Poverty and the functional distribution of income: in pursuit of strategies for inclusive growth

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Abstract

This study contributes to the discussion of inclusive growth policies, which allow work opportunities for the low-income population and self-sustaining elimination of poverty. To do so, we developed a microsimulation model integrated with input-output data where consumption and income data were merged and along with sectorial information were analyzed in the light of Miyazawa (1976). Based on this detailed database, it was possible to map, by sector and by household, the ways of transmitting economic growth through the labor market identifying the effects on poverty and income distribution. The results show how labor-intensive sectors are important in attaining the goal of ending poverty and how the income generated by those sectors can generate positive effects on the rest of the economy. In addition, the results also show that some activities contribute to reconciling the interests of poverty reduction, inequality, and economic growth.

Keywords: poverty; income distribution; inclusive growth; Miyazawa.

JEL Classification: C67, C63, I32.

Resumo

Este estudo contribui para a discussão de políticas de crescimento inclusivo, que possibilitem oportunidades de trabalho para a população de baixa renda e a eliminação autossustentável da pobreza. Para isso, desenvolvemos um modelo de micro-simulação integrado com dados de insumo-produto, onde os dados de consumo e renda foram integrados e, juntamente com as informações setoriais, foram analisados à luz de Miyazawa (1976). Com base nessa detalhada base de dados, foi possível mapear, por setor e por domicílio, as formas de transmissão do crescimento econômico pelo mercado de trabalho identificando os efeitos sobre a pobreza e a distribuição de renda. Os resultados mostram como os setores intensivos em mão de obra são importantes para o cumprimento da meta de erradicação da pobreza e como a renda gerada por esses setores pode gerar efeitos positivos no restante da economia. Além disso, os resultados também mostram que algumas atividades contribuem para conciliar os interesses de redução da pobreza, desigualdade e crescimento econômico.

Palavras-chave: pobreza; distribuição de renda; crescimento inclusivo; Miyazawa.

Classificação JEL: C67, C63, I32.

Area 13: Desigualdade, pobreza e políticas sociais.

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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 (FERREIRA et al., 2007; BARROS, 2001, 2007, 2009). However, in the most recent period, the incidence of poverty in Brazil has increased, from 17.9% in 2014 to 21% in 2017, according to the World Bank (2019).

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 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 and LUNDSTROM, 2009).

In the research literature, several studies, using econometric approaches, demonstrate the contributions of economic growth and inequality to poverty reduction. (RAVALLION and CHEN, 1997; RAVALLION, 2001; MARINHO and SOARES, 2003).

Other studies, based on input-output approaches, highlight changes in the Brazilian productive structure in the 2000s, in consumption and income patterns, highlighting, for instance, the role of some activities in generating income for the poorest income classes, and the role of some activities and policy measures to reduce inequality (MOREIRA, 2008; GUTIERRE, GUILHOTO and NOGUEIRA, 2012; SILVA, 2018).

In this sense, this study investigates the role of sectoral relations and their interconnections in the functional distribution of income, it being possible to verify, through changes in final demand, what are the effects on the household's labor income and which activities contribute to further reduction in the percentage of poverty and inequality. Using Miyazawa's (1976) approach, we developed a microsimulation model, with multiple households, matching data from the Family Budget Survey (POF[1]) for 2008, the National Household Sample Survey (PNAD[2]) for 2015, and input-output matrices for 2015.

The study contributes to the existing literature in three ways: by constructing a detailed database linking microdata on consumption and labor payments to input-output data, by allowing an analysis of the connection between sectorial demand and its effects on household poverty and inequality at the microlevel, and by discussing the trade-offs between stimulating growth and reducing poverty.

In addition to this introduction, the present paper is divided as follows. The next section presents the literature review on the relationship between productive structure and the income generation process. Then the methodology and database section describe the data used, as well as the procedures for building the database. Then the results are discussed. Finally, the last section presents the final considerations.

[1] From Portuguese "Pesquisa de Orçamentos Familiares."
[2] From Portuguese "Pesquisa Nacional por Amostra de Domicílios."

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

As Ivanic and Martin (2017) point out, much of the analysis on the pattern of growth and poverty was based on econometric approaches, allowing to test hypotheses from real data, generally relating growth and inequality to poverty (RAVALLION and CHEN, 1997; RAVALLION, 2001; MARINHO and SOARES, 2003) or the pattern of growth in poverty (DATT and RAVALLION, 1996; FERREIRA et al., 2007). On the other hand, approaches based on input-output models offer the advantage of considering, in addition to the direct effects, the indirect and induced effects of the growth pattern, consumption, and income under poverty and inequality.

Among the pioneering works on the theme recorded in Stone (1958) for the United Kingdom and other industrialized countries, the works of Pyatt and Round (1979) for Sri Lanka, Defourny and Thorbecke (1984) for South Korea, Thorbecke et al. (1992) for Indonesia, studies that jointly evaluate the role of an increase in income on income distribution and on the earnings of economic groups. Round (2003) employs the approach of Miyazawa (1976), incorporating a cycle of income expenditure, in an input-product model with multiple families.

To illustrate a few examples from the international literature, Pyatt and Round (1979) used a 1970 Social Accounting Matrix (SAM) for Sri Lanka to describe the income distribution structure among Sri Lankan families, demonstrating a greater income multiplier for urban families. Thorbecke and Jung (1996) using a 1980 SAM for Indonesia, and considered 23 categories of sectors and 8 households, highlighted how different activities impact household incomes, due to changes in average income and elasticity in relation to average income.

To assess sectoral contributions to poverty, Thorbecke and Jung (1996) used the proportion of people and the poverty gap and considered the effects of the SAM's multiplier related to the elasticity of poverty in relation to the growth of the average income by family group. The authors demonstrated that the highest effects on poverty were in agricultural production, services, and informal activities, in contrast to lower effects for industrial activities, indicating low distributional effects for non-labor-intensive activities. In this light, Thorbecke and Jung (1996) draw attention to the need to strengthen the human capital of the poorest, as the industrialization process progresses.

Using a similar method, Thorbecke and Jung (1996) and Pradhan and Sahoo (2012) calculate the SAM's multiplier for India, for 1994-95 and 2004-05, with 19 sectors, and 8 household groups, divided between urban and rural families, and four different types of policy scenarios (post-1991 reforms, from a closed and controlled regime scenario, with capital, government and rest of the world accounts exogenous to a fully liberalized regime). The authors demonstrated that, for the year 1994-95, education, agriculture, and other services made the greatest contribution to the alleviation of poverty, these sectors being more labor-intensive. The same results were found for 2004-05, except for education in the fully liberalized regime. The authors also point out that other labor-intensive sectors, such as food products, traditional manufacturing industries (leather, wood, and paper), and construction, presented average results for poverty alleviation, both for the percentage of poverty, and the poverty gap.

In Brazil, several studies (such as Moreira, 2007; Moreira et al., 2008; Gutierre, Guilhoto, and Nogueira, 2012; Santos et al., 2013; Marcos, 2015, and Silva, 2018), used input-output analysis focused on poverty and inequality assessments. In general, these studies reveal the highly concentrated income in the country, and the improvement in the income of the poorest classes in the 2000s.

Moreira (2007) using input-output data for 2002, POF 2005, PNAD-2004, 31 activities, and 10 families, through the Leontief-Miyazawa approach, shows that a stimulus to some sectors, such as private non-market services sectors (including unpaid domestic services and non-profit private institutions), public administration, and services provided to families and

businesses, had the greatest impact on household income through wage payments. However, it was the private non-market services, agriculture, wood and furniture, and civil construction sectors that resulted in the greatest impacts for the poorest income classes (up to R$ 1,000.00). The author points out that sectors that are major employers of less qualified labor, with a large mass of low wages, are the ones that most contribute to the reduction of inequality, that is, private non-market services, wood and furniture, and clothing. The author also observes that sectors such as agriculture, mineral extraction, the textile industry, and food industry when stimulated have the potential to reduce inequality in almost the entire country, paying most of the increase in income to low-income families, in contrast to financial institutions and public administration.

Moreira et al. (2008) aiming to evaluate the impacts of changes in the productive structure of Brazil from 1992 to 2002 under income distribution used the Leontief and Leontief-Miyazawa model, with input-output data from 1992 and 2000, PNAD 1991 and 2001, and POF 2002, for 31 sectors, and 10 income classes. First, the authors highlighted the most unequal sectors, referring to inequality within the sector (among them rubber, footwear, other industries). Secondly, they perform a simulation of an increase of BR$ 1 million in each sector, maintaining the participation of the activities in 1992, obtaining as a result the changes in the productive structure between the years 1990 and 2000. The authors conclude that the process of economic opening favored inequality reduction, because the sectors expanding their participation were the ones with below average inequality, such as construction, the textile industry, and food.

However, when considering the indirect and induced effects, Moreira et al. (2008) show that some sectors with low internal inequality ended up causing an increase in global inequality through their pattern of interaction with other sectors through the consumption structure. In addition, the changes in sectoral share between the years were positive for reducing inequality, emphasizing that the causes for the increase in inequality were related to the distribution of wages within sectors.

In this sense, Gutierre, Guilhoto, and Nogueira (2012) also highlight how differences in labor demand between skilled and unskilled workers have an impact on the income formation process. The authors use the Leontief-Miyazawa approach, with input-output data from 2008, POF 2008-2009, PNAD-2008 and PME[3]-2008, 7 income classes, and 49 sectors. They found results that supported income formation of the poorer classes in agriculture, forestry, construction, transport, warehousing, and mail, while incomes for the upper classes were provided by financial intermediation and insurance, real estate, and rental services. Using the interrelational multipliers of Miyazawa, the authors indicated that the production-income-consumption relationship has a tendency towards income concentration. Additionally, the multi-sectoral multipliers revealed the importance of the sectors agriculture, forestry, livestock and fishing, food and beverages, garments, accessories, shoes and leather goods, and wood products (excluding furniture) for the poorer classes, which according to the authors, are sectors that produce basic necessities and employ the poorest. The authors conclude that to increase the income of the poorest, some effective policies would be, for instance, export incentives, and credit and tax incentives for sectors with larger multi-sector multipliers.

The evidence of an income-concentrating structure was also demonstrated by Marcos (2015) for 2004 and 2009, especially for the consumption of services (mainly food, financial intermediation and insurance, and trade). The author showed that increasing the participation of the labor factor in the appropriation of added value in relation to capital, despite being concentrated in more educated workers, allowed families to rise from lower income classes to intermediate classes or even high classes. Without this change, the inequality could be even

[3] Monthly Employment Survey, from the Portuguese “Pesquisa Mensal do Emprego.”

greater. For this, the author used a methodology of fixed price multipliers to the data from the SAM of 2004 and 2009, POF 2002-03 and PNAD 2004, with 12 families, and 5 macro-regions.

In order to identify and compare the sectors that contribute the most to economic growth and reducing inequality in Brazil, Santos et al. (2013) used input-output data for 2008, PNAD 2008 and POF 2008-09. The authors used the Leontief-Miyazawa model for 31 sectors and 5 income classes, and found that footwear manufacturing, food industry, vehicles and parts, plastic articles, and machinery and equipment boosted economic growth. For the inter-class income multiplier, the authors find that class C (with monthly household income between BR$ 1,126.00 and BR$ 4,854.00) was the main destination of income generated by an impact on the income of other classes. The authors also found that better results could be obtained with the sectors of agriculture, the food industry, and private services not mercantile to improve the distribution of income in classes E and D.

Finally, Silva (2018) used Miyazawa's approach and Structural Decomposition Analysis to verify changes in income, consumption, and productive structure in Brazil, in the period from 2000 to 2010, combining 2000 and 2010 Input-Output data, with POF's from 2002-2003 and 2008-2009. Detailing the results for 10 families and 45 sectors, the author highlights an increase between 2000 and 2010 in the income generating power of the poorest class (from 0 to 2 minimum wages), through the interrelational multiplier, in addition to a reduction in the percentage of income absorbed by the highest class (above 30 minimum wages). For the author, this result is related to the fall in inequality, the appreciation of the minimum wage in conjunction with the increase in employment and the expansion of consumption of the middle class. Even so, the higher income classes benefit the most from an increase in income for the poorest class. Regarding the multi-sector multiplier, Silva (2018) highlights that the highest multipliers in 2010 were for education, private health activities, and other services, and, especially for other services, there is a change between 2000 and 2010 in favor of lower classes, in relation to the portion of income absorption.

The present study advances this literature by incorporating data at the individual level, integrating a microsimulation module to the Leontief-Miyazawa model. According to Figari, Paulus, and Sutherland (2015), microsimulation refers to the wide variety of modeling techniques that operate at the level of individual units. Orcutt's (1957) work is considered the pioneer in micro-simulation models in the 1950s to analyze the impact of social economic policies in relation to the behavior of micro units. For Figari, Paulus, and Sutherland (2015), there are several motivations for the use of a microsimulation model. It is a tool that can assist in the development of new policies with specific objectives, or in dimensions that have not been considered, according to the authors.

3 Methodology

The empirical strategy used has three main steps: i) statistical matching between consumption and labor market microdata; ii) calibration between national input-output 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 input-output 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 5,000 products. Household expenses were

brought into line with the classification of the National Accounts System, and aggregated in 67[4] 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 input-output 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 number of adults; d) the total number of children; 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[6] 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 Input-Output Matrix (IOM-2015), from the Brazilian Institute of Geography and Statistics (IBGE[7]), considering 66 activities[8].

3.2 Statistical matching

To combine the POF and PNAD data, a statistical matching technique was used that 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; RASSLER, 2002). 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 the use of 115,623 households to apply the Leontief-Miyazawa model.

Considering the synthetic database, the ratio between total consumption and income per household in the POF was obtained, which was used to transform the units consumed in values compatible with PNAD household income. The shares obtained in household consumption by

[4] 68 sectors were adjusted to 67 sectors, and from 128 to 127 products considering the combination of trade and repair of motor vehicles and motorcycles and wholesale and retail trade, except automotive vehicles in the wholesale and retail trade.

[5] From Portuguese "Classificação Nacional de Atividades Econômicas."

[6] The accumulated inflation in the period was 47.21%.

[7] From Portuguese "Instituto Brasileiro de Geografia e Estatística."

[8] Sectors 66 (Associative organizations and other personal services) and 67 (Domestic services) were aggregated, since for the domestic services sector there are no intra-sector flows.

sector and income by sector were then used to disaggregate the vectors of labor income and consumption of the 2015 national input-output matrix.

3.3 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 4,947 representative families. From this, the Leontief-Miyazawa multiplier for the 4,947 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 terms of results on poverty and inequality. At the same time, the simulation allows for a comparison in terms of elasticity of poverty and inequality, as was presented in the literature review. 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 simulation is 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 4,947 representative households were again disaggregated for individuals, obtaining 356,904 individuals, and enabling us to evaluate the effects in relation to poverty and inequality. 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 Brazil9. 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 general characteristics of the data, as well as the results for the interrelational multipliers, in which the income generated for all households, from changes in income of each household, and for the multi-sector multipliers, can be calculated. In addition, the results obtained for the four simulations are presented. For each of them, we update income by household and sector, as well as the results for poverty and inequality measures.

[9] The adoption of this line is complementary to the $ 1.90 per day line considered by the World Bank. For more information on this discussion of the complementary lines, see Jolliffe and Prydz (2017) and Poverty and Shared Prosperity Report-2018.

4.1 Database

First, it was possible to verify the distribution of poor people 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 Forest production have a poverty rate around 50%[10], 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 includes, 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.

The concentration of poor individuals in each sector is deeply related to the movement of income from wages to consumption. 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 ¼ to ½ 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 3 income levels, compared to the 7th. 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 1, 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 what was discussed in the literature review on inequality between sectors and income absorption by the upper classes.

Table 1 – Interrelational multiplier

Income Group	Wage	Columns sum	Line sum
1	Up to ¼ minimum wage	2.146	1.026
2	From ¼ to ½ minimum wage	2.719	1.045
3	From ½ 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.

The result of the multi-sector 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 2. The largest multi-sector 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, the multi-sector multipliers of Associative organizations, other personal and domestic services, and Clothing and accessories; Textile products; Artistic, creative and entertainment activities and Agriculture.

[10] See Appendix for detailed results.

Table 2 – Multi-sector multiplier

Activity	Multi-sector 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.

4.2 Simulations

The variation in the percentage of poverty for each simulation is detailed in Table 3 and Table 4 details percentage change in Gini. In Simulation 1, the main contribution to poverty reduction is from Construction with a reduction of 3.15% in the percentage of poverty, after stimulus of 10% in the final demand, followed by the sector of Public administration, defense, and social security and Associative organizations, other personal and domestic services which are activities that 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 Simulation 1, there are balanced contributions between activities related to industry and activities related to services in relation to the number of sectors and reduction in the percentage of poverty. In Simulation 2, the main contribution comes from industry activities.

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 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 Appendix, 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.

Table 3– 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

Table 4 – 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.

In common, Simulations 1 and 2 indicate Associative organizations, other personal and domestic services, Construction, and Agriculture as the main activities to reduce inequality (Table 4). In both simulations, activities such as Public administration, defense, and social security and Financial intermediation, insurance, and private pension stand out as the activities that have the lowest contributions, or even contribute to the increase of inequality in the case of Simulation 2, which can be related to the payment of income and employment concentrated in upper classes. These results are in line with Moreira (2007). In both, Simulation 1 and Simulation 2, activities related to industry indicated the greatest contribution to reducing inequality.

Simulations 3 and 4 show similar results by indicating that Construction and Associative organizations, other personal services and domestic services make the lowest contributions to the reduction of inequality, and at the same time, only when the variation in the final demand for Public administration, defense, and social security is smaller is the contribution to the reduction of inequality the greatest (Simulation 3).

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. 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, also 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.

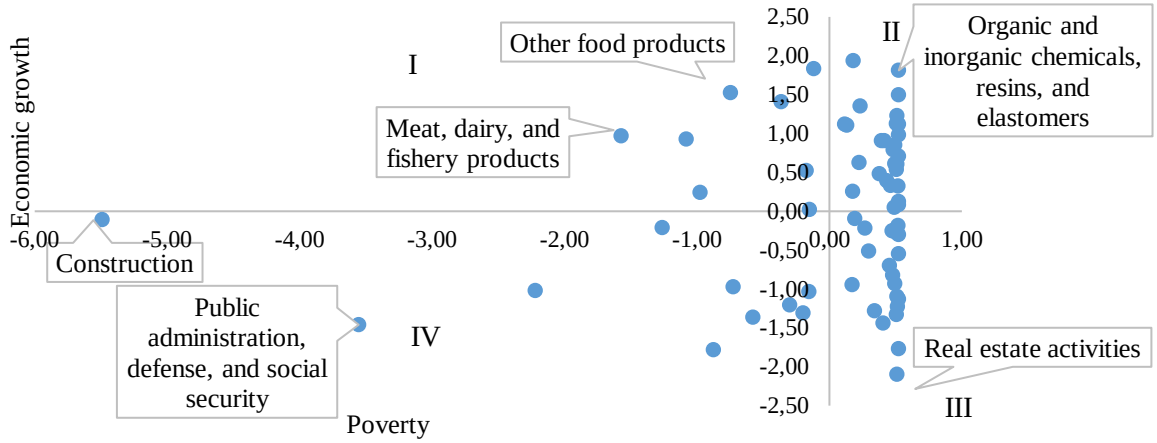
In addition, the results allow us to compare whether the sectors that contribute most to poverty reduction also contribute to economic growth through increased production. This relationship is illustrated in the following figures, relating the Leontief-Miyazawa output multipliers to the poverty variation percentages. These figures are divided into four quadrants. The first quadrant (I) highlights the activities whose contribution to poverty reduction is above average, according to our simulations, and at the same time contribute to the increase in production, i.e., also with a production multiplier above average. In the second quadrant (II), we have the activities that contribute to the increase in production, but also increase poverty. In the third (III), we have the activities that contribute to the increase of poverty and have production multipliers below the average. Finally, in the fourth quadrant (IV), we have those activities that contribute to the reduction of poverty, while having production multipliers below the average

Simulation 1 shows the concentration of activities in Quadrants II and III, in which a change in final demand results in an increase in production, but combined with an increase in poverty, examples of these activities are: Organic and inorganic chemicals, resins, and elastomers; Pesticides, disinfectants, paints, and other chemicals. In Quadrant III, there are 21 activities that contribute to an increase in poverty and reduced growth, among them: Non-real estate rentals and management of intellectual property assets; Real estate activities; Television, radio, cinema, and sound or image recording or editing activities; and Artistic, creative, and entertainment activities.

In Quadrant I, there are only 8 activities that contribute to reducing poverty and increasing economic growth, which are: Agriculture; Meat, dairy, and fishery products; Other food products; Clothing and accessories; Computer equipment, electronic, and optical products; Cars, trucks, and buses, except parts; Furniture and products from different industries; with the exception of agriculture, all activities related to industry. In Quadrant IV are activities such as Construction; Public administration, defense, and social security; and Associative

organizations, other personal and domestic services in which there is a contribution to poverty reduction, combined with below average effects on growth.

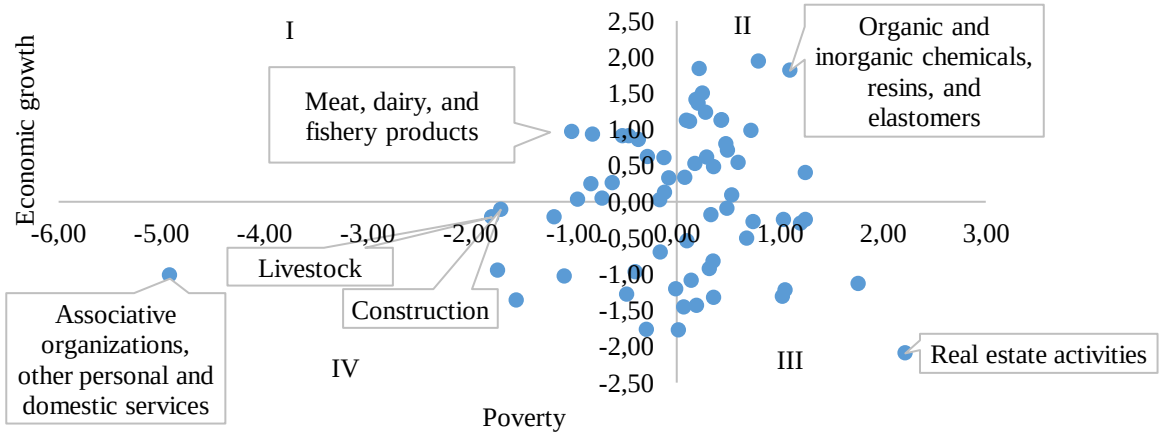
Figure 1 – Output multiplier and poverty reduction – Simulation 1



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

In Simulation 2 (Figure 2), it is also possible to observe a concentration of activities in Quadrants II and III, but now with a few more activities. This shows that some activities would need to have a considerable increase in final demand, greater than in all simulations to allow poverty reduction and economic growth simultaneously. In this simulation, these activities were: Agriculture; Meat, dairy, and fishery products; Sugar manufacture and refining; Tobacco; Clothing and accessories; Footwear and leather goods; Wood products; Printing and playback of recordings; Biofuels; Non-metallic mineral products; Furniture and products from different industries and Land transportation; they were, therefore, mostly related to industry.

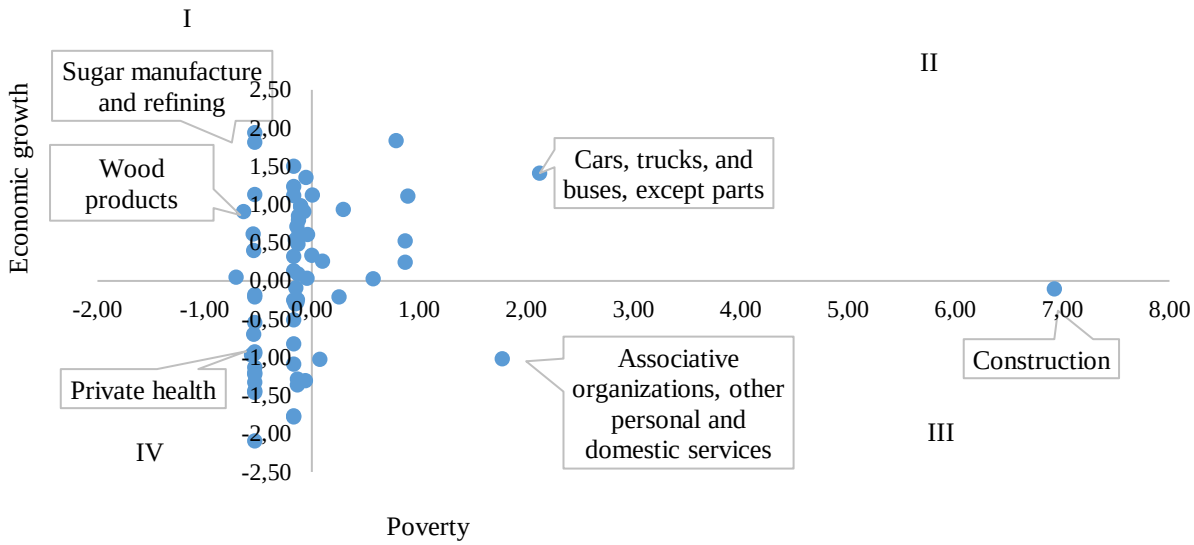
Figure 2 – Output multiplier and poverty reduction – Simulation 2



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

In Simulation 3 (Figure 3), the number of activities in Quadrant I increases, with emphasis on the manufacture of wood products; Sugar manufacture and refining; Manufacture of cellulose, paper, and paper products, sectors with an increase in final demand between 2016 and 2015.

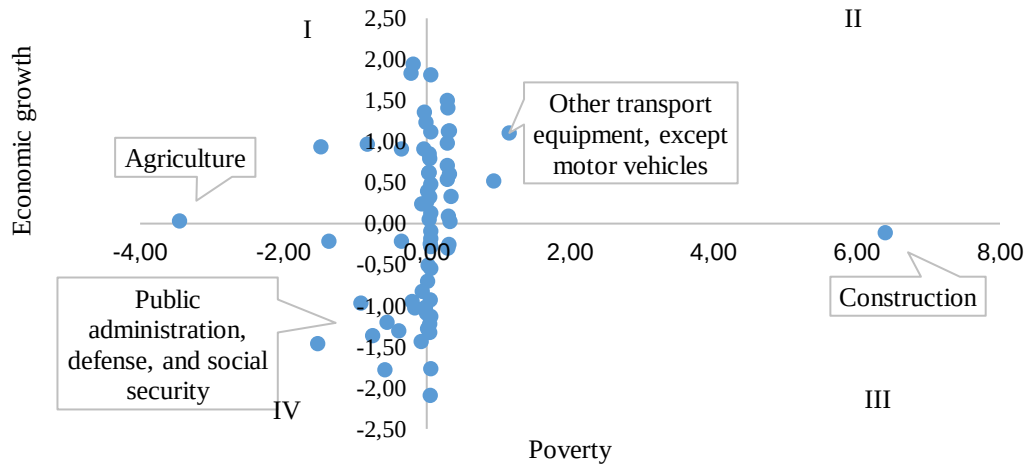
Figure 3 – Output multiplier and poverty reduction – Simulation 3



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

In Simulation 4 (Figure 4), with the recovery of growth in various sectors in final demand, once again activities are concentrated in Quadrants II and III. In Quadrant I, in addition to the activities already mentioned in Graph 1, are: Sugar manufacture and refining; Textile products; Cleaning products, cosmetics, perfumery, and personal hygiene; Rubber and plastic products; with the exception of: Cars, trucks, and buses, except parts; Furniture and products from different industries. Especially activities related to industry and which registered an increase in final demand in 2017.

Figure 4 – Output multiplier and poverty reduction – Simulation 4



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

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 point out by PRADHAN and SAHOO, 2012) have the potential to reconcile these interests.

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 sectorial 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, mainly explained, according to Moreira (2007), by the potential of these sectors to allocate a large part of spending in the form of wages. Gutierre, Guilhoto, and Nogueira (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.

Therefore, the information presented in this paper reinforces that the sectorial pattern of economic growth has heterogeneous effects for poverty and inequality reduction. In addition, the results can support the elaboration of public policies indicating activities that have the potential to reconcile the interests of poverty reduction, inequality reduction, and economic growth, in line with the goal of inclusive growth. Among these activities, we highlight Meat, dairy, and fishery products; Clothing and accessories; Textile products; Sugar manufacture and refining, and Other food products.

Concisely, our results indicated that some manufacturing activities have the potential for reducing poverty, and inequality, and to promote economic growth, at the same time. Therefore, despite labor-intensive sectors having an important role to play in reducing poverty and inequality, inclusive growth can be especially activated with activities related to manufacturing and services that are not necessarily the most labor-intensive sectors. Another contribution was the construction of a detailed Leontief-Miyazawa system that can be used for future research.

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Appendix

Poverty (%) and Employment (%)

Activities	Poverty (%)	Employment (%)
Forest production; fisheries and aquaculture	55.33%	0.74%
Agriculture	49.21%	5.52%
Livestock	35.05%	2.79%
Water, sewage and waste management	28.48%	0.44%
Other food products	28.21%	0.92%
Associative organizations, other personal and domestic services	26.38%	27.29%
Construction	25.99%	10.44%
Food services	25.18%	3.14%
Non-metallic mineral products	24.66%	0.57%
Tobacco	22.92%	0.01%
Clothing and accessories	21.97%	0.82%
Wood products	21.82%	0.46%
Extraction and processing of non-ferrous metallic minerals	21.77%	0.07%
Accommodation	21.74%	0.31%
Textile products	21.31%	0.37%
Other administrative activities and complementary services	20.71%	1.73%
Cleaning products, cosmetics, perfumery and personal hygiene	20.61%	0.07%
Sugar manufacture and refining	19.08%	0.13%
Wholesale and retail trade	18.57%	13.95%
Maintenance, repair and installation of machinery and equipment	18.38%	0.08%
Artistic, creative and entertainment activities	18.36%	1.67%
Extraction of mineral coal and non-metallic minerals	17.33%	0.09%
Water transportation	16.49%	0.08%
Furniture and products from different industries	16.38%	0.52%
Land transportation	15.45%	4.56%
Meat, dairy and fishery products	15.12%	0.45%
Metal products, except machinery and equipment	15.09%	0.64%
Footwear and leather goods	14.51%	0.41%
Electrical machinery and equipment	14.15%	0.25%
Storage, auxiliary transport and mail activities	13.97%	0.54%
Surveillance, security and investigation activities	13.56%	0.95%
Pesticides, disinfectants, paints and other chemicals	13.10%	0.26%
Cellulose, paper and paper products	13.10%	0.20%
Private education	13.10%	2.34%
Biofuels	13.09%	0.10%
Beverage Manufacturing	13.07%	0.18%
Other transport equipment, except motor vehicles	11.66%	0.19%
Rubber and plastic products	11.41%	0.28%
Telecommunications	10.75%	0.26%
Iron ore extraction	10.09%	0.15%
Private health	9.80%	2.03%
Public administration, defense, and social security	9.17%	5.20%
Machinery and mechanical equipment	9.08%	0.53%
Air Transport	9.05%	0.06%
Electric power, natural gas and other utilities	8.88%	0.25%
Other professional, scientific and technical activities	8.46%	0.21%
Oil refining and coking plants	7.80%	0.06%
Nonferrous metal metallurgy and metal casting	7.54%	0.19%
Public health	7.39%	0.94%

(continued)

Poverty (%) and Employment (%)

Activities	Poverty (%)	Employment (%)
Public education	5.93%	2.44%
Pharmaceutical chemicals and pharmaceutical products	5.56%	0.13%
Printing and playback of recordings	5.42%	0.22%
Legal, accounting, consulting and corporate headquarters activities	5.26%	1.28%
Computer equipment, electronic and optical products	4.55%	0.06%
Development of systems and other information services	4.41%	0.31%
Cars, trucks and buses, except parts	4.12%	0.44%
Architectural, engineering, technical testing/analysis and R&D services	3.69%	0.45%
Television, radio, cinema and sound/image recording/editing activities	3.44%	0.12%
Financial intermediation, insurance and private pension	3.00%	0.86%
Pig iron, ferroalloys, steel and seamless steel tubes	2.98%	0.12%
Oil and gas extraction	2.43%	0.11%
Parts and accessories for motor vehicles	0.00%	0.01%
Organic and inorganic chemicals, resins and elastomers	0.00%	0.01%
Editing and editing integrated with printing	0.00%	0.01%
Real estate activities	0.00%	0.01%
Non-real estate rentals and management of intellectual property assets	0.00%	0.01%

Source: Own elaboration.