcelo Corrêa da Silva. PhD in Animal Science from the Universidade Federal de Goiás. Post-Doctorate in Agribusiness and also in Zootechnics, from the Universidade Federal da Grande Dourados. Special consultant for the United Nations, FAO Brazil, and Researcher at the Itamarati Rural Development Center, in Ponta Porã. Main lines of research: Family farming, Transparency of agri-food supply chains, Sustainable rural development and Integration of research and extension. More recent publications include: Supporting supply-chain actors and bovine traceability systems: case study in Mato Grosso do Sul, Brazil. *Organizações Rurais & Agroindustriais, 25*, e1916 (2023);

Abertura comercial e segurança alimentar na China: o papel das exportações brasileiras de proteína animal. *Organizações Rurais & Agroindustriais*, v. 25, e1850 (2023), y Prospection of sustainable agrifood systems based on discourse analysis of Curraleiro Pé-Duro cattle breeders in Brazil. *Arquivo Brasileiro de Medicina Veterinária e Zootecnia*. *75*(2), 267-279 (2023). E-mail: marcelo-correadasilva@hotmail.com

http://dx.doi.org/10.22136/est20242033