Economic Systems Research

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/cesr20

Poverty and the functional distribution of income in the input–output framework: in pursuit of strategies for inclusive growth

Tânia Moreira Alberti, Kênia de Souza & Alexandre Porsse

To cite this article: Tânia Moreira Alberti, Kênia de Souza & Alexandre Porsse (2022): Poverty and the functional distribution of income in the input–output framework: in pursuit of strategies for inclusive growth, Economic Systems Research, DOI: 10.1080/09535314.2022.2067029

To link to this article: https://doi.org/10.1080/09535314.2022.2067029

Published online: 22 May 2022.

ECONOMIC SYSTEMS RESEARCH
https://doi.org/10.1080/09535314.2022.2067029

Poverty and the functional distribution of income in the input–output framework: in pursuit of strategies for inclusive growth

Tânia Moreira Alberti, Kênia de Souza and Alexandre Porsse

Department of Economics, UFPR, Curitiba, Brazil

ABSTRACT

The eradication of poverty as proposed by the first Sustainable Development Goal is one of the main challenges faced by all countries, especially the underdeveloped and developing nations. In this paper, we develop an approach for integrating the input–output framework with a microsimulation model where consumption and income data are highly disaggregated and along with Miyazawa linkages. This allows us to identify how sectoral economic structure affects income distribution. This, in turn, provides information relevant to the inclusive growth policies that can create work opportunities for the low-income population and, thereby eliminating poverty. Results show how labor-intensive sectors might be important in ending poverty and in reducing inequality. They even show the set of activities that could best contribute to this goal via changes in the productive structure.

ARTICLE HISTORY
Received 29 April 2020

KEYWORDS
Poverty; income distribution; inclusive growth; Miyazawa

1. Introduction

Since 2000, the world poverty rate has fallen by more than half according to the United Nations (2018). Brazil contributed to this progress with a decline in its poverty indicators, attributed mainly to economic growth and partly to the reduction of inequality in income distribution (Barros et al., 2001, 2007; Ferreira et al., 2010). However, in the most recent period, the incidence of poverty in Brazil has increased, from 22.8% in 2014 to 24.7% in 2019, according to the Brazilian Institute of Geography and Statistics (IBGE, 2019).[1]

Understanding how economic growth can contribute to poverty alleviation is critical to promoting inclusive and sustainable economic development. Poverty is often related to several social problems. Reducing poverty and inequality are at the heart of development problems, which is fundamental for the achievement of the UN Sustainable Development Goals (SDGs). In addition, achieving a pattern of economic growth that includes the workforce is a concern expressed in the definition of inclusive growth, which highlights the need for a structural transformation of the economy, with a focus on productive employment (Ianchovichina & Lundstrom, 2009).

CONTACT Tânia Moreira Alberti taniamoreiraalberti@gmail.com Department of Economics, UFPR, Curitiba 80060-000, Brazil

[1] From Portuguese 'Instituto Brasileiro de Geografia e Estatística'.

Several studies assess the role of economic growth in reducing poverty and inequality, largely considering econometric approaches (Ferreira et al., 2010; Marinho & Soares, 2003; Ravallion, 2001; Ravallion & Chen, 2007). They largely use economic growth and sectoral growth to explain poverty reduction. This enables an assessment of the influence of the direct effect of economic growth but does not consider the indirect and induced effects caused by the economic interdependence between sectors, income and consumption. Especially for developing countries, these studies highlight the importance of the service sector and other labor-intensive activities. With regard to the service sector, Ferreira et al. (2010) also highlight its heterogeneous effects across Brazilian states.

In this sense, an input–output (IO) approach makes it possible to consider the direct, indirect and induced effects of economic growth on poverty. Studies using this approach in Brazil generally assess changes in the production structure, consumption pattern and income of the Brazilian economy and the impacts on inequality (Gutierre et al., 2012; Moreira et al., 2008; Silva, 2018). The results obtained by these studies contrast sectors that contribute the most to the reduction of inequality with sectors that contribute to economic growth. They generally highlight the effect for representative households by income class. Also common in this literature is that poverty is not assessed, largely due to a lack of heterogeneity among households.

Thus, we evaluate the role of sectoral relations and their interconnections in the reduction of poverty and inequality. Regarding econometric approaches, in this study we consider, in addition to the direct effects, the indirect effects and the effects induced in an IO analysis integrated with a microsimulation module. The adopted method has the benefit of dealing with the heterogeneity pointed out by econometric studies (Ferreira et al., 2010; Marinho & Soares, 2003; Ravallion, 2001; Ravallion & Chen, 2007). This makes possible a sectoral breakdown as well as the use of multiple household types. Regarding IO approaches, most such studies carried out in Brazil account for household heterogeneity in an aggregate manner, considering consumption patterns disaggregated into a handful of income classes (Gutierre et al., 2012; Moreira et al., 2008; Santos et al., 2013). But inequality within income classes also is generally high in developing countries like Brazil, and the use of these classes can mask transmission channels if the analyst is not careful. To overcome this limitation, we, therefore, use a high resolution for the household consumption by exploiting integration with a microsimulation module. This enables better measurement of the effect on inequality of the interactive effect of household-consumption heterogeneity interindustry economic structure.

Our empirical approach is: (a) construct a novel database from the 2008 Family Budget Survey (POF[2]) and the 2015 National Household Sample Survey (PNAD[3]), both published by IBGE (2011, 2016), based on statistical matching methods; (b) integrate data via statistical matching to Brazil's official 2015 IO table; (c) perform multiple microsimulations with multiple Miyazawa's (1976) households. Using this approach, we find that a critical role for labor-intensive activities is in poverty reduction. Especially important are activities linked to the service sector, which employs a high percentage of Brazil's poorest adult populations in low-wage activities. Our results are in line with those in previous literature

[2] From Portuguese 'Pesquisa de Orçamentos Familiares'.
[3] From Portuguese 'Pesquisa Nacional por Amostra de Domicílios'.

(Moreira, 2007; Pauli et al., 2012). A novelty result indicates the contribution of the change in the industry mix, as poverty declines in sectors in which wages rise.

2. Sectoral economic growth, poverty reduction, and inequality: a review

Ivanic and Martin (2018) point out, that most analyses on the pattern of growth and poverty are based on econometric tests of hypotheses using real data. These analyses generally examine the effect of growth and inequality on poverty (Marinho & Soares, 2003; Ravallion, 2001) or how growth cycles affect poverty (Datt & Ravallion, 2002; Ferreira et al., 2010; Ravallion & Chen, 2007). Gibson (2005a); note that many econometric studies on developing economies test theories conceived for developed economies. But particularities of developing economies likely hinder such analyses in particular data issues like highly aggregated sectors, extraordinary disparities in household incomes, recurrent changes in the social structure, large informal sectors and black markets, and hefty macroeconomic imbalances.

In this regard, simulation models can contribute by using broad economic data. They are particularly less sensitive to data calibration criteria and exploit indirect and induced effects of growth, as well as patterns of consumption and income on poverty and inequality (Gibson, 2005a; Ivanic & Martin, 2018).

Pioneering works on this theme of jointly evaluating the role of a broader income distribution on the earnings of economic groups include Stone's (1985) for the United Kingdom and other industrialized countries, Pyatt and Round's (1979) for Sri Lanka, Defourny and Thorbecke's (1984) for South Korea, and Thorbecke (1992) and Thorbecke and Jung's (1996) for Indonesia. The first to employ Miyazawa's (1976) approach was Round (2003). Other simulation models with similar goals were used by Gibson (2005b), who calibrated a structuralist and neoclassical model based on a social accounting matrix (SAM) for Argentina; Pradhan and Sahoo (2012) who analyse a SAM for India; Cicowiez and Lofgren (2017), who estimate SAMs for 133 countries (using data from the World Bank, IMF and GTAP); and Tiberti et al. (2017) who use a computable general equilibrium (CGE) combined with a microsimulation (MS) model for Uganda. All of the above-mentioned studies evaluate specific policies or time periods; but, regardless of the purpose, all of them highlight the importance of sectoral structure and sectoral composition changes to poverty and/or inequality. And, except for Tiberti et al. (2017), they use a single or few households, keeping poverty and inequality unchanged within each household type.

In Brazil, several studies have used an IO approach to evaluate the change in the productive structure, in consumption and income, the impact of social policies, and impacts on social inequality, generally using income groups, constructed by connecting consumption and income data. The methods used vary from IO (Moreira, 2007), SAM (Marcos, 2015; Marcos et al., 2014); shift-share (Pauli et al., 2012), structural decomposition analysis (Moreira, 2007; Silva, 2018) and Leontief–Miyazawa model (Gutierre et al., 2012; Santos et al., 2013; Silva, 2018; Silva et al., 2018).

As for other countries, these studies also operate with homogeneous families connected only by income thresholds and the analyses generally focus on the activities that contribute to economic growth and not on the activities that contribute most to poverty reduction. In common these papers point out that there was an improvement in the incomes of the poorer classes in the 2000s, and that most of the income absorption was concentrated in the higher income groups. Labor-intensive sectors, like agriculture and services, are pointed as the most important for reducing poverty and inequality.

The present study aims to contribute to the literature through a large database, which allows considering heterogeneous households and consumption and income data paired at the individual level evaluated in a microsimulation model.

The emphasis on treating heterogeneity between households is due to two reasons. First, Brazil is one of the countries with a highest level of inequality (Barros et al., 2001), in which there is a marked distance between the appropriate income for the poorest and the appropriate income for the richest compared to developed countries (Moreira, 2007). Second, there are recommendations in the literature on IO and CGE models that encourage the use of heterogeneous family profiles as opposed to the use of representative families as in Savard (2005), Kim et al. (2014), revealing that the contribution of the heterogeneity of the family structure may not be relevant in macroeconomic results, but it is not marginal in matters relating to the distribution of income and poverty.

According to Figari et al. (2014) there are several motivations for using a microsimulation model,[4] such as it can be used to quantify the role of policies on inequality and poverty. Further, it is a tool that can assist in the development of new policies with specific objectives, or in dimensions that have not been considered previously.

3. Research approach

The empirical strategy used has three main steps: (i) statistical matching between consumption and labor market microdata; (ii) calibration between national IO data and individual microdata; and finally, (iii) Miyazawa basic indicators and simulations.

3.1. Database

This study performs simulations of the Leontief–Miyazawa model from three databases: POF 2008–2009, PNAD-2015, and IO data for 2015. POF and PNAD are fundamental for building the consumption and income vectors of families as explained below. To disaggregate the consumption vector, we used microdata from POF 2008–2009, considering the expenditure for 56,063 households and more than 5000 products. Household expenses were brought into line with the classification of the National Accounts System and aggregated in 67 groups of activities considering the sections of the National Classification of Economic Activities – CNAE[5] Version 2.0., obtaining 117,706 households to carry out the merger phase of the PNAD-POF surveys.

In turn, for the construction of the household income vector of the Leontief–Miyazawa model, we used microdata from PNAD-2015, based on the archives of people and households. The activities, considering the main and secondary work, were arranged according to the classification of the System of National Accounts, after the correspondence between CNAE, and the 67 sectors according to IO data from 2015.

For the matching process, the data from both datasets were organized according to: (a) the 27 federation units; (b) the average age of the members of the household; (c) the total

[4] For them, microsimulation refers to a wide variety of modeling techniques that operate at the level of individual units.
[5] From Portuguese 'Classificação Nacional de Atividades Econômicas'.

number of adults; (d) the total number of children; and (e) per capita household income. As we used POF-2008 in conjunction with the PNAD-2015, the expenditure and income figures have been updated for the year 2015, using the PNAD deflator. The total number of households obtained was 117,706 households. These households were then used to apply the Leontief–Miyazawa model together with the 2015 IO Matrix (IOM-2015), from IBGE (2018), considering 66 activities.

From the database, it was possible to verify the distribution of poverty by sector. The poverty rate initially was 22.04% (calculated at the individual level using PNAD-2015 microdata). Nevertheless, the poverty rate is diverse across sectors, i.e. considering poverty among people who work in each sector. For instance, Agriculture and Livestock have a poverty rate of around 50%, which means that half of the workers allocated in these sectors are in households where per capita income is below US$ 5.50 per day. Other highly labor-intensive sectors such as Associative organizations, other personal and domestic services (which include, for example: personal service activities; repair of appliances, shoes, personal and domestic objects; services among others) also have poverty rates above the national average, and with a large share in total employment. These activities concentrate the largest number of people in poverty, as shown in Table 1.

In general, the sectors linked to the service activity have a large participation in total employment, concentrating many workers in poverty. Only associative organizations, other personal and domestic services hold 27.29% of total employment and it is a sector with a high percentage of poverty and low wages. Agriculture stands out with a high percentage of poverty (49.21%) and with lower average wages in relation to all other activities.

According to the literature, the greater participation of employment in services could be related to changes in the Brazilian productive structure, marked by the displacement of labor from the manufacturing sector to the service sector (Pauli et al., 2012). An important percentage in the number of jobs is the Wholesale and retail trade, with a poverty rate below the national average. Also, according to Pauli et al. (2012), this sector absorbed a large part of the workforce with an intermediate level of education.

Table 1. Poverty (%) and employ (%).

Activities	Poverty (%)	Employment (%)
3 Forest production; fisheries and aquaculture	55.33%	0.74%
1 Agriculture	49.21%	5.52%
2 Livestock	35.05%	2.79%
39 Water, sewage and waste management	28.48%	0.44%
10 Other food products	28.21%	0.92%
66 Associative organizations, other personal and domestic services	26.38%	27.29%
40 Construction	25.99%	10.44%
47 Food services	25.18%	3.14%
26 Non-metallic mineral products	24.66%	0.57%
12 Tobacco	22.92%	0.01%
14 Clothing and accessories	21.97%	0.82%
16 Wood products	21.82%	0.46%
7 Extraction and processing of non-ferrous metallic minerals	21.77%	0.07%
46 Accommodation	21.74%	0.31%
13 Textile products	21.31%	0.37%
58 Other administrative activities and complementary services	20.71%	1.73%
23 Cleaning products, cosmetics, perfumery and personal hygiene	20.61%	0.07%

(*continued*)

Table 1. Continued.

Activities	Poverty (%)	Employment (%)
9 Sugar manufacture and refining	19.08%	0.13%
41 Wholesale and retail trade	18.57%	13.95%
37 Maintenance, repair and installation of machinery and equipment	18.38%	0.08%
65 Artistic, creative and entertainment activities	18.36%	1.67%
4 Extraction of mineral coal and non-metallic minerals	17.33%	0.09%
43 Water transportation	16.49%	0.08%
36 Furniture and products from different industries	16.38%	0.52%
42 Land transportation	15.45%	4.56%
8 Meat, dairy and fishery products	15.12%	0.45%
29 Metal products, except machinery and equipment	15.09%	0.64%
15 Footwear and leather goods	14.51%	0.41%
31 Electrical machinery and equipment	14.15%	0.25%
45 Storage, auxiliary transport and mail activities	13.97%	0.54%
59 Surveillance, security and investigation activities	13.56%	0.95%
22 Pesticides, disinfectants, paints and other chemicals	13.10%	0.26%
17 Cellulose, paper and paper products	13.10%	0.20%
62 Private education	13.10%	2.34%
20 Biofuels	13.09%	0.10%
11 Beverage Manufacturing	13.07%	0.18%
35 Other transport equipment, except motor vehicles	11.66%	0.19%
25 Rubber and plastic products	11.41%	0.28%
50 Telecommunications	10.75%	0.26%
6 Iron ore extraction	10.09%	0.15%
64 Private health	9.80%	2.03%
60 Public administration, defense, and social security	9.17%	5.20%
32 Machinery and mechanical equipment	9.08%	0.53%
44 Air Transport	9.05%	0.06%
38 Electric power, natural gas and other utilities	8.88%	0.25%
56 Other professional, scientific and technical activities	8.46%	0.21%
19 Oil refining and coking plants	7.80%	0.06%
28 Non-ferrous metal metallurgy and metal casting	7.54%	0.19%
63 Public health	7.39%	0.94%
61 Public education	5.93%	2.44%
24 Pharmaceutical chemicals and pharmaceutical products	5.56%	0.13%
18 Printing and playback of recordings	5.42%	0.22%
54 Legal, accounting, consulting and corporate headquarters activities	5.26%	1.28%
30 Computer equipment, electronic and optical products	4.55%	0.06%
51 Development of systems and other information services	4.41%	0.31%
33 Cars, trucks and buses, except parts	4.12%	0.44%
55 Architectural, engineering, technical testing/analysis and R&D services	3.69%	0.45%
49 Television, radio, cinema and sound/image recording/editing activities	3.44%	0.12%
52 Financial intermediation, insurance and private pension	3.00%	0.86%
27 Pig iron, ferroalloys, steel and seamless steel tubes	2.98%	0.12%
5 Oil and gas extraction	2.43%	0.11%
34 Parts and accessories for motor vehicles	0.00%	0.01%
21 Organic and inorganic chemicals, resins and elastomers	0.00%	0.01%
48 Editing and editing integrated with printing	0.00%	0.01%
53 Real estate activities	0.00%	0.01%
57 Non-real estate rentals and management of intellectual property assets	0.00%	0.01%

Source: Own elaboration.

3.2. *Miyazawa model*

In general, the IO model represents the monetary flow of goods and services between the various sectors of an economy. In a basic IO model, intersectoral transactions or flows in an economy, considering technological and economic factors, can be represented according to Leontief (1951). Where, $\mathbf{x}$ denotes the total value of production of each sector, considering a vector $(n \times 1)$, with n sectors; $\mathbf{y}$ a vector $(n \times 1)$ representing the values of final demand of each sector and $\mathbf{A}$ the matrix ($n \times n$) with the technical coefficients of production. By solving this model it is possible to verify the effects of changes in final demand on the economy, thus we have:

$$\mathbf{x} = (\mathbf{I} - \mathbf{A})^{-1}\mathbf{y} \tag{1}$$

where $(\mathbf{I} - \mathbf{A})^{-1}$ is defined as the Leontief inverse or total requirements matrix. It demonstrates the relationship between the value of final demand and the value of production in each sector. Each element of this matrix shows the impact of an exogenous change in final demand on sectoral production.

Household consumption is exogenously determined in the basic model. Families earn income as payment for their labor inputs used in production. As consumers, they spend income, so that an increase in labor demand leads to an increase in the amounts spent on consumption (Miller & Blair, 2009). Alternatively, following, Miyazawa (1976), we can incorporate these relations by treating household consumption as endogenous.

Therefore, we considered household consumption unbundled and the income distribution structure is disaggregated into groups according to the value added in production. Household consumption is separated into q different groups of income brackets and payments to workers are identified according to these groups. Following Miller and Blair (2009) and Miyazawa (1976), such that:

> $\mathbf{V} = [v_{gj}]$; the matrix of value added by households, with v_{gj} representing the income paid to a worker in each income group g, per additional production unit in the industry j, with $g = (1, \ldots, q)$ and $j = (1, \ldots, n)$. That is, $v_{gj} = \frac{y_{gj}}{W_j}$, with w_j representing income.
> $\mathbf{C} = [c_{ih}]$; the consumption expenditure coefficient matrix; with c_{ih} consumption expenses for i's products, due to the gain of a unit of income by the families according to the income group $h = (1, \ldots, q)$. That is, $c_{ih} = \frac{C_{ih}}{Y_{ih}}$.

Therefore, the expanded system to incorporate household consumption and income into the IO model becomes:

$$\begin{bmatrix} \mathbf{x} \\ \mathbf{l} \end{bmatrix} = \begin{bmatrix} \mathbf{A} & \mathbf{C} \\ \mathbf{V} & 0 \end{bmatrix} \begin{bmatrix} \mathbf{x} \\ \mathbf{l} \end{bmatrix} + \begin{bmatrix} \mathbf{y}^* \\ 0 \end{bmatrix} \tag{2}$$

where $\mathbf{l}$ is the vector of total income according to each income group.

As demonstrated by Miyazawa (1976), assuming $\mathbf{VBC} = \mathbf{L}$ and $\mathbf{K} = (\mathbf{I} - \mathbf{B})^{-1} = (\mathbf{I} - \mathbf{VBC})^{-1}$ and $\mathbf{L} = (\mathbf{I} - \mathbf{A})^{-1}$, allowing to rewrite the equation system 2 as follow:

$$\begin{bmatrix} \mathbf{x} \\ \mathbf{l} \end{bmatrix} = \begin{bmatrix} \mathbf{L}(\mathbf{I} + \mathbf{CKVL}) & \mathbf{LCK} \\ \mathbf{KVL} & \mathbf{K} \end{bmatrix} \begin{bmatrix} \mathbf{y}^* \\ 0 \end{bmatrix} \tag{3}$$

where $\mathbf{B}$ represents the intergroup coefficients of income that show the interrelationships between incomes of each group according to the process of propagation of consumption expenses. That is, an element of $\mathbf{B} = \{b_{gh}\}$ represents a direct increase in income of the group g resulting from the expenditure of an additional unit of income by group h. In other words, an additional unit of family spending by a group requires the consumption of inputs in production, which in turn generates payments to families employed in the income groups g.

According to Miyazawa (1976), the income propagation process continues through the **K** matrix, called the interrelational income multiplier matrix. This matrix represents the total increase (direct, indirect and induced) in the income of one group, resulting from an additional expenditure of income by another group. Formally, starting from Equation (3):

$$\mathbf{x} = \mathbf{L}(\mathbf{I} + \mathbf{CKVL})\mathbf{y}^* \tag{4}$$

According to Miller and Blair (2009), the effect of final demand on production results from the product of two matrices, the Leontief matrix **L** and ($\mathbf{I} + \mathbf{CKVL}$). This makes endogenous the effect of total income expenditure, $\mathbf{Ly}^*$ in the initial production (without household consumption, considered as endogenous). $\mathbf{VLy}^*$ represents the initial rent payments for each group. $\mathbf{KVLy}^*$ is the total revenue received by each group. $\mathbf{CKVLy}^*$ relates the revenue given by each group in the production of each sector. Equation (4) provides the increased Leontief multiplier.

The **KVL** matrix is considered the matrix of multi-sectoral income multipliers (or multiplier matrix of income formation) indicating the direct, indirect and induced effects on the income of each group that is generated by an exogenous expenditure (this being represented by $\mathbf{VLy}^*$) and by an endogenous demand as a function of income (representing by **K**). The model provides a different interpretation in which the total income and the incomes of the groups have different values, depending on the proportions of the final demand (Miyazawa, 1976).

In this paper, we adapted the Leontief–Miyazawa (LM) model to fully account for the household heterogeneity. Usually, studies applying LM model assume that matrix **C** and **V** works on few *g* incomes groups whose stratification is expected to be sufficient for catching some heterogeneity (Gutierre et al., 2012; Moreira et al., 2008; Santos et al., 2013). In our approach, we let *g* represents 4947 households obtained from the matching model described in Section 3.3. We consider this high disaggregation of the consumption and income behavior is appropriated to see a high degree of heterogeneity in the interconnection with the linkages with the sectoral economic structure. At the same time, the disaggregation allows for better measurements of poverty and inequality.

3.3. Statistical matching

A statistical matching technique was used to combine the POF and PNAD data. The technique allows the integration of data sources for the same target population, obtaining information on variables that are not observed together (D'Orazio et al., 2006; Rässler, 2012). When using statistical matching of two data sources A and B, which share a set of *X* variables, not equally identified, and in which file B has *Y* information (not available in file A) and file A has *Z* information (not available in file B), it is possible to obtain information on the joint distribution of *X*, *Y*, and *Z*, obtaining a single synthetic file with complete information (D'Orazio et al., 2006).

In this article, we used the micro non-parametric approach through the distance hot deck. POF provided information on consumption expenditures per household for PNAD households. The variables used were monthly household income per capita, total number of adults, total number of children in the household, and the average age in the household. In addition, the federation unit was established as a donation class, that is, only information from one state could be provided to the same state, while still respecting all the variables listed above. Using the Manhattan distance function, the households in both surveys were merged, resulting in a synthetic database with complete information on consumption expenses for 117,706 households. Finally, households without income information were excluded, which resulted in 115,623 households.

3.4. Data calibration

This section describes the methodological procedures used to reproduce the POF consumption pattern according to PNAD income. Next, we describe the methodological approach used to make the information in the MIP compatible and obtain the C and V matrices of the Leontief–Miyazawa model.

As PNAD is the official data used to calibrate IO labor information, we assumed the employment distribution of PNAD to be the main dataset. Therefore, all consumption data from POF was matched to PNAD households in relative terms. That is, even if we do not have the same household, the procedure allocates only the consumption pattern considering a statistically similar household. This procedure guarantees consistence between consumption, labor, and IO data. Additionally, as consumption patterns do not change quickly, we do not expect the methodological choices in the matching procedure to have relevant effects on our results.

Considering the constructed database (with matched individual data), the sum of total consumption per household from POF, denoted by C, was obtained. Thus, the proportion of consumption by income, denoted by r, can be calculated as:

$$r = \frac{C}{\text{RPOF}_{\text{household}}} \tag{5}$$

Therefore, the ratio r is obtained for 115,623 households. Following, the proportion (sC_i) that represents sector consumption by total consumption (C) is given by:

$$sC_i = \frac{\text{Group}\,i\,\text{consumption}}{C} \tag{6}$$

sC_i is a matrix with 115,623 households (rows) and 66 activities (columns) expressing the share of consumption at sectoral level from POF. These values were used considering income data from PNAD, in order to calibrate consumption according to PNAD's income level. First, household income by sector (considering main and secondary labor) was weighted by the households' survey weights in the PNAD. Then, from the income in PNAD (RPNAD), we obtained the total consumption estimated from PNAD, which we denote by CTPNAD:

$$\text{CTPNAD} = r \times \text{RPNAD} \tag{7}$$

Hence, it was possible to calculate the consumption (C_i) estimated for the PNAD households and by sector:

$$C_i = sC_i \times \text{CTPNAD} \tag{8}$$

The calibrated consumption was distributed according to the MIP consumption vector to generate the final consumption data in matrix C, whose coefficients C represent the consumption expenditures, by sector, due to the gain in labor income by households.

From the synthetic database, in the income side, all labor income (from primary and secondary jobs) were summed by household, considering survey weights. Then, the proportion (sR_i) of each sector's income to total income (R_PNAD) is given by:

$$sR_i = \frac{\text{Income}i\text{sector}}{\text{RPNAD}} \tag{9}$$

Thus, the values obtained in sR_i were multiplied by the MIP income vector obtaining the matrix V, with its terms representing the income paid to a worker in a given income sector, per additional unit of production.

3.5. Simulations

Due to the computational impossibility of applying the Leontief–Miyazawa model to the complete base disaggregated at the level of microdata, of 115,623 households, we aggregated households by percentile of income and the predominant sector in household income, obtaining 4947 representative families. From this, the Leontief–Miyazawa multiplier for the 4947 households was obtained and the following simulations were performed:

(i) Simulation 1: 10% increase in the final demand for each sector.
(ii) Simulation 2: increase of BR$ 100 billion in the final demand for each sector.
(iii) Simulation 3: observed change in final demand between 2015 and 2016 for each sector.
(iv) Simulation 4: observed change in final demand between 2015 and 2017 for each sector.

The simulations complement each other in the following sense. In Simulation 1, the increase in final demand is proportional to the size of the sector. Consequently, sectors with a higher participation in the final demand tend to cause greater changes in poverty and inequality. At the same time, the simulation allows for a comparison in terms of the elasticity of poverty and inequality with previous literature. In turn, Simulation 2 imposes the same variation in volume for all sectors, enabling a monetary comparison, in terms of efficiency in the allocation of resources in each sector. Finally, the third and fourth simulation are about observing a period in the economy, reflecting the effects of a short-term change, within a context of crisis and economic stagnation, on the level of poverty and inequality in each sector.

After each simulation, information on changes in income for the 4947 representative households were again disaggregated for individuals, recovering 356,904 individuals, and enabling us to evaluate the effects in relation to poverty and inequality. It is worth noting that the percentage of reduction in poverty and inequality is calculated in relation to the initial percentage of the database. Therefore, it is not calculated by sector, which means that the percentage change evaluated shows the contribution of each sector to the reduction of poverty and inequality in the entire economy. So, each simulation was calculated 67 times, once for each sector, totaling 268 measurements.

In this study, we used the World Bank poverty line of US$ 5.50 per day (in 2011 Purchasing Power Parity) used for countries classified in the upper middle-income group, as is the case of Brazil. Therefore, we used a poverty line of BR$ 321.00 per month considering the exchange rate of 2011 (BR$ 1.47 per US dollar) and for the inflation accumulated up to 2015 the Consumer Price Index from IBGE. For inequality, we used the Gini index, calculated from the PNAD-2015 database and updated considering all income changes from each simulation.

4. Results

This section describes the simulation results and the multipliers. The results of Miyazawa's interrelational and multi-sectoral multipliers are presented in Tables 1 and 2. For the interrelational multiplier, the average multipliers are presented by seven income groups. Income range 2 (more than $\frac{1}{4}$ to $\frac{1}{2}$ minimum wage), with income between BR$ 197.00 and BR$ 394.00, have the highest multiplier effect, i.e. meaning the generation of income for all income groups is higher for an increase in income from household group 2 (column sum). These middle-class multipliers were higher for the first three income levels, compared to the seventh. Therefore, the result indicates that policies allowing an increase in income for the lower income groups contribute to income generation for all income groups, and benefit the poorest, considering the productive structure interrelation. According to Table 2, it is also possible to see that the highest income class (7) absorbs most of the income generated by the other groups (line sum), which reinforces income concentration, as discussed in the literature, for instance by Gutierre et al. (2012).

The result of the multisector multiplier, which indicates the generation of income by the direct, indirect, and induced effects of each income group from an exogenous increase in the production of each activity, is shown in Table 3. The largest multisector multipliers were obtained for Private education, Public education, and Associative organizations, other personal and domestic services. On average, multipliers are higher for services, followed by industrial activities. Considering only the first three income groups, stands out the multisector multipliers of Associative organizations, other personal and domestic services, and Clothing and accessories; Textile products; Artistic, creative and entertainment activities and Agriculture.

The variation in the percentage of poverty for each simulation is detailed in Table 4. The reductions (or increases) in the indicators are in relation to the initial percentages of poverty and inequality in the Brazilian economy calculated in the database. In Simulation 1, the main contribution to poverty reduction is from Construction with a reduction of

Table 2. Interrelational multiplier.

Income group	Wage	Columns sum	Line sum
1	Up to $\frac{1}{4}$ minimum wage	2.146	1.026
2	From $\frac{1}{4}$ to $\frac{1}{2}$ minimum wage	2.719	1.045
3	From $\frac{1}{2}$ to 1 minimum wage	2.360	1.133
4	From 1 to 2 minimum wages	2.046	1.282
5	From 2 to 3 minimum wages	2.058	1.508
6	From 3 to 5 minimum wages	1.900	1.870
7	More than 5 minimum wages	1.872	3.569

Note: minimum wage of BR$ 788.00 in September 2015, according to the PNAD per capita household monthly income range.
Source: Own elaboration.

Table 3. Multisector multiplier.

Activity	Multisector multiplier
Private education	1.283
Public education	1.193
Associative organizations, other personal and domestic services	1.150
Surveillance, security, and investigation	1.120
Artistic, creative, and entertainment activities	1.102
Public health	1.075
Printing and playback of recordings	0.968
Clothing and accessories	0.967
Public administration, defense, and social security	0.939
Accommodation	0.933
Private health	0.900
Architectural, engineering, technical testing/analysis, and R&D services	0.877
Other administrative activities and complementary services	0.873
Footwear and leather goods	0.871

Source: Own elaboration.

3.15% in the percentage of poverty, after a 10% increase in the final demand. It is followed by the sector of Public administration, defense, and social security and Associative organizations, other personal and domestic services. These activities stand out in occupation and in the percentage of poverty, especially in the case of the first and last activity, in addition to the importance in the final demand in the case of Public administration, defense, and social security and Construction. Other prominent activities are Meat, dairy, and fishery products, Food services, and Other food products. In aggregate, in simulation 1 the main contribution to poverty reduction comes from the services group, which is responsible for a high percentage of employment in the Brazilian economy, especially through the contribution of Associative Organizations, other personal and domestic services, and Public Administration, Defense and Social Security. The result is aligned with the literature (Thorbecke & Jung, 1996, for Indonesia; Pradhan & Sahoo, 2012, for India; and for Brazil Gutierre et al., 2012; Moreira et al., 2008; and Silva et al., 2018), who also indicate de importance of labor-intensive activities.

In simulation 2 the main contributions were from Associative organizations, other personal and household services; Animal husbandry, including support to animal husbandry; Artistic, creative and entertainment activities and Construction. Unlike the previous simulation, the main contribution is from industry activities. In this simulation, the distribution of the product is altered, and industry becomes the activity with the largest participation in the product. This leads to the conclusion that the productive structure itself is configured as an obstacle to poverty reduction (Table 4).

Simulations 3 and 4 indicate similar results. In these simulations, a positive change in the final demand for Construction; Public administration, defense, and social security and Associative organizations, other personal and domestic services reduce poverty. On the other hand, a reduction in final demand for Construction, for example, with observed decreases in 2016 and 2017, places the sector in the last position of the poverty reduction ranking. The same for Associative organizations, other personal and domestic services, with a slight increase in final demand only in 2017, resulting in a reduction in the poverty

Table 4. Change in poverty rate (%).

Sector	Simulation 1		Simulation 2		Simulation 3		Simulation 4	
Construction	−3.15	1	−5.06	4	3.47	66	4.71	66
Public administration, defense, and social security	−2.08	2	−2.73	28	0.00	19	−1.17	2
Associative organizations, other personal and domestic services	−1.34	3	−9.27	1	1.08	64	−0.06	22
Meat, dairy, and fishery products	−0.98	4	−4.16	8	0.20	46	−0.66	6
Food services	−0.81	5	−4.38	6	0.37	57	−1.06	4
Other food products	−0.71	6	−3.89	11	0.38	58	−1.14	3
Clothing and accessories	−0.66	7	−3.92	10	0.65	61	−0.09	18
Public education	−0.60	8	−2.80	27	0.17	32	−0.48	8
Agriculture	−0.53	9	−4.08	9	0.23	51	−2.61	1
Private health	−0.52	10	−3.35	17	−0.01	3	−0.73	5
Private education	−0.43	11	−4.86	5	0.18	38	−0.61	7
Wood products	0.15	41	−3.77	12	−0.08	1	−0.02	31
Livestock	−0.28	27	−5.17	2	0.00	7	−0.31	12
Artistic, creative, and entertainment activities	0.03	14	−5.10	3	0.00	21	−0.19	14
Sugar manufacture and refining	0.11	33	−3.51	14	−0.05	2	−0.31	11

Source: Own elaboration.

rate by only 0.06%. In Simulation 3, only the activities of Wood products and Sugar manufacture and refining stand out with low contributions to the reduction of poverty. Construction and Associative organizations, other personal and domestic services were in the last positions of the ranking.

In Simulation 4, Agriculture stands out with a high percentage of the poor among the employed, as highlighted in the Table 1, and with the most important growth in final demand observed for 2017. Public administration, defense, and social security occupy the second place, with a reduction of −1.17% in poverty, and Other food products. Construction once again was in the final position of the ranking. Similarly, Simulation 2 indicates Associative organizations, other personal and domestic services, and Construction among the top positions in the ranking, in addition to Livestock, and Artistic, creative, and entertainment activities.

In addition, the results allow us to compare whether the sectors that contribute most to poverty reduction also contribute to economic growth through increased production. In general, it is possible to emphasize that the activities that contribute to the reduction of poverty are not necessarily the same that contribute to the reduction of inequality (Table 5). A common result, for both objectives, is the activities of Associative organizations, other personal services and domestic services and Construction. That is, these sectors with a high percentage of poverty are sensitive to variations in final demand, with important results on poverty and inequality. Another point, highlighted by Moreira (2007), that can be used to explain our result, is the characteristic of some sectors allocating most of their production cost on wages, with less participation of intermediate inputs. In these cases, the cost structure favors the reduction of poverty and inequality.

This relationship is illustrated in the following figures, relating the Leontief–Miyazawa output multipliers to the poverty variation percentages. According to Figure 1, sectors located further to the left of the poverty axis are sectors that contribute significantly to poverty reduction and sectors located further up the Growth axis are sectors that have the

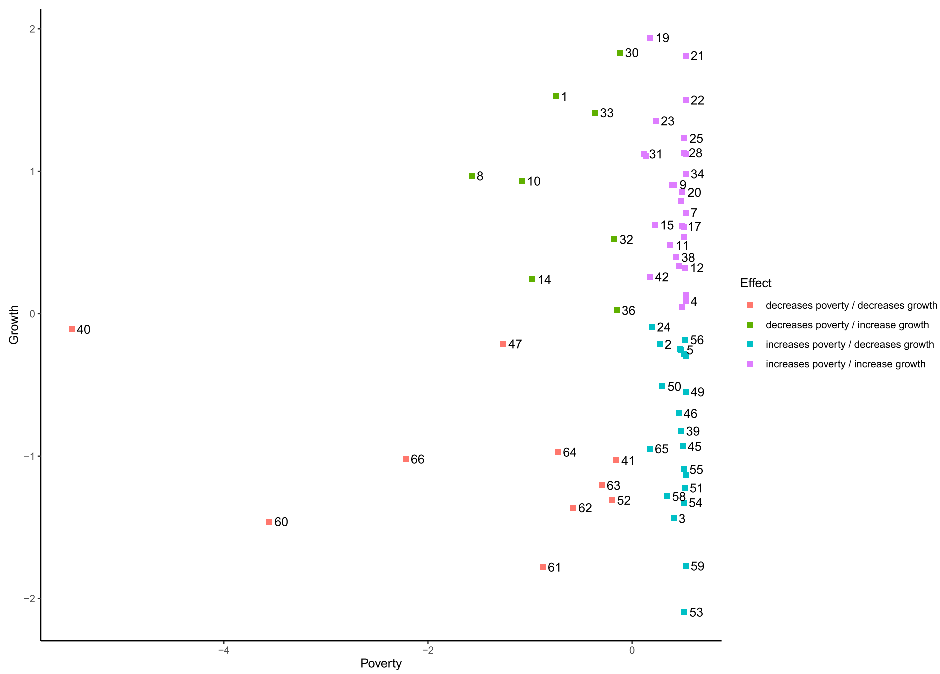
Table 5. Change in inequality (% change in Gini coefficient).

Sector	Simulation 1		Simulation 2		Simulation 3		Simulation 4	
Associative organizations, other personal and domestic services	−0.59	1	−1.27	1	−0.29	65	−0.43	8
Construction	−0.56	2	−0.66	3	−0.18	66	−0.06	66
Agriculture	−0.47	3	−0.68	2	−0.39	59	−0.60	1
Food services	−0.47	4	−0.61	4	−0.38	63	−0.48	2
Clothing and accessories	−0.46	5	−0.48	11	−0.34	64	−0.41	13
Meat, dairy, and fishery products	−0.45	6	−0.52	6	−0.40	50	−0.44	5
Other food products	−0.45	7	−0.52	5	−0.39	60	−0.41	25
Footwear and leather goods	−0.43	8	−0.32	19	−0.39	57	−0.41	16
Land transportation	−0.42	9	−0.49	9	−0.39	58	−0.41	17
Furniture and products from different industries	−0.42	10	−0.31	21	−0.38	62	−0.40	48
Livestock	−0.42	11	−0.49	10	−0.41	21	−0.43	6
Wholesale and retail trade	−0.42	12	−0.48	12	−0.40	53	−0.41	15
Forest production; fisheries and aquaculture	−0.42	13	−0.50	8	−0.41	22	−0.42	11
Sugar manufacture and refining	−0.42	14	−0.50	7	−0.41	7	−0.45	3
Manufacture of textile products	−0.41	15	−0.28	23	−0.40	56	−0.43	7

Source: Own elaboration.

largest contribution to increased production. Sectors to the left and above have a joint contribution to economic growth and poverty reduction, with only eight sectors: 8, 10, 14, 1, 33, 32, 36, and 30. Many sectors contribute to increased economic growth, but increase poverty, as is the case for example with the sectors: 44, 34, and 22. And there are still

Figure 1. Output multiplier and poverty reduction – Simulation 1.



Note: Standardized multiplier and percentage of poverty. Source: Own elaboration.

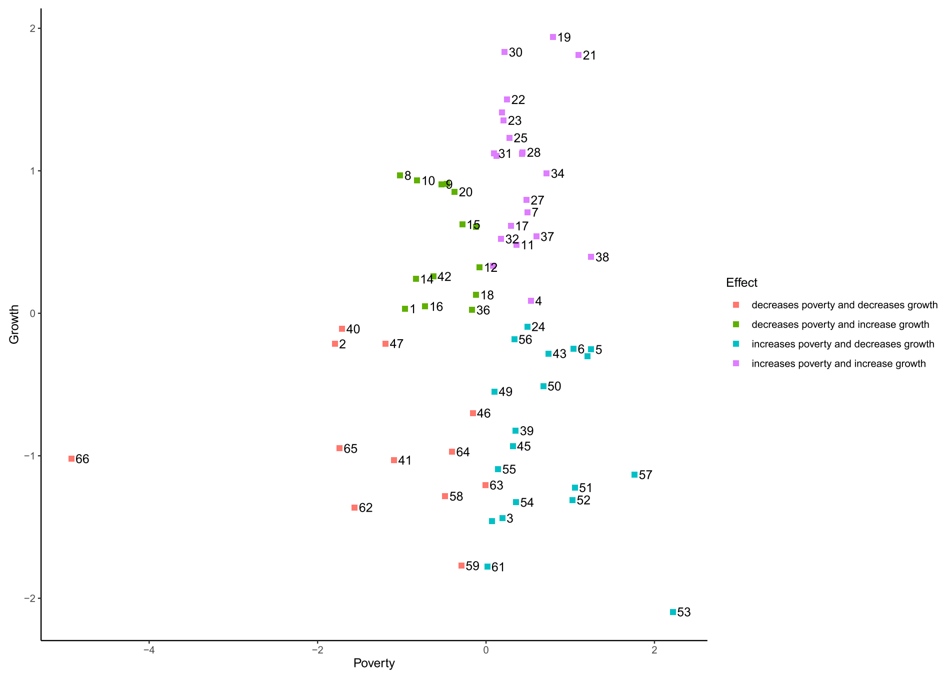
activities that contribute to reduced economic growth and increased poverty, such as: 53, 58, 2, 3, among others.

In simulation 2, many activities contribute to economic growth at the same time as they contribute to the increase of poverty, among these activities are: 38, 21, 44, 22. Sectors 1, 8, 9, 10, 12, 13, 14, 15, 16, 18, 20, 26, 36 and 42 contribute to economic growth and poverty reduction (Figure 2). In simulation 3, the number of activities that contribute to economic growth and poverty reduction increases, with the sectors: 16, 9 and 17 standing out, with higher percentages of poverty reduction (Figure 3).

In Simulation 4, with the recovery of growth in various sectors in final demand, many sectors contribute to an increase in poverty and economic growth, as is the case of: 28, 32, 34, 35. Among the sectors that contribute to poverty reduction while increasing economic growth are: 8, 9, 10 (Figure 4).

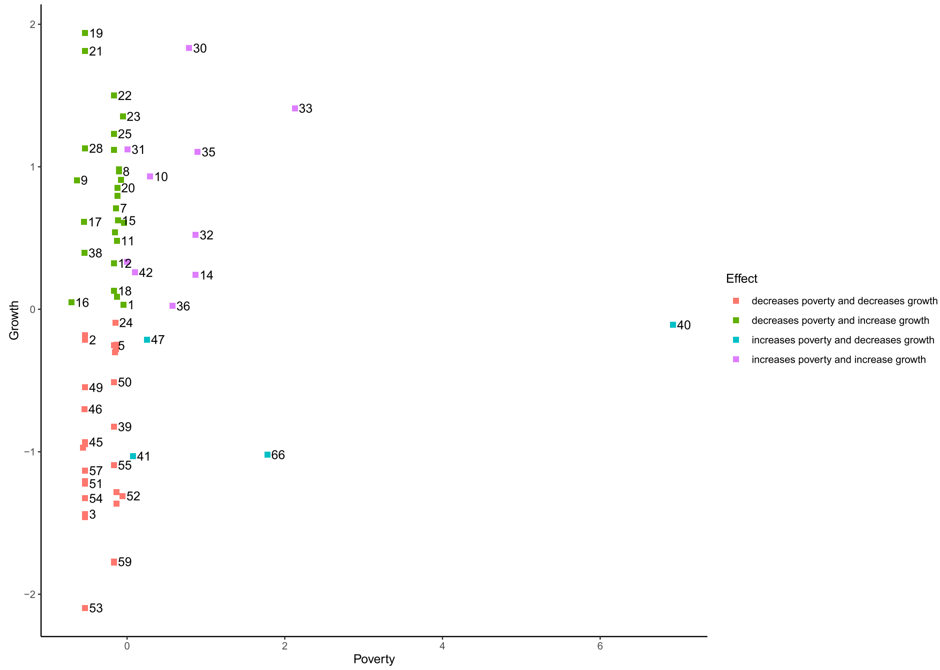
This comparison reinforces that the pattern of sectoral growth has a special contribution to the reduction of poverty, showing that labor-intensive activities, employing and paying income to a high percentage of poor individuals, such as Construction and Associative organizations, other personal and domestic services are activities with high potential for poverty reduction, and are also important for reducing inequality according to some simulations. However, these activities are not able to conciliate the interest in reducing poverty and increasing economic growth. On the other hand, other activities, predominantly linked to industry, especially traditional industries (as pointed out by Pradhan & Sahoo, 2012) have the potential to reconcile these interests. This can be highlighted in Figure 2, with simulation 2, since a stimulus that changes the output composition contributes significantly

Figure 2. Output multiplier and poverty reduction – Simulation 2.



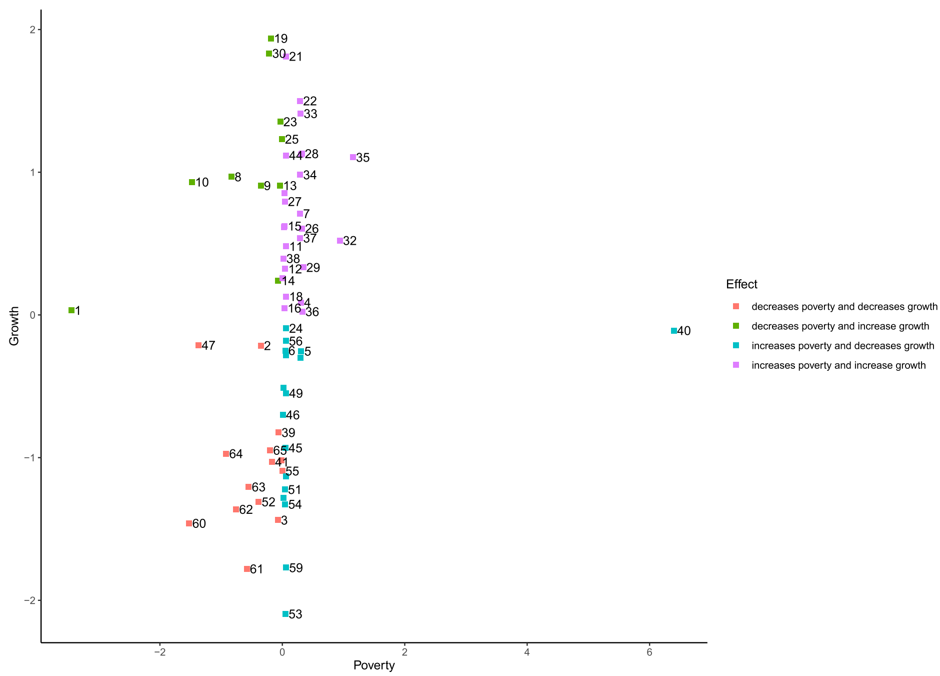
Note: Standardized multiplier and percentage of poverty. Source: Own elaboration.

Figure 3. Output multiplier and poverty reduction – Simulation 3.



Note: Standardized multiplier and percentage of poverty. Source: Own elaboration.

Figure 4. Output multiplier and poverty reduction – Simulation 4.



Note: Standardized multiplier and percentage of poverty. Source: Own elaboration.

to increasing the number of activities that contribute to poverty reduction and increased economic growth.

From simulation 1, it is possible to highlight that the productive structure itself is an obstacle to the goal of poverty reduction, obtaining a productive arrangement in which the activities that most contribute to poverty reduction are also activities that perpetuate poverty, employing a high percentage of workers in low-productivity and low-wage activities. In simulation 2, the result obtained shows a broader contribution to the reduction of poverty, with a greater incentive to industrial activities, but based on an effort to change the composition of the product.

Simulation 3 represents a period of economic crisis, with a contribution to the reduction of poverty in some activities that had an expansion of the product, as is the case of the manufacture of wood products. Simulation 4, on the other hand, represents a period of economic recovery and also reflects the effect of an important expansion of agricultural activity, which ends up laying pressure on industrial activity that eventually starts to contribute to the increase in poverty.

5. Final remarks

Through the integration of a Leontief–Miyazawa model with a microsimulation model, this paper highlighted the connections between the economic structure and the potential of reducing poverty and inequality in Brazil. The results allow us to shed some light on the debate about the sectoral potential for inclusive growth policies.

First, the construction of the Leontief–Miyazawa system showed that some activities, when stimulated, considering an exogenous demand, have a great capacity to raise income, especially for the poorest classes. The activities with the greatest potential for increasing incomes were: Associative organizations, other personal and domestic services; Clothing and accessories; Textile products; and Agriculture. Those activities generate direct effects on poverty by employing low-wage workers. This result is consolidated in the literature, as explained by Moreira (2007), by the potential of these sectors to allocate a large part of spending in the form of wages. Gutierre et al. (2012) also show that not only do these activities employ the poorest, but also, they produce necessities demanded by the whole population.

In relation to poverty reduction, the results showed the role of Construction and Associative organizations, other personal and domestic services, with a high percentage of poor individuals, in addition to Public administration, defense, and social security with high importance in the final demand, which despite contributing to the reduction of poverty, make a low contribution to the reduction of inequality or even make a contribution to the increase of inequality. On the other hand, a major contribution to the reduction of inequality was identified in Construction; Associative organizations, other personal and domestic services; Agriculture; Food services; Meat, dairy, and fishery products.

Our results are in line with the literature by emphasizing the importance of labor-intensive activities to reduce inequality and improve the income of low-income groups, as in the studies by Moreira et al. (2008), Gutierre et al. (2012), who highlight how the changes in the productive structure were especially favorable for the reduction of inequality.

Additionally, the information presented in this paper reinforces that the sectoral pattern of economic growth has heterogeneous effects on poverty and inequality reduction.

With a greater participation in total production, from simulation 2, the industry revealed an important contribution to the reduction of poverty, inequality and to production growth. Therefore, these activities are able to conciliate the interest in reducing poverty and increasing economic growth. At the same time, although positive for reducing inequality according to the literature, those results show that the productive structure obtained represents a barrier to the objective of poverty reduction by allocating a high percentage of employees in low productivity and low remuneration activities, generating a contribution that, in fact, may perpetuate poverty. Highlighting this, this study could contribute to the elaboration of public policies that affect the sectoral composition of the product, as it is the case of trade policy and the Brazilian orientation towards commercial specialization in a few products, especially non-industrial ones.

Finally, it is important to highlight that this study uses a static simulation and IO, so that it does not take into account the changing behavior of firms in the demand for work and the reaction of the supply of workers. The construction of the database and the methodology used to make it possible to simulate the distributive effects of aggregate adverse shocks or of specific sectors, providing detailed information on the transmission mechanism in the inequality process. In particular, we believe that the same method and database could be applied to obtain a better understanding of the relationship between productive structure, poverty and inequality in the context of events such as climate shocks with localized sectoral effects, catastrophes and pandemics.

Acknowledgement

We would like to thank anonymous reviewers for their valuable comments and suggestions.

Disclosure statement

No potential conflict of interest was reported by the author(s).

ORCID

Kênia de Souza http://orcid.org/0000-0002-6306-2044
Alexandre Porsse https://orcid.org/0000-0002-2858-9043

References

Barros, R. P., Carvalho, M., Franco, S., & Mendonça, R. (2007). *A Importância da Queda Recente da Desigualdade na Redução da Pobreza* (Texto para discussão 1256, pp. 1–26). Ipea. http://repositorio.ipea.gov.br/bitstream/11058/1965/1/TD_1256.pdf

Barros, R. P., Henriques, R., & Mendonça, R. (2001). *A Estabilidade Inaceitável: Desigualdade e Pobreza no Brasil* (Texto para discussão 800, pp. 1–24). Ipea. https://www.ipea.gov.br/portal/images/stories/PDFs/TDs/td_0800.pdf

Cicowiez, M., & Lofgren, H. (2017). *Building macro SAMs from cross-country databases: Method and matrices for 133 countries* (Policy Research Working Paper 8273, pp. 1–32). World Bank. Retrieved March 15, 2021, from https://ssrn.com/abstract=3087666

D'Orazio, M., Di Zio, M., & Scanu, M. (2006). *Statistical matching: Theory and practice*. Wiley.

Datt, G., & Ravallion, M. (2002). Is India's economic growth leaving the poor behind? *Journal of Economic Perspectives*, *16*(3), 89–108. https://doi.org/10.1257/089533002760278730

Defourny, J., & Thorbecke, E. (1984). Structural path analysis and multiplier decomposition within a social accounting matrix framework. *The Economic Journal*, *94*(373), 111–136. https://doi.org/10.2307/2232220

Ferreira, F. H. G., Leite, P. G., & Ravallion, M. (2010). Poverty reduction without economic growth? Explaining Brazil's poverty dynamics, 1985–2004. *Journal of Development Economics*, *93*(1), 20–36. https://doi.org/10.1016/j.jdeveco.2009.06.001

Figari, F., Paulus, A., & Sutherland, H. (2014). *Microsimulation and policy analysis* (ISER Working Paper Series 2014-23, pp. 1–122). University of Essex, Institute for Social and Economic Research (ISER). http://repository.essex.ac.uk/13536/1/2014-23.pdf

Gibson, B. (2005a). *Empirical modeling and data problems in development*. University of Vermont.

Gibson, B. (2005b). *Two models for analyzing the impact of economic policies*. University of Vermont.

Gutierre, L. M., Guilhoto, J. J. M., & Nogueira, T. A. (2012). *Estrutura produtiva, de consumo e de formação de renda brasileira: Uma Análise de Insumo-Produto para o ano de 2008* (MPRA Paper 46956). University Library of Munich. https://mpra.ub.uni-muenchen.de/46956/1/MPRA_paper_46956.pdf

Ianchovichina, E., & Lundstrom, S. (2009). *Inclusive growth analytics: Framework and application* (Policy Research Working Paper WPS4851, Vol. 1, pp. 1–42). World Bank. https://elibrary.worldbank.org/doi/abs/10.1596/1813-9450-4851

IBGE. (2011). *Pesquisa de Orçamentos Familiares 2008-2009: Análise do Consumo Alimentar Pessoal no Brasil* (pp. 1–150). IBGE. Retrieved April 5, 2020, from https://www.ibge.gov.br/estatisticas/sociais/saude/24786-pesquisa-de-orcamentos-familiares-2.html?=&t=resultados (in Portuguese).

IBGE. (2016). *Pesquisa Nacional por Amostra de Domicílios: Síntese de Indicadores 2015* (pp. 1–108). IBGE. Retrieved April 5, 2020, from https://www.ibge.gov.br/estatisticas/sociais/educacao/9127-pesquisa-nacional-por-amostra-de-domicilios.html?=&t=destaques (in Portuguese).

IBGE. (2018). Matriz *de Insumo-Produto: 2015* (pp. 1–60). IBGE. Retrieved April 5, 2020, from https://www.ibge.gov.br/estatisticas/economicas/contas-nacionais/9085-matriz-de-insumo-produto.html?=&t=publicacoes (in Portuguese).

IBGE. (2019). *Síntese de Indicadores Sociais: Uma Análise das Condições de Vida da População Brasileira: 2019* (pp. 1–130). IBGE. Retrieved April 5, 2020, from https://www.ibge.gov.br/estatisticas/multidominio/genero/9221-sintese-de-indicadores-sociais.html?edicao=25875&t=resultados (in Portuguese).

Ivanic, M., & Martin, W. (2018). Sectoral productivity growth and poverty reduction: National and global impacts. *World Development*, *109*, 429–439. https://doi.org/10.1016/j.worlddev.2017.07.004

Kim, K., Kratena, K., & Hewings, G. J. D. (2014). The extended econometric input-output model with heterogeneous household demand system. *Economic Systems Research*, *27*(2), 257–285. https://doi.org/10.1080/09535314.2014.991778

Leontief, W. (1951). *The structure of American economy, 1919–1939*. Oxford University Press.

Marcos, R. P. (2015). *Decomposição da Queda nas Desigualdades Regional e Pessoal de Renda no Brasil entre 2004 e 2009: Uma Análise via Matrizes de Contabilidade Social* [Master's thesis, Universidade de São Paulo]. Universidade de São Paulo Archive. https://teses.usp.br/teses/disponiveis/12/12138/tde-11032015-140657/pt-br.php

Marcos, R. P., Azzoni, C. R., & Guilhoto, J. J. M. (2014). *Decomposição da Queda na Desigualdade de Renda no Brasil: Uma Análise via Matriz de Contabilidade Social para os Anos de 2004 e 2009*. 42° Encontro Nacional de Economia, Natal, Brazil.

Marinho, E., & Soares, F. (2003). *Impacto do Crescimento Econômico e da Concentração de Renda sobre a Redução da Pobreza nos Estados Brasileiros*. 31° Encontro Nacional de Economia, Porto Seguro, Brazil.

Miller, R. E., & Blair, P. D. (2009). *Input-output analysis: Foundations and extensions* (Chapter 6, pp. 271–275). Cambridge University Press.

Miyazawa, K. (1976). *Input-output analysis and the structure of income distribution*. Springer.

Moreira, G. R. C. (2007). *Políticas Sociais, Desigualdades Pessoais e Regionais da Renda no Brasil: Uma Análise de Insumo-Produto* [Doctoral dissertation, Universidade de São Paulo]. Universidade de

São Paulo Archive. https://www.teses.usp.br/teses/disponiveis/11/11132/tde-15062007-102435/pt-br.php
Moreira, G. R. C., Almeida, L., Guilhoto, J. J. M., & Azzoni, C. R. (2008). Productive structure and income distribution: The Brazilian case. *The Quarterly Review of Economics and Finance*, *48*(2), 320–332. https://doi.org/10.1016/j.qref.2006.12.010
Pauli, C., Nakabashi, L., & Sampaio, A. V. S. (2012). Structural changes and labor market in Brazil. *Brazilian Journal of Political Economy*, *32*(3), 459–478. https://doi.org/10.1590/S0101-31572012000300007
Pradhan, B. K., & Sahoo, A. (2012, June 24–29). *Preliminary draft sectoral growth and poverty alleviation under Alternative market regimes: A two-period social accounting matrix approach for India,1-15*. 2nd Edition of the International School of Input-Output Analysis, Bratislava, Slovakia.
Pyatt, G., & Round, J. I. (1979). Accounting and fixed price multipliers in a social accounting matrix framework. *The Economic Journal*, *89*(356), 850–873. https://doi.org/10.2307/2231503
Ravallion, M. (2001). Growth, inequality and poverty: Looking beyond averages. *World Development*, *29*(11), 1803–1815. https://doi.org/10.1016/S0305-750X(01)00072-9
Ravallion, M., & Chen, S. (2007). China's (uneven) progress against poverty. *Journal of Development Economics*, *82*(1), 1–42. https://doi.org/10.1016/j.jdeveco.2005.07.003
Rässler, S. (2012). *Statistical matching: A frequentist theory, practical applications, and alternative Bayesian approaches*. Springer.
Round, J. (2003). Social accounting matrices and SAM-based multiplier analysis. In F. Bourguignon & L. A. Pereira da Silva (Eds.), *The impact of economic policies on poverty and income distribution: Evaluation techniques and tools* (Chapter 14, pp. 261–276). World Bank and Oxford University Press.
Santos, W. O., Santos, A. S., Gonzales, E. O., & Lopes, R. L. (2013). *Simulações de Impactos Setoriais sobre a Distribuição de Renda e o Crescimento Econômico: Evidências para o Brasil*. 41° Encontro Nacional de Economia, Foz do Iguaçu, Brazil.
Savard, L. (2005). Poverty and inequality analysis within a CGE framework: A comparative analysis of the representative agent and micro-simulation approaches. *Development Policy Review*, *23*(3), 313–331. https://doi.org/10.1111/j.1467-7679.2005.00289.x
Silva, L. A., Ribeiro, L. C. S., & Souza, K. B. (2018). *Estrutura Produtiva e Distribuição Interpessoal de Renda no Estado da Bahia*. XXI Encontro de Economia da Região Sul, Curitiba, Brazil.
Silva, M. V. A. (2018). *Estrutura de Renda, Consumo e Sistema Produtivo: Mudanças na Economia Brasileira entre 2000 e 2010* [Doctoral dissertation, Universidade Federal de Juiz de Fora]. Universidade Federal de Juiz de Fora Archive. http://bdtd.ibict.br/vufind/Record/UFJF_034c99e41db51dbfe8fef7959ba966a3
Stone, R. (1985). The disaggregation of the household sector in the National accounts. In G. Pyatt & J. Round (Eds.), *Social accounting matrices: A basis for planning* (pp. 145–185). Word Bank.
Thorbecke, E. (1992). *Adjustment and equity in Indonesia*. OECD Development Center.
Thorbecke, E., & Jung, H. S. (1996). A multiplier decomposition method to analyze poverty alleviation. *Journal of Development Economics*, *48*(2), 279–300. https://doi.org/10.1016/0304-3878(95)00037-2
Tiberti, L., Cockburn, J., & Cicowiez, M. (2017). *A top-down behaviour (TDB) microsimulation toolkit for distributive analysis* (Working Paper 2017-24). Partnership for Economic Policy. https://papers.ssrn.com/sol3/Delivery.cfm/SSRN_ID3159366_code361712.pdf?abstractid=3159366&mirid=1
United Nations. (2018). *Goal 1: End poverty in all its forms everywhere*. Sustainable Development Goals, United Nations. https://www.un.org/sustainabledevelopment/povertyAccessed 04-05-2020