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Poverty and Inequality Dynamics in Manaus:  
Legacy of a Free Trade Zone?

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*For sustainable and inclusive world development*

# Poverty and Inequality Dynamics in Manaus: Legacy of a Free Trade Zone?\*

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## ABSTRACT

This study contributes to the literature on the social impacts of Special Economic Zones by analyzing the dynamics of poverty and inequality in the Brazilian state of Amazonas, where the Free Trade Zone of Manaus (FTZM) is located. Using census data, micro-decompositions and counterfactual simulations, we show that if labor income was a major driver of poverty and inequality declines for the municipality of Manaus in the 2000-2010 decade, non-labor income was far more important in the rest of the state of Amazonas. Our contrasting results illustrate both the benefits and limitations of the influence of the FTZM. A better targeting of both social policies and training programs could improve distributional outcomes in the whole area.

**Keywords:** Free trade zone, poverty; inequality; Manaus; Brazil.

**JEL codes:** D31, F16, F14, I32

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## 1. INTRODUCTION

Special economic zones (SEZs) can be broadly defined as “demarcated geographic areas contained within a country’s national boundaries where the rules of business are different from those that prevail in the national territory” (see Farole and Akinci, 2011). The creation of these zones inside a country’s borders has been used in past decades as a policy instrument to generate employment, promote industrialization, enhance regional integration and, ultimately, as a tool to foster economic development and raise peoples’ standards of living. The number of SEZs has indeed surged in the world, particularly in developing countries, and a wide range of them can now be found with different goals and distinct strategies.<sup>1</sup>

Despite this widespread use of SEZs in developing countries, their economic and social record has remained controversial. Although SEZs can drive up job creations and technology transfers, attract foreign direct investment and multinational companies, strengthen integration into global value chains and create backward and forward linkages with the rest of the economy, they can also create distortions (tax-based, geographical, etc.) and their impact on labor standards and human development is still a subject of considerable debate. Recent reviews of descriptive case studies point out how gains from zone operations vary across countries, but also within countries and across zones and time (see Aggarwal 2007, 2012; FIAS 2008; Farole 2011).

One area in which evidence is still scarce (partly due to data availability problems and measurement difficulties) has to do with the potential poverty-alleviating effect of SEZs in developing countries. Some recent studies find how SEZs might offer better job opportunities, particularly for more vulnerable groups (women, young people, minorities and poor people in general), which may include higher wages (Amengual and Milberg, 2008; McCallum, 2011) and better labor conditions (Jenkins, 2005; Cling et al., 2005; Glick and Roubaud, 2006; Cling et al., 2009; Aggarwal, 2007; Amengual and Milberg, 2008; De Hoyos et al., 2012). These factors may lead to poverty and/or inequality reduction. At the same time, several case studies (Oberai et al., 2001; Kwaku Akpokavie, 2001; ILO, 2003 and 2008; Glick and Roubaud, 2006; McCallum, 2011)

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<sup>1</sup> The denomination ‘SEZ’ covers a broad range of more specific zone types such as Free Trade Zones (FTZ), Export Processing Zones (EPZ), Enterprise Zones, Free Ports and others. See Farole (2011), Farole and Akinci (2011), and Siroën and Yücer (2014) for descriptions and classifications of different types of SEZs in the world. As an example of their development, the International Labour Organization’s (ILO) database of SEZs reported 176 zones in 47 countries in 1986, and approximately 3,500 zones in 130 countries by 2006 (Singa Boyenge, 2007). In addition, Yücer, Siroën and Archanskaia (2014) find some 1,083 zones (not counting Maquiladoras and US Foreign Trade Zones) in 2008 in their World FTZ Database covering 158 countries. Note that differences in the numbers of SEZs found across databases are closely linked to the type of SEZ definition chosen, but there is clear evidence of growth in numbers.

also find some troubling signals associated with the development of SEZs, such as lax enforcement of labor laws (unrestrictive firing regulations and a lack of social protection), lower labor standards (with respect to social dialogue, freedom of association, collective bargaining, etc.), high turnover due to “sweatshop” working conditions in factories (working hours, pace of work, health and safety), and persistently low wage levels over time. However, almost none of the abovementioned studies focus on the ultimate effects of SEZs on household poverty and inequality and indeed few are based on individual data (average sector data or aggregate firm-level data are more frequently used). Among the exceptions, Glick and Roubaud (2006) and Cling et al. (2005, 2009), for Madagascar, do focus on workers’ earnings using individual-level labor force surveys in the Malagasy capital (Antananarivo), and De Hoyos et al. (2012), for Honduras, is one of the rare studies to look at the effects of SEZs on total household income poverty. For example, Cling et al. (2005) find that, in the 1995-2001 period, firms in the Malagasy Zone Franche offered wages as high as the formal private sector ones, while employees’ working conditions were in general more generous (with the exception of working hours).<sup>2</sup> The econometric study of De Hoyos et al. (2012) also shows for Honduras that workers in the maquila sector earned higher wages between 1991 and 2006 and the authors evaluate, through a partial equilibrium simulation exercise, that poverty would have been higher without the maquila sector.

Depending on the set of characteristics and the environment of each SEZ, the consequences for poverty and inequality at a local or regional level can be very different.<sup>3</sup> For example, the type of activities promoted and their links with the local economy matter. Consequently, the role of SEZs in poverty alleviation and, more generally, in income distribution changes still calls for clarification and an in-depth analysis of each specific case, and in the end, remains an empirical issue. Our aim is to contribute to the literature by analyzing poverty and inequality changes in the Free Trade Zone of Manaus (FTZM) and, more generally, in the Brazilian state of Amazonas in the past decade.

The FTZM in Brazil is an interesting case study to analyze the impact of SEZs on distributional outcomes. First, the creation of the FTZM, in the center of the Amazon Forest, was designed from the outset to contribute to the economic and social development of the Amazon Region,

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<sup>2</sup> In a subsequent study, Cling et al. (2009) show that the end of the Multifibre Arrangement had, the following years, a negative impact on wages and working conditions in the Zone Franche.

<sup>3</sup> For a review on the theoretical approaches describing the effects of SEZs on different outcomes, see Aggarwal (2012).

one of the poorest regions in Brazil<sup>4</sup>, and to step up its political integration into the rest of the country. The municipality of Manaus is an isolated enclave where the only means of transportation are the Amazon River and airplane. Despite these problems with transport and market access (local, regional, domestic and foreign), the creation of the FTZM prompted the development of an important industrial hub in Manaus that has posted particularly good economic outcomes over the last decade. By way of illustration, between 2000 and 2010, gross domestic product in Manaus posted high levels of growth (4.4% on an annual average basis), resulting in major job creations.<sup>5</sup> As of 2010, the manufacturing sector represented a higher share of employment in the municipality of Manaus than the average for Brazil as a whole and even for Brazil's urban areas only.<sup>6</sup> Defenders of the FTZM argue that this economic boom generated economic gains as well as positive environmental and social effects. However, if the FTZM's good economic performance can be related to particularly relevant improvements in poverty and inequality indicators in the municipality of Manaus, and more widely in the poor state of Amazonas, still needs to be documented.<sup>7</sup>

This study uses micro-decomposition methods to identify and quantify the relevant factors that account for observed changes in income poverty and inequality from 2000 to 2010 in the municipality of Manaus, where the Free Trade Zone is established, and in the rest of the Amazonas state, based on a series of counterfactual simulations. As we will see, the FTZM is a rather unique experience in Brazil, with a complex and evolving system of taxes and incentives, and the implementation of alternative evaluation methods (such as experimental or cost-benefit analysis) are problematic. In our case, we use two micro-decomposition approaches that have been recently employed in the analysis and comparison of poverty and inequality dynamics in developing and emerging countries, in particular in Latin American countries (Azevedo et al. 2013b; Inchauste et al. 2014). The first methodology is a Shapley-Shorrocks estimate of the standard Datt-Ravallion (1992) decomposition method, which sets out to assess the intricate

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<sup>4</sup>According to the Institute of Applied Economic Research Poverty Series (see [www.ipeadata.gov.br](http://www.ipeadata.gov.br)), high levels of poverty are historically encountered mostly in the Northeast and North. Taking their longest time series available (which uses a poverty line based on an estimation of basic needs in terms of calorie intake), the proportion of poor in 1976 was estimated as 62% in the Northeast and 42% in the North (with values ranging from 32% to 20% in the other regions). In 2011, poverty numbers fell, but rankings across the regions remained almost the same: 28% in the Northeast, 25% in the North and around 7% elsewhere (IPEA, 2015).

<sup>5</sup> GDP growth in the municipality of Manaus, and even that observed at the level of the state of Amazonas (5.3%), was higher on average than the growth observed in Brazil (3.6%) in the 2000-2010 decade.

<sup>6</sup> In 2010, this share stood at 17% in Manaus, compared to 14.3% in Brazil as a whole and 15.2% in urban Brazil.

<sup>7</sup> Figures A1 and A2 in the appendix present the poverty and inequality maps for Brazil for 2001 and 2011 (see also, for example, Ferreira de Souza, 2012), and show how the country saw not only a sharp reduction in poverty rates in the past decade, but also - for the first time in decades - a steady decline in income inequality. Note, however, that the lack of coverage of rural areas in the Northern region in the Brazilian household surveys through to 2003 (see Section 3.1) have edged out these areas from these figures and most studies on poverty and inequality in Brazil.

relationship between poverty, economic growth and inequality by breaking down changes in poverty into the two main poverty reduction mechanisms: growth and redistribution components. Our second decomposition method seeks to gauge which income sources and household characteristics make large contributions to changes in poverty and/or inequality. We use the Azevedo et al. (2012a and 2012b) recently developed Shapley-value decomposition, which builds on the Barros et al. (2006) method, to quantify contributions to distributional changes due to changes in demographics, employment, labor income and non-labor income. Though these decomposition methods are an accounting exercise and do not prove causality, understanding the relative importance of the proximate determinants considered in our analysis can inform discussions on the potential particularities of Manaus within the region and the country as well as the role that different types of public policies may have effectively played in the area's poverty and inequality dynamics. These accounting methods are thus applied separately to the municipality of Manaus and the rest of the state of Amazonas, but also to total and urban Brazil samples to view our results from a country perspective.

This paper is organized as follows. Section 2 gives an overview of the FTZM regime, its characteristics and its economic performance in the last decade. Section 3 describes the data, samples and variables used (subsection 3.1) and provides some summary statistics (subsection 3.2). Section 4 presents our two decomposition methods and Section 5 summarizes the decomposition results. Lastly, Section 6 concludes.

## **2. THE FREE TRADE ZONE OF MANAUS (FTZM)**

The Free Trade Zone of Manaus (FTZM) was established in 1967, although the issue of the Amazon Region's economic development and political integration had been on Brazil's official agenda for a long time.<sup>8</sup> Following the collapse of the rubber-based economy in the early twentieth century, many government measures were adopted to create incentives and enhance the

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<sup>8</sup> The WTO (2013) states that, "Brazilian legislation defines free-trade zones (FTZ), for imports and exports, as zones created to promote the development and regional integration of border areas in the north region, for which they are granted fiscal incentives" (p.92). Eight FTZs have been created (Manaus and Tabatinga, in Amazonas; Macapá/Santana in Amapá, Brasília and Cruzeiro do Sul in Acre; Boa Vista and Bonfim in Roraima; and Guajará-Mirim, in Rondônia). However, the Manaus Free Trade Zone is the only one engaged in production operations, while the others are free ports for the import and export of goods involved only in trade operations. Twenty-four export-processing zone (EPZ) projects with a specific legal framework had also been approved as of December 2012. However, none had yet started operations (WTO, 2013).

region's development, suffering as it was from a lack of economic buoyancy, poverty and geostrategic handicaps.<sup>9</sup>

Decree-Law No. 288 of February 1967 created “an area of free trade of imports and exports and special tax incentives, established with the purpose of creating an industrial, commercial, agricultural and livestock center” in the Amazon region, with a government agency - the Superintendent of the Manaus Free Trade Zone (SUFRAMA) – responsible for the implementation of the incentive schemes.<sup>10</sup> Since its creation, the FTZM has nevertheless undergone a number of economic, legal and institutional changes following changes to the government's development strategy. In the 1970s, for example, the objective of deepening Brazilian industrialization (with an import substitution strategy) prompted stricter restrictions on imports in the FTZM to encourage the emergence of local industry. The industrial hub gradually flourished as wholesale and retail trade activities declined. In the 1990s, Brazilian trade liberalization measures reduced import restrictions nation-wide, especially in the FTZM where a system of federal incentives with counterparts was also implemented (firms applying for these benefits had to comply with some minimum requirements in terms of tasks, number of jobs and investment in R&D).<sup>11</sup> Since the 1990s, only minor changes have been made to FTZM policies, such as firms' contributions to public R&D funds in the Amazon region.

Consequently, the FTZM is now a “fiscal incentive area” (Garcia, 2009), and its fiscal benefits were recently extended through to 2073 by an amendment to the Brazilian Constitution.<sup>12</sup> The main incentives granted to firms in the industrial hub in the 2000-2010 decade were federal, state and local tax breaks and exemptions.<sup>13</sup> Firms in the FTZM also have the benefit of infrastructure.

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<sup>9</sup> Article 199 of the Federal Constitution of 1946 already stipulates the obligation to invest for the execution of the Economic Recovery Plan for the Amazon region (*Plano de Valorização Econômica da Amazônia*).

<sup>10</sup> Note that a first FTZM was created by law (No. 3173, 1957) back in 1957, with a trading zone and a warehouse. However, Sá (1996) finds that poor fiscal incentives and the small geographical area involved (less than 200 ha) failed to create the expected economic boost in the Amazon area. The 1967 Decree-Law amended the initial 1957 Law, implementing the new FTZM format.

<sup>11</sup> Launched in 1991, the “Basic Productive Process” program (Processo Produtivo Básico or PPB) grants tax reductions or exemptions for all products (except arms and munitions, alcoholic beverages,.. See art.3º, Decree-Law 288/1967 for a complete list) to companies that set up a manufacturing process for these products in the FTZM. The PPB scheme is used for the FTZM and the special tax regime that applies to information technology (IT Law, 2001 and 2004).

<sup>12</sup> A first extension of FTZM incentives was granted in 2003 through to 2023, with the second extension in 2014 through to 2073.

<sup>13</sup> The main measures in the system of FTZM fiscal incentives were: (i) 88% reduction of or exemption from import duties on inputs (depending on the product's final destination) and total exemption for capital goods, (ii) a 75% reduction on corporate tax (Imposto de Renda sobre Pessoa Jurídica - IRPJ), (iii) exemption from federal tax on industrial products (Imposto sobre produtos industriais - IPI), (iv) exemption from or reduction of a number of social contributions (such as PIS/PASEP and COFINS, which are employers' contributions based on sales), (v): a 55% to 100% reduction on the state tax on value-added (ICMS – Imposto sobre a Circulação de Mercadorias e



An important feature that differentiates the FTZM from many SEZs around the world is the fact that it imports many inputs from abroad to sell most of its output to the domestic market. As pointed out by Siroën and Yücer (2014), the FTZM is more of an import processing zone than an export processing zone, which is the more usual type of SEZ. In the 2000-2010 decade, around 50% of inputs were imported from foreign markets and more than 90% of sales were made either to other Brazilian states (the majority) or to the rest of Amazonas.<sup>14</sup> Consequently, the FTZM's external trade balance showed an increasing deficit<sup>15</sup> while its internal trade balance posted a growing surplus.

The fiscal incentive policies have created a thriving industrial center in Manaus, with a growing share of this Amazonian industry in national production. The Annual Industrial Survey by the Brazilian Census Bureau (PIA/IBGE) reports that the share of the state of Amazonas (the survey's smallest geographical unit) in Brazilian manufacturing production reached 3.7% in 2010 (while Manaus accounts for just 0.9% of the Brazilian population).<sup>16</sup> After a decade of high growth, Amazonas' manufacturing production had grown by a factor of 3.4, with an annual average growth rate of 13% (see Figure 1a). SUFRAMA data on the firms set up in the FTZM present a similar pattern of growth in the FTZM's sales, also posting average annual growth of 13% between 2000 and 2010 (compared with -2% from 1995 to 2000). This economic buoyancy drove a huge wave of job creations (see Figure 1b). In the state of Amazonas, manufacturing employment almost doubled between 2000 and 2010: PIA/IBGE data show that the number of workers in formal manufacturing industries grew from 59,586 to 116,503 over the period - a 96% increase soaring above Brazil's average 50%. In the FTZM specifically (SUFRAMA data), the number of employees rose from 50,005 in 2000 to 103,673 in 2010 (+107%). In the same time period, the number of firms rose from 307 to 431 (on an annual average basis) while the structure of the FTZM industries remained highly concentrated.

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Serviços, Brazilian VAT) for industrial goods, and (vi) exemption from local taxes on real estate (Imposto sobre a Propriedade Territorial Urbana - IPTU). This last exemption applied only to firms with more than 500 employees and was phased out in 2008.

<sup>14</sup> In 2010, the five main countries from which the FTZM imported were: China, South Korea, Japan, US and Taiwan. The five main export partners were: Argentina, Colombia, Venezuela, US and Mexico. In 2000, the five main export countries were the same. The import countries were: Japan, US, Korea, China and Malaysia (SECEX data).

<sup>15</sup> Even after stated efforts to increase the region's exports in the 1990s, exports remained very low. The average share of exports in total sales was 6.3% over the decade (2000-2010) with its highest level of 12% attained in 2003. The ratio of imports to total purchases started growing in 2004 and stood at 60% by 2012 (SUFRAMA data).

<sup>16</sup> Almost all the formal manufacturing activities covered by PIA/IBGE in the state of Amazonas are concentrated in the FTZM.

One explanation of the FTZM's dynamism in the 2000-2010 period is its production specialization in durable goods for the domestic market.<sup>17</sup> Throughout the last decade, Brazilian GDP growth was driven strongly by rising household consumption and growing investment. The growth in household consumption is linked both to an increase in household income (labor earnings along with pensions and social transfers) and a boom in consumer credit (IPEA, 2010). Household income growth together with the upturn in credit gave low-income families the means to buy durable goods. Motorcycles and electronic devices, the FTZM's main industrial sectors, largely benefited from this increase in domestic demand. Among other factors, Machado and Sá (2012) also underline the positive impact on business expectations of the stated time extensions of the FTZM incentives and some improvements to the fiscal incentive system that stimulated the development of the production of intermediate goods in the area.

The FTZM's costs and benefits are the subject of long-standing ongoing debate among Brazilian economists. FTZM detractors talk about the cost of the tax incentives and the allegedly poor competitiveness of the goods produced in the FTZM. Defenders of the FTZM argue that it generates economic gains as well as positive social and environmental effects, because industrial activities add up to less deforestation and predatory vegetal extraction.<sup>18</sup> The success of a SEZ and its effect on the economic development of a region also depend on its backward and forward linkages with the rest of the regional economy. On average for the 2000-2010 decade, 52% of inputs were imported from abroad, 28% produced by "regional firms"<sup>19</sup> and 20% by companies in the rest of the country.<sup>20</sup> Sá (2015) believes that the FTZM's regional linkages might still be too weak considering policymakers' expectations and should therefore be strengthened. However, the FTZM does have linkages with local and national suppliers albeit with regional differences.<sup>21</sup>

In a move to gauge how the FTZM's good economic performance in the past decade may have helped improve social outcomes in the area and see if wider regional effects are in play, we

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<sup>17</sup> Electronics (basically consumer electronic goods), computers, two-wheelers and beverages are the FTZM's main sectors. In 2010, the state of Amazonas' computer and electronics industries represented 40.5% of Brazilian gross output (compared with 39.9% for São Paulo). In addition, the FTZM became the main producer of two-wheelers in the country in the 2000-2010 period.

<sup>18</sup> For more details on this argument, see Rivas et al (2009).

<sup>19</sup> SUFRAMA publishes statistics on the origin of intermediate goods differentiating between regional, national and foreign markets. Regional inputs are those bought either in the FTZM itself or in the other Amazonian regions whose incentives are administered by SUFRAMA (see footnote 7 on Brazilian FTZs).

<sup>20</sup> Average sales for the 2000-2010 decade show that 75% of FTZM goods were produced for the domestic market, 18% for the region and only 7% were exported.

<sup>21</sup> A total of 79.3% of electronics inputs came from abroad in 2010, while most two-wheeler inputs were "regional" (44.3% of inputs were produced in the FTZM or the region, 30.3 % in the rest of the country). Other sectors – like optical products and industries intensive in natural resources (paper and metallurgy) – import most of their inputs from the rest of the country.

present all our descriptive statistics and decomposition results separately for the municipality of Manaus and the rest of the state of Amazonas, with urban and total Brazil samples used as a benchmark.

### 3. DATA AND DESCRIPTIVE STATISTICS

#### 3.1. The data

The usual data source in Brazilian income poverty and inequality studies is the Pesquisa Nacional por Amostra dos Domicílios (PNAD), a well-known Brazilian household survey conducted annually by the Brazilian Census Bureau. This survey has detailed data on income and its sources and now boasts both national and Federation Unit representativeness. However, two important limitations made it unsuitable for our study: (i) its representativeness and coverage do not extend to below state level, and (ii) prior to 2003, the sample excluded rural areas in six Federation Units (including the Amazon region, and it was not until 2004 that the PNAD achieved total national coverage).<sup>22</sup> So in order to focus on Manaus and remain representative at the municipality level, we turned to census data. In this paper, we use the two most recent Brazilian Population Census datasets for the years 2000 and 2010.<sup>23</sup> Census data are collected every ten years in Brazil and cover the entire population. A detailed questionnaire (*questionario da amostra*) including household and individual information on socio-economic variables is administered to a census sample of around 11% of the Brazilian population in such a way as to maintain population representativeness at the municipality level.<sup>24</sup>

The variable used in this study to compute poverty and inequality measures over the 2000-2010 period is total monthly household income per capita, expressed in 2010 Brazilian Reais (deflated using the national price index). A major issue when estimating income poverty and inequality indicators is the quality of income data, which usually includes measurement errors and outliers, often more prevalent at the two tails of the distribution. A common practice is to simply trim a

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<sup>22</sup> The rural areas not covered previously by the PNAD are in the states of Acre, Amapá, Amazonas, Pará, Rondônia and Roraima.

<sup>23</sup> Our focus on the 2000-2010 decade is not without reason. First of all, it allows us to concentrate on a period where the overall Brazilian extensive trade liberalization reform had already taken place, and economic and distributional indicators seem to have generally improved, which permits to better understand and isolate the relative effect of the FTZM. Moreover, the definition of period of activity for income variables changed in the last two census datasets, and proper comparisons with previous census years is troublesome.

<sup>24</sup> Basically, this detailed questionnaire is put to a sample of 10% of households in municipalities with more than 15,000 inhabitants, and to a sample of 20% of households in municipalities with up to 15,000 inhabitants.

certain number or percentage of observations at the top and bottom of the income distribution.<sup>25</sup> In our case, we decided to use additional Census information on households' non-monetary welfare conditions and essentially exclude from the top and bottom income quintiles those households that declared inconsistent information on asset holdings. Basically, we excluded from our sample those households in the top income quintile that said they had no electric lighting or water supply problems (i.e. no municipal supply or water well in the household), a type of dwelling other than a house, flat or room (i.e. makeshift, collective, etc.), no toilet in the household, or no more than one asset on the following list: refrigerator, washing machine, phone line, computer, television, car. Observations of monthly household per capita income over R\$ 100,000 were also excluded from the sample. From the bottom income quintile, we excluded those households that said they had all the assets in the above list and those with a household head declaring more than 14 years of schooling.<sup>26</sup> Also, as is usual, households with missing information on variables were dropped from this study. All in all, data cleaning eliminated about 10% of the sample. Yet since we use Census data, our final sample sizes are still very large. For Manaus, we have some 131,000 observations (representing around 1.3 million individuals) in 2000 and around 77,000 observations (representing around 1.6 million individuals) in 2010. For the rest of the state of Amazonas, our sample sizes are respectively approximately 150,000 observations (representing 1.2 million individuals) in 2000 and 192,000 observations (representing 1.5 million individuals) in 2010. For urban Brazil, we have 13.6 million observations (representing 122.5 million individuals) in 2000 and 14.7 million observations (representing 148.4 million individuals) in 2010. Lastly, for Brazil, the samples cover 18.1 million observations (representing 151.5 million individuals) in 2000 and 19.3 million observations (representing 176.9 million individuals) in 2010.

Given that we are interested in understanding which factors contribute to changes in poverty and inequality, our decomposition exercises differentiate, among others, between labor and non-labor income sources. Labor income is defined here as the proportion of total monthly household income per capita earned from all household members' jobs. Non-labor income covers retirement, pensions, rents, social transfers, unemployment insurance and others. Note that

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<sup>25</sup> For example, Hoffmann and Ney (2008) make inequality comparisons using data from the 2000 Census as well as the PNAD and the National Accounts. In their study, they conclude that the proportion of households declaring zero income in the Census is suspiciously larger than in the PNAD. They also report some very extreme income values at the very top. They end up trimming all zero incomes as well as observations with household incomes over R\$ 30,000 in 2000 Brazilian Reais.

<sup>26</sup> We believe that excluding zero incomes from our analysis could misrepresent rural areas in the Amazon region. But as a robustness test, we also computed all our results eliminating all zero incomes and setting a lower top income threshold (R\$ 50,000 in 2010 Brazilian Reais), as found in some other studies on Brazil. All our main conclusions remain unchanged.

although the 2000 Census specified the income quantities corresponding to different non-labor income sources, the 2010 Census database only provides a constructed aggregate for total non-labor income. Thus, the distinction between labor and non-labor income sources is the only one that we can fully identify at the municipality level between 2000 and 2010.<sup>27</sup>

### 3.2. Descriptive statistics

Table 1 reports on the descriptive statistics for the poverty and inequality indicators in 2000 and 2010, as well as for the mean household per capita income levels.<sup>28</sup> Two poverty thresholds are used to measure poverty: a R\$ 70 line that we consider captures extreme poverty; and a R\$ 140 line to include more moderate poverty in our numbers.<sup>29</sup> Two poverty and two inequality indicators are presented: the headcount ratio and the poverty gap index (which places more weight on the poorest households), the Gini index and the Theil T measure. We differentiate between the municipality of Manaus and the rest of the state of Amazonas (RAM hereafter), and present total Brazil and urban Brazil as benchmarks.

As expected, poverty decreased in the four areas considered between 2000 and 2010, irrespective of the poverty threshold or indicator used. Poverty levels (and changes) in the municipality of Manaus are very close to the average Brazilian situation (so still worse off than in urban Brazil).

In the RAM, where urban areas accounted for just 51% of the population in 2000 and 58% in 2010 (compared to 99% for the metropolitan area of Manaus), poverty levels were three times higher (or more) in 2010 than in the state capital of Manaus (irrespective of the poverty line or indicator used). In percentage points, poverty reductions were lower in the RAM with the exception of extreme poverty when considering the poverty gap index (with a decrease of 22.4% compared to 18.7% in Manaus).

Turning to inequality, Gini and Theil index decreases are again observed everywhere, though they are smaller in Manaus and in the RAM than at the national level (urban and total Brazil). This

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<sup>27</sup> Studies at the country level based on the Brazilian household survey (PNAD) can actually disentangle the different non-labor income sources, but as explained and unlike the Census data, the PNAD is not representative of the municipalities.

<sup>28</sup> Mean hourly wages are also reported for workers aged 15-65 earning positive income from their main job in the survey's reference week.

<sup>29</sup> Though Brazil does not have an official poverty line, ad-hoc administrative poverty lines of R\$ 70 and R\$ 140 can be used respectively for extreme poverty and poverty. They correspond to the 2009 values used to define the monetary benefits for the Brazilian main cash assistance program, Bolsa Familia.

implies that whereas the municipality of Manaus had a slightly less unequal income distribution than the average observed in Brazil in 2000, it was slightly more unequal in 2010.

In terms of average income (and wage) levels, the municipality of Manaus posted a sharp rise in the last decade (a 38% increase in both mean monthly per capita income and mean hourly wages). This performance outweighs – by far for hourly wages - the already good results for urban Brazil (respectively 33% and 23%). Although household income levels were still lower in Manaus than the Brazilian averages (urban and total), workers were being relatively better paid in Manaus (with hourly wages averaging at R\$ 10) than in urban Brazil (respectively at R\$ 9.1) by 2010. In the RAM, mean household per capita income weighed in at just 27% of the Brazilian average in 2000. Although the situation had improved by 2010 (at 32% of the Brazilian average), income (and wage) levels remained strikingly low.

The Census also enables us to look at non-monetary aspects of poverty since it provides information on households' living conditions. Table A1 in the Appendix shows how the population of the RAM suffers from much worse living conditions in addition to higher income poverty levels. For example, the percentage of the population with access to a municipal water supply in the RAM still stood at less than 50% (more than 75% in Manaus) in 2010. Regarding sanitation facilities, over 80% of the population in the RAM had access to neither a public network nor a septic tank (less than 40% in Manaus). In terms of household assets, 37.8% of the population in the RAM (2.9% in Manaus) had just one or none of the following household assets: refrigerator, washing machine, phone line, computer, TV and car.

Tables A2 and A3 in the Appendix report major population differences, both for the total population and for workers, between the municipality of Manaus and the RAM (again with country averages included as a benchmark). For example, levels of education in the RAM were much lower than in Manaus (still at 3.8 versus 6.2 years of schooling in 2010) and household sizes and numbers of children per household were larger (2.8 children on average in the RAM versus 1.6 in Manaus in 2010). Nonetheless, migration from the RAM to the municipality of Manaus or across states is remarkably low and only increased slightly by about 3% in the 2000-2010 decade. The sector-based structure of employment finds the weight of agriculture, forestry and fishing activities in the RAM to be 30% in 2010, while the manufacturing sector represented less than 6% (compared to 17% in Manaus). Throughout the decade, approximately one quarter

of workers had access to a formal job<sup>30</sup> in the RAM, whereas numbers climbed to more than 50% in Manaus.<sup>31</sup>

To sum up, although poverty and inequality indicators fell everywhere in the 2000-2010 decade, income distribution levels and trends differed between Manaus and the RAM. Manaus generally posted better indicators close to the average situation for Brazil and even sometimes for urban Brazil, while the RAM remained poor with high inequality.

#### 4. DECOMPOSITION METHODS

Our first step to better understand the links between the economic performance of the area where the FTZM is established and observed changes in poverty and inequality indicators, is to perform a Shapley-Shorrocks estimate of the standard Datt-Ravallion (1992) poverty decomposition into growth and redistribution components. Although there is little doubt that economic growth contributes to poverty reduction,<sup>32</sup> initial conditions (in terms of economic development or inequality levels) and growth patterns (i.e. the sector and/or geographic composition of economic activity) are usually behind the observed heterogeneity in the poverty-growth relationship. Our aim is to explore if the state of Amazonas (both Manaus and the rest of the state) presents particularities compared to Brazil.<sup>33</sup>

Let the level of poverty at period  $t$  be written as a function  $P_t = P(z_t, \mu_t, L_t)$ , where  $z_t$  is the poverty line,  $\mu_t$  is the mean income and  $L_t$  is the associated Lorenz curve, at date  $t$ , representing distributional inequality. Holding the poverty line constant over time, the overall change in poverty from the base period to the end period is equal to

$$\Delta P = P(\mu_1, L_1) - P(\mu_0, L_0),$$

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<sup>30</sup> Our definition of formal workers corresponds to private and public employees with a registered or signed contract (“assinada carteira de trabalho”) as required by Brazilian law, the military and civil servants, and employers and own-account workers with social security coverage.

<sup>31</sup> Formalization in Manaus (from 53% in 2000 to 61% in 2010) displays the same growth pattern as the national trend over the decade (from 53% to 62% for Brazil).

<sup>32</sup> A partial list of contributions include cross-country studies such as the World Bank (1990, 2000), Ravallion and Chen (1997), Datt and Ravallion (2002), Dollar and Kray (2002). Recent evidence on Latin America or, more specifically, Brazil includes Menezes-Filho and Vasconcellos (2006) and Inchauste et al. (2014).

<sup>33</sup> See, for example, Bourguignon (2003), Headey (2008), Loayza and Raddatz (2010) and Ferreira et al. (2010).

The Datt-Ravallion(1992) method measures, in a ceteris paribus strategy, how much of observed poverty changes can be attributed to changes in income growth and how much to changes along the income distribution, respectively known as the growth and redistribution effects, and represented below:

$$\begin{aligned}\text{Growth effect} &= \Delta\mu = P(\mu_1, L_0) - P(\mu_0, L_0) \\ \text{Redistribution effect} &= \Delta L = P(\mu_0, L_1) - P(\mu_0, L_0)\end{aligned}$$

Note that these expressions are counterfactual outcomes. In order to amount to observed poverty changes, they need to include a third argument, the residual, interpreted as an interaction effect between the growth and redistribution components. Additionally, different decompositions are possible depending on the period of reference (or path) taken, and no particular one is preferable a priori. In order to deal with these concerns, Shorrocks (1999) proposed, and Kolenikov and Shorrocks (2005) empirically implemented the Shapley approach, deriving a single decomposition value that is always accurate (i.e. includes no residual) and treats all possible routes symmetrically. In this paper, we calculate this Shapley-Shorrocks estimate for each component of the Datt-Ravallion decomposition using an algorithm proposed by Azevedo et al. (2012b).

The second decomposition method we apply in this paper generates entire counterfactual income distributions and quantifies the contributions that changes in demographics, employment, labor and non-labor income sources may have made to observed poverty and inequality changes. Following the methodology proposed by Azevedo et al. (2012a), which builds on previous work by Barros et al. (2006), we decompose the contributions of different household income factors to observed distributional changes by simulating the distribution of monthly total household per capita income, changing only one income component at a time and keeping everything else constant.

In concrete terms, we begin by modelling household per capita income ( $y_{pc}$ ) as the sum of individual income sources  $y_i$  divided by the number of household members  $n$ .

$$y_{pc} = \frac{1}{n} \sum_{i=1}^n y_i$$



If we assume that only individuals older than 15 years old contribute to household income,<sup>34</sup> and if we capture labor ( $y^L$ ) and non-labor ( $y^{NL}$ ) income sources separately, we can write per capita household income as:

$$y_{pc} = \frac{n_A}{n} \left( \frac{1}{n_A} \sum_{i=1}^n y_i^L + \frac{1}{n_A} \sum_{i=1}^n y_i^{NL} \right)$$

where  $n_A$  is the number of adults (as of 15 years old) in the household. Since not all adults work in a household, we can go one step further and differentiate the number of employed ( $n_E$ ) adults from those unemployed or inactive in the household such that our final decomposition reads:

$$y_{pc} = \frac{n_A}{n} \left( \frac{n_E}{n_A} \left( \frac{1}{n_E} \sum_{i=1}^n y_i^L \right) + \frac{1}{n_A} \sum_{i=1}^n y_i^{NL} \right)$$

This equation enables us to decompose income changes into changes in two demographic components – the share of adults in the household and the share of the occupied adults – and two income components – the contribution of labor income per occupied adult and the contribution of non-labor income per adult. The decomposition method consists in constructing counterfactual distributions by substituting the observed distribution for each component in one period, one at a time, until we attain a complete change from that period to the next. For each counterfactual distribution, poverty (or inequality) measures are computed and interpreted as the level of poverty (or inequality) that would have prevailed in the absence of a change in that indicator. Note that since sample sizes may differ from one period to the next, a rank rescaling procedure is applied between the two periods. In addition, since results are again sensitive to the order in which effects are calculated (by component and over time), a Shapley value rule is also implemented here and decompositions calculated across all possible paths to present average results for each component (for more details on the decomposition method, see Azevedo et al. 2012a).

In order to capture what happened in the Free Trade Zone of Manaus and place our results in a country perspective, all estimations are again repeated separately for the municipality of Manaus, for the rest of the state of Amazonas (RAM) and for urban Brazil and Brazil as a whole. Our decomposition results are described in the next section.

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<sup>34</sup> Although the Brazilian Census surveys ask all household members from 10 years old up about earnings, given that schooling in Brazil is compulsory until 14 years old, we fixed the bottom age threshold of our sample at 15.

## 5. DECOMPOSITION RESULTS

### 5.1. Decomposition Analysis into Growth and Redistribution Components

The Shapley-Shorrocks estimate of the Datt-Ravallion (1992) decomposition quantifying the relative contributions of (distribution-neutral) growth versus redistribution to changes in poverty is performed using the headcount ratio and the poverty gap index, and using our two poverty thresholds (R\$ 70 and R\$ 140). Findings are reported in Table 2.<sup>35</sup> Between 2000 and 2010, we find that growth explains a slightly larger part of the observed reduction in poverty (R\$ 140) in Brazil; that is, if the Lorenz curve had remained constant over the decade, the poverty indexes would have decreased by approximately 54% due solely to growth in mean incomes over the period.<sup>36</sup> When we focus on extreme poverty (poverty line fixed at R\$ 70), the relative importance of the growth component generally drops in Brazil (down to values of 50% of the total change based on the headcount ratio). This decrease is larger when we focus on urban areas of Brazil only (from 54% down to values of 48 %).<sup>37</sup> In Manaus, where the reduction in inequality was less significant over the decade, changes in poverty over the same time period are essentially explained by the growth component, irrespective of which poverty indicator or threshold is used (the growth percentage contribution ranges from 56% to 63%). In the RAM, where inequality levels are more persistent and still very high in 2010, the observed reductions in poverty over the decade are clearly the result of distribution-neutral growth.

To conclude, our findings from the above decomposition show that, over this decade of particularly good economic performance, especially in the FTZM, growth played an important role in the observed poverty changes in the Amazonas state (not exclusively in the municipal area of Manaus). The role of redistribution, though similar to the growth component in Brazil, seems to have counted less in RAM and Manaus. If most of the poverty reduction observed in Manaus and the RAM in this past decade was the result of mean income growth, the obvious question

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<sup>35</sup> Table A4 in the Appendix presents decomposition results eliminating all zero incomes as a robustness test, and all our main conclusions remain unchanged.

<sup>36</sup> This result of growth as the slightly larger contributor to poverty reduction is in line with what is found by Inchauste et al. (2014) for Brazil using PNAD data for the similar 2001-2009 period (note that they use different international poverty lines, in PPP dollars, in order to draw up international comparisons). In their study (Figure 3.2 on page 45), Brazil appears as one of the three Latin American countries where the growth component contributes the least to poverty reduction (only Argentina and Paraguay display lower contributions of growth to poverty reduction over the decade).

<sup>37</sup> The reduction is less pronounced for the poverty gap index.

that arises is how household per capita income growth reduced poverty and which particularities can be found for the FTZM area.

## 5.2. Decomposition Analysis into Demographics and Income Components

Our second decomposition exercise provides a better understanding of the factors behind poverty and inequality reductions. At least three factors could have influenced poverty and inequality declines: demographic changes (particularly the share of adults per household); growth in labor income (either because more people are employed or because their earnings have increased), and growth in non-labor income (in the form of public or private transfers or possibly savings patterns).

Before presenting our decomposition results, Table 3 shows descriptive statistics on the changes in these factor components for the entire population as well as for the poor and extremely poor to make it easier to understand our decomposition exercise. Over the 2000-2010 decade, the average number of hours worked decreased everywhere (Manaus, RAM, urban and total Brazil), for the whole population as well as for poor households. This change, together with the observed overall increase in hourly wages, captures the economy-wide improvement in working conditions in the country.<sup>38</sup> Note that, whereas the average number of hours worked was higher in Manaus than in Brazil in 2000 (looking at both urban and total samples), this was no longer the case in 2010.<sup>39</sup> Over the same time period, the share of adults per household increased everywhere. Indeed Brazil has been experiencing a typical demographic transition in recent decades, with sustained declines in mortality rates since the 1940s and fertility falling sharply at a much faster rate than mortality since the late 1960s (see, for example, Gagnolati et al., 2011).<sup>40</sup> As expected in such a large and heterogeneous country, demographic indicators in Brazil vary considerably across geographic areas. Here we see that both Manaus and the RAM have lower shares of adults per household than found in the national figures. When we focus on the poor or when figures include rural areas (total Brazil compared to urban Brazil; the RAM compared to Manaus), the relative number of adults in the household is smaller. The share of occupied adults in the household increased over the 2000-2010 decade for the entire population and in all areas

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<sup>38</sup> Brazil's labor market performed well in the 2000s, with strong rates of job creation and formal job growth outpacing informal job growth by a three-to-one ratio (see below and, among others, Berg, 2010).

<sup>39</sup> Although the general decrease in the number of hours worked can be linked to a positive reading of increased formality and improved working conditions, the fact that the lowest work duration is found among the extreme poor in all samples may reveal some barriers to employment opportunities for certain disadvantaged population groups.

<sup>40</sup> Note that although Brazil is in an advanced phase of demographic transition (compared to other Latin American countries), it is still a relatively young country compared to OECD countries (Gagnolati et al., 2011).

considered, but converse trends appear when only the poor are considered (irrespective of whether we look at households with an income per capita under R\$ 70 or R\$ 140). In terms of levels, the situation in Manaus is close to the Brazilian average while the share of occupied adults in the household is much smaller in the RAM.<sup>41</sup>

Table 4 displays the results of our decomposition into demographic and income components for poverty measures and Table 5 for inequality measures. We present the respective contributions of demographics, employment, labor income and non-labor income factors to observed reductions in poverty and inequality in the municipality of Manaus, in the RAM, and in urban and total Brazil.<sup>42</sup> We will first present the results common to all areas. Then we will identify particularities in the area of Manaus that could point to the influence of the FTZM and the existence (or absence) of spillover effects in the rest of the state of Amazonas.

First of all, the demographic transition that started in Brazil in past decades and continued over the 2000-2010 period, with rises in the share of the working-age population and the elderly, contributed everywhere to a reduction in poverty, irrespective of the poverty measure or threshold used (Table 4), as it did to inequality declines (Table 5). With respect to the poverty decompositions, the RAM, which includes many rural municipalities, is where demographics plays a greater role (shares increasing 16.5% to 21.3%), while the share of adults per household accounts for up to 14% in Manaus. When it comes to reductions in inequality, however, the demographic transition has the greatest impact in Manaus, not in the RAM. Yet differences are less marked within the state.

When we focus on the role played by the share of occupied adults per household, we obtain mixed results in both poverty and inequality. Looking at the poverty decompositions (Table 4), although the share of working adults per household declined among the poor in all our samples over the decade (Table 3), this change had a different effect across the income distribution. The household employment rate drop is found to have a positive impact on poverty reduction when the higher R\$ 140 threshold is used, but not necessarily when we focus on the extreme poor. This may be interpreted as a positive effect of better labor market conditions, particularly growth in

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<sup>41</sup> Descriptive statistics in Table A2 already display lower employment rates in the RAM compared to Manaus.

<sup>42</sup> Tables A5 and A6 present decomposition results eliminating all zero incomes as a robustness test, and all our main conclusions remain unchanged. We also run our estimations fixing the top income threshold at a lower level (R\$ 5,000) and again our main conclusions remain unchanged (these estimations are available from the authors on request).

mean hourly wages,<sup>43</sup> which could possibly allow young household members to stay in school and older adults to retire. Yet this effect would only apply to those individuals closer to the higher poverty thresholds. At lower income levels, the positive effect of employment rate decreases in the household could actually become negative. Note that there is not a clear pattern to the relative importance of this factor across samples, which is probably linked to this dual role across the income distribution. Inequality decompositions, on the other hand, display a systematically positive, albeit small, role of household employment shares in Manaus (7% to 12% using the Gini and Theil indexes respectively), with a fairly large negative effect in the RAM (similarly, 52% to 57%). Thus, the increase in employment shares within households across the total population (see Table 3) is a source of income inequality in the RAM whereas it slightly reduces it in Manaus. Differential changes in the sector-based structure of employment (see Table A3) may explain these results: for example, the share of public administration jobs (known to be among the better paid jobs) in the RAM increased over the decade, while there the share of agricultural jobs contracted. The sector-based employment structure is much more stable in Manaus.

Turning now to labor income, we find that growth in labor income almost always leads to a decline in poverty. The only exception is when we look at extreme poverty using the poverty gap index, particularly in those samples that include rural areas (the RAM and our total Brazilian sample). The fact that the influence of labor income on poverty reduction seems to fade away for these extremely poor populations when the poverty gap index is used (an index that overrepresents the poorest of the poor) may be explained by the fact that the extremely poor do not yet have full access to the Brazilian labor market and do not benefit as much from the recent positive developments on this market at the country level.<sup>44</sup> The impact of labor income on poverty reduction is much greater relatively speaking in Manaus than in the three other areas considered, irrespective of the poverty measure or threshold used (ranging from 20% for the poverty gap to 50% of total poverty reduction based on the headcount index with the lowest R\$ 70 threshold). In the RAM, the greatest impact on poverty reduction by labor income reaches just 26% (again with the headcount index and the R\$ 140 poverty line). In urban Brazil, it jumps as high as 35% (again for the headcount and the R\$ 140 line), a number significantly lower than

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<sup>43</sup> Note that the average number of hours worked by the poor dropped over the decade, so it is probably not due to workers working more hours. An alternative explanation might be found in the increase in social protection coverage (pensions and social transfers). Yet it is less clear why the poorest of the poor would benefit less in this case. A mix of the two factors is probably at play.

<sup>44</sup> Lavinás (2013, p. 31) comes to a similar conclusion for Brazil: “The effects of economic growth were not as favorable to those living in extreme poverty as they had been for those classed simply as ‘poor’. The much lower levels of schooling, and the even more precarious, badly paid jobs held by the indigent, make them much less likely to benefit from upward trends in the job market.”

observed in Manaus. Turning now to our results for the inequality decompositions (Table 5), the highest contributor to inequality reduction is without doubt labor income, both in Manaus and Brazil (urban and total samples), with the highest impact of labor income again observed in the municipality of Manaus. In the RAM, however, the non-labor income factor takes the lead in reducing both Gini and Theil indexes.

Lastly, changes in non-labor income over the 2000-2010 decade always lead to a reduction in poverty. The contribution of non-labor income to poverty changes is higher when poverty is measured using the lower poverty threshold of R\$ 70 or the poverty gap index. So as expected, the relative weight of non-labor income grows when we focus on the poorest of the poor: either by restricting our study to changes in extreme poverty (capturing households below R\$ 70 per month) rather than including households with monthly per capita incomes of between R\$ 70 and R\$ 140 in our poverty numbers; or by giving the poorest of the poor more weight in our poverty calculations by using the poverty gap index instead of the headcount ratio. Note that, although our measure of non-labor income covers a range of heterogeneous sources (theoretically including social transfers, pensions, capital income, etc.), the fact that our poverty decompositions focus on the very low end of the income distribution allows us to presume the essential role played by public transfers in this non-labor income component. In particular, we can assume that pensions<sup>45</sup> and the Bolsa Familia Program (BFP) – Brazil’s “flagship” conditional cash transfer program covering 12.8 million families in 2010 despite its relatively small benefit amounts<sup>46</sup> – have both played a role in improving extremely poor families’ living standards.<sup>47</sup> Our inequality decompositions, which are not restricted to the low end of the distribution, find a mixed role for non-labor income. Although non-labor income reduces inequality in the RAM and in Brazil (urban and total samples), it drives up inequality in Manaus. In addition, non-labor income plays a smaller role when only the urban sample is considered than when the entire Brazilian population is taken into account. These mixed results may be due to the fact that the non-labor income measure contains more capital income in urban areas.

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<sup>45</sup> Public pensions have largely benefited from growth in the minimum wage as two thirds of public pensions correspond to the minimum wage (Lavinias, 2013).

<sup>46</sup> According to data from the Social Development Ministry (Ministerio do Desenvolvimento Social), 5.6% of the people living in the municipality of Manaus received the BFP in 2010, compared to 8% for the state of Amazonas and 6.7% in Brazil as a whole.

<sup>47</sup> Soares (2012) reviews several studies on the impact of the BFP on poverty and inequality in Brazil: the BFP has had a growing impact on poverty reduction over time and its influence is also stronger when the intensity of poverty is taken into account. Nevertheless, although evaluations vary greatly (mainly because of studies’ methodological differences), the BFP has had a modest effect on inequality reduction. The author also underlines that the cost of the BFP - dubbed “a little big program” (p. 6) - is low considering its wide coverage, but “in spite of the improvement of welfare among those who remain poor, greater impacts on the percentage in poverty require higher benefits” (p .22).

The relative weight of the labor income factor in poverty and inequality reduction in emerging and developing countries compared to other factors such as non-labor income is a subject of recent debate. For example, Inchauste et al. (2014), using a similar time frame (2001-2009) to ours and international poverty lines in PPP dollars<sup>48</sup>, show for a sample of 21 countries (including Brazil) that, "The most important contributor to reductions in moderate poverty has been the growth in labor income. In particular, among 12 of them with substantial declines in poverty, changes in labor income and employment explain more than half of the change in poverty; in another 6 countries, the same changes account for more than 40 percent of reduced poverty".

In the specific case of Brazil, our results are in line with recent evidence despite the fact that our study uses census data and is therefore not strictly comparable to research based on Brazilian household surveys. For example, Inchauste et al. (2014) find in their abovementioned study of Brazil (using PNAD surveys) that the most important factor for poverty reduction when measured by the lowest poverty lines (US\$ 1.25 a day) is growth in non-labor income.<sup>49</sup> It is only when the highest poverty line is considered (US\$ 4 a day) that labor income becomes the most important contributor.. On inequality, Azevedo et al. (2013b) - using the same decomposition technique and PNAD surveys for the 2001-2011 period - show that the contributions of labor income and non-labor income to the Gini coefficient downturn come to 45% and 46% respectively. Using a similar decomposition approach (despite some methodological differences) and again PNAD surveys, Barros et al. (2010) find that decreases in inequality (measured successively by a Gini coefficient and the ratio between the income of the richest 20 percent and the poorest 20 percent) were due to changes in the distribution of non-labor income per adult<sup>50</sup> in 40-50% of cases and to changes in the distribution of labor income per adult (taking the proportion of working adults and labor income per working adult) in 31-46% of cases between 2001 and 2007. Our results on inequality in Brazil find that labor income has an even greater influence. In addition, we find a clear distinctive pattern within the state of Amazonas: the predominant role that labor income appears to play in Manaus contrasts with the major influence of non-labor income in the RAM in explaining poverty and inequality dynamics. This greater

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<sup>48</sup> Inchauste et al. (2014) consider several international poverty lines, respectively US\$1.25, US\$2.50, US\$4.00 for Brazil (the two lowest ones being the most adequate for comparisons with our two poverty lines).

<sup>49</sup> Taking the US\$ 1.25-a-day poverty line, the shares are 47.9% for non-labor income versus 44.7% for labor income based on the headcount ratio and 75.3% and 28.1% respectively using the poverty gap index. Taking the US\$ 2.50-a-day poverty line, non-labor income is the most important contributor in the case of the poverty gap index (45.2% versus 41.7%), but not with the headcount ratio (31.7% versus 44.8%).

<sup>50</sup> The authors decomposed non-labor income in seven sources: rents, interest and dividends, private transfers from non-residents, private pensions and three types of public transfers (pensions and other standard contributory social security benefits, Benefício de Prestação Continuada – BPC is a transfer for people aged 65 and over and disabled – Bolsa Família and similar programs). Public transfers explain 49% of the total reduction in inequality with the role of contributory transfers being predominant (almost 30%).

relative importance of labor income in the municipality of Manaus is due, at least in part, to the FTZM's good economic performance throughout the 2000-2010 decade.

## 6. CONCLUSION

The recent proliferation and wide range of SEZs in emerging and developing countries show that these types of policies are more than just a trade openness instrument. They are part of a broader economic development strategy to promote additional investment, scale up technology transfers, increase employment and fight regional inequalities, among others. Although SEZs appear to have found increasing support among developing nation governments as a means to expand and modernize the economy, their economic effectiveness and social repercussions are the subject of ongoing debate.

This article focuses on the Free Trade Zone of Manaus (FTZM) in Brazil to gain a better understanding of the impact of SEZs on distributional outcomes. The FTZM is a particularly suitable case for an analysis of the influence of a SEZ on poverty and inequality due to its location in an isolated, poor enclave of the country. The FTZM was designed from the outset as a regional development strategy to address the lack of economic buoyancy and harsh living conditions in the area. Trade liberalization measures and, more generally, fiscal incentives have now made it a dynamic industrial hub - operating as an import processing zone - in the middle of the Amazon rainforest.

The 2000-2010 decade was a period of significant, widespread improvements in poverty and inequality indicators in Brazil. The state of Amazonas, where the FTZM is located, was no exception to this trend. This analysis seeks to identify the possible sets of factors behind the reduction in poverty and inequality in the Amazonas state (with Brazil taken as a benchmark), and investigate the role played by the FTZM. Attempts to clearly capture the FTZM's causal effects on welfare outcomes would call for a counterfactual of the situation without the FTZM, which is not possible. Another option might be to use time and cross-section variations in SEZs' establishment across municipalities.<sup>51</sup> Unfortunately, the FTZM is a rather unique experience in Brazil (as already mentioned the FTZM is the only one engaged in production operations in

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<sup>51</sup> See, for example, the recent Picarelli (2014) study of Nicaragua for the period from 1993 to 2009.



Brazil).<sup>52</sup> However, our results based on micro-decomposition techniques and a series of counterfactual simulations already shed some light on how the FTZM's establishment in this remote Amazon region has influenced poverty and inequality dynamics. In addition, we use census data to study the municipality of Manaus, where the FTZM is established, and the rest of the state of Amazonas separately. Comparisons of our findings in these two separate areas hint at the extent of the FTZM's influence and its potential spillover effects.

In the 2000-2010 decade, income growth was the most important factor behind observed poverty changes in Amazonas state (not solely in the municipal area of Manaus). The role of redistribution, although very similar in importance to the growth component in Brazil, seems to have always counted less in Manaus and especially in the rest of the state of Amazonas (RAM). Among the poverty and inequality reduction drivers, our second micro-decomposition exercise finds that labor income plays a major role in Manaus whereas the contribution of non-labor income is far more important in the RAM. These contrasting results illustrate both the benefits and limitations of the FTZM's good economic performance over the last decade.

Labor market buoyancy in the municipality of Manaus is closely linked with the FTZM's success driving direct and indirect job creations. Not only did the share of employed adults in households grow, but the income gains perceived by the workers also rose while the number of hours worked fell, evidencing an improvement in job quality. Our micro-decomposition approaches find that these labor market developments contributed significantly to poverty and inequality reduction in the state capital.

In the RAM, where poverty and inequality levels were still high in 2010 and considerably higher than in Manaus, the much lower incidence of the labor income component points to problems of weak "employability" among the poor (as already mentioned, migration across municipalities in Amazonas state and also to other states is particularly low in this region). The spillover effects of the FTZM in the state might be said to be limited still. However, without the FTZM, the situation would probably have been worse, not only in terms of social outcomes, but also possibly from an ecological point of view. For example, in a household-level interview study of Ecuadorian Amazon migrant farmers in 1990, Murphy et al. (1997) already discuss how economic development in small urban areas in the Amazon Rainforest Frontier could increase employment

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<sup>52</sup> Another approach would be a cost-benefit analysis. However, as pointed out by Aggarwal (2012), a real cost-benefit study requires exhaustive data on numerous parameters that are very hard to collect rigorously. In the FTZM, and Amazonas state more generally, a complex and evolving system of incentives and taxes is in place that makes this type of methodology very difficult to implement.

opportunities (in local government, retail sales, services and ecotourism) and how increasing such opportunities could alleviate pressure to keep clearing the forest. More recently, comparisons of deforestation and predatory vegetal extraction rates with other Amazonian states in Brazil rate the state of Amazonas among the lowest ranks. This result is often put forward as an indicator of the FTZM's positive environmental impact since the FTZM's attractiveness and buoyancy has concentrated people and economic activity in the capital city of Manaus (see Rivas et al. 2012). In addition to ecological arguments, the creation of the FTZM is also regarded as a successful regional development strategy, contributing to the spatial decentralization of Brazilian industrial activities (see Saboia and Kubrusly, 2015).<sup>53</sup>

While the FTZM's spillover effects may still be limited, it is also rather bothersome to find that non-labor income appears to contribute less to poverty reduction in the RAM than in Brazil as a whole. We interpret this result as probable evidence of social transfer targeting problems in remote areas of the state. Recommendations to improve social outcomes in poorer areas of the Amazon region could include the need for training programs for the poor to improve their “employability” and better targeting of social policies in the area.

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<sup>53</sup> In Brazil, federal and state governments and municipalities have implemented measures in past decades to attract investments and firms to regions less developed than the main urban coastal areas. The FTZM is seen as successful from this point of view (see Saboia and Kubrusly, 2015). Naturally, the FTZM's special regime has a cost, and the recent extension of fiscal incentives through to 2073 may suggest that the federal government does not believe the region is ready for autonomous development.

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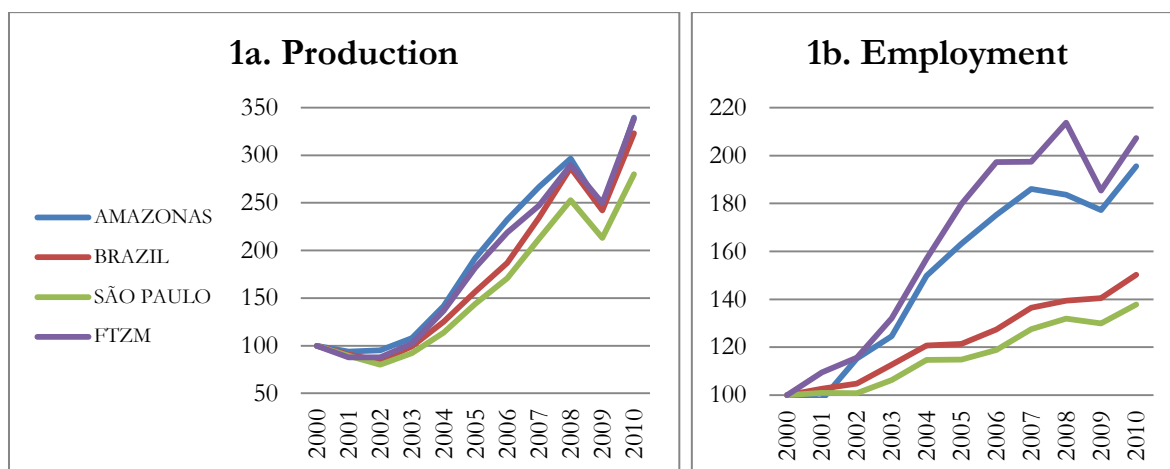
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**Figure 1. Manufacturing Production and Employment in Brazil, Amazonas, São Paulo and the FTZM (Index: Base 2000 = 100)**



Note: Manufacturing production is measured by the value of gross manufacturing output for Amazonas, Brazil and São Paulo (PIA/IBGE) and sales for the FTZM (SUFRAMA).

Source: Authors' calculations based on various sources (PIA/IBGE and SUFRAMA).



**Table 1. Poverty and Inequality Levels**

|  | Manaus |      | Amazonas<br>excluding<br>Manaus |      | Urban<br>Brazil |      | Brazil |      |
|--|--------|------|---------------------------------|------|-----------------|------|--------|------|
|  | 2000   | 2010 | 2000                            | 2010 | 2000            | 2010 | 2000   | 2010 |
| Poverty (R\$ 140 threshold):           |        |      |                                 |      |                 |      |        |      |
| Headcount ratio                        | 32.0   | 18.1 | 74.4                            | 53.9 | 24.3            | 13.0 | 30.9   | 17.6 |
| Poverty gap index                      | 16.4   | 10.5 | 46.4                            | 33.5 | 12.1            | 6.9  | 16.4   | 9.7  |
| Extreme poverty (R\$ 70<br>threshold): |        |      |                                 |      |                 |      |        |      |
| Headcount ratio                        | 14.8   | 9.4  | 48.3                            | 33.5 | 10.9            | 6.4  | 15.5   | 9.3  |
| Poverty gap index                      | 9.3    | 7.6  | 29.6                            | 23.0 | 6.3             | 4.5  | 9.0    | 6.3  |
| Inequality:                            |        |      |                                 |      |                 |      |        |      |
| Gini index                             | 0.64   | 0.61 | 0.66                            | 0.64 | 0.63            | 0.59 | 0.65   | 0.60 |
| Theil index                            | 0.87   | 0.82 | 1.06                            | 0.92 | 0.84            | 0.76 | 0.90   | 0.80 |
| Mean monthly hh per capita<br>income   | 501    | 693  | 150                             | 240  | 640             | 848  | 555    | 759  |
| Mean hourly wages                      | 7.2    | 10.0 | 4.2                             | 5.5  | 7.4             | 9.1  | 6.8    | 8.5  |

Note: Mean hourly wages are calculated for workers between 15 and 65 years old declaring a monthly labor income from their main job. Manaus refers to the municipality of Manaus; Amazonas excluding Manaus corresponds to the rest of the state of Amazonas (RAM), where the municipality of Manaus has been excluded.

Source: Authors' calculations from 2000 and 2010 Brazilian Census microdata.

**Table 2. Contribution of Growth and Redistribution to Poverty Reduction, 2000-2010.**

|                                       | Manaus       | Amazonas<br>excluding<br>Manaus | Urban Brazil | Brazil       |
|---------------------------------------|--------------|---------------------------------|--------------|--------------|
| <b>Using the R\$ 140 poverty line</b> |              |                                 |              |              |
| <b>Headcount ratio %</b>              |              |                                 |              |              |
| 2000                                  | 32.0         | 74.4                            | 24.3         | 30.9         |
| 2010                                  | 18.1         | 53.9                            | 13.0         | 17.6         |
| <i>Total change</i>                   | <i>-13.8</i> | <i>-20.5</i>                    | <i>-11.3</i> | <i>-13.3</i> |
| <i>Growth</i>                         | <i>-8.6</i>  | <i>-17.4</i>                    | <i>-6.1</i>  | <i>-7.2</i>  |
| <i>Redistribution</i>                 | <i>-5.2</i>  | <i>-3.2</i>                     | <i>-5.3</i>  | <i>-6.1</i>  |
| <b>Poverty gap index %</b>            |              |                                 |              |              |
| 2000                                  | 16.4         | 46.4                            | 12.1         | 16.4         |
| 2010                                  | 10.5         | 33.5                            | 6.9          | 9.7          |
| <i>Total change</i>                   | <i>-5.9</i>  | <i>-12.9</i>                    | <i>-5.1</i>  | <i>-6.6</i>  |
| <i>Growth</i>                         | <i>-3.7</i>  | <i>-11.7</i>                    | <i>-2.6</i>  | <i>-3.6</i>  |
| <i>Redistribution</i>                 | <i>-2.2</i>  | <i>-1.2</i>                     | <i>-2.6</i>  | <i>-3.1</i>  |
| <b>Using the R\$ 70 poverty line</b>  |              |                                 |              |              |
| <b>Headcount ratio %</b>              |              |                                 |              |              |
| 2000                                  | 14.8         | 48.3                            | 10.9         | 15.5         |
| 2010                                  | 9.4          | 33.5                            | 6.4          | 9.3          |
| <i>Total change</i>                   | <i>-5.4</i>  | <i>-14.8</i>                    | <i>-4.5</i>  | <i>-6.2</i>  |
| <i>Growth</i>                         | <i>-3.0</i>  | <i>-13.8</i>                    | <i>-2.2</i>  | <i>-3.1</i>  |
| <i>Redistribution</i>                 | <i>-2.3</i>  | <i>-1.0</i>                     | <i>-2.3</i>  | <i>-3.1</i>  |
| <b>Poverty gap index %</b>            |              |                                 |              |              |
| 2000                                  | 9.3          | 29.6                            | 6.3          | 9.0          |
| 2010                                  | 7.6          | 23.0                            | 4.5          | 6.3          |
| <i>Total change</i>                   | <i>-1.8</i>  | <i>-6.6</i>                     | <i>-1.7</i>  | <i>-2.7</i>  |
| <i>Growth</i>                         | <i>-1.1</i>  | <i>-6.7</i>                     | <i>-0.9</i>  | <i>-1.4</i>  |
| <i>Redistribution</i>                 | <i>-0.7</i>  | <i>0.1</i>                      | <i>-0.9</i>  | <i>-1.2</i>  |

Note: Results are obtained using a Shapley-Shorrocks estimate of the Datt-Ravallion (1992) decomposition on growth and redistribution components (see Azevedo et al., 2012b). Manaus refers to the municipality of Manaus; Amazonas excluding Manaus corresponds to the rest of the state of Amazonas (RAM) from which the municipality of Manaus has been excluded.  
Source: Authors' calculations from 2000 and 2010 Brazilian Census microdata.

**Table 3. Descriptive Statistics on Azevedo et al. (2012a) decomposition factors**

|   | Manaus |      | Amazonas<br>excluding<br>Manaus |      | Urban Brazil |      | Brazil |      |
|---|--------|------|---------------------------------|------|--------------|------|--------|------|
|   | 2000   | 2010 | 2000                            | 2010 | 2000         | 2010 | 2000   | 2010 |
| Total population:                                   |        |      |                                 |      |              |      |        |      |
| Mean monthly household per capita income            | 501    | 693  | 150                             | 240  | 640          | 848  | 555    | 759  |
| Mean hourly wage                                    | 7.2    | 10.0 | 4.2                             | 5.5  | 7.4          | 9.1  | 6.8    | 8.5  |
| Number of hours worked                              | 45.5   | 39.5 | 40.7                            | 36.4 | 43.7         | 40.2 | 43.3   | 39.7 |
| Share of adults per household                       | 0.66   | 0.70 | 0.54                            | 0.60 | 0.71         | 0.76 | 0.70   | 0.75 |
| Share of occupied adults per household              | 0.48   | 0.53 | 0.34                            | 0.38 | 0.52         | 0.57 | 0.50   | 0.55 |
| Population under poverty line threshold at R\$ 140: |        |      |                                 |      |              |      |        |      |
| Number of hours worked                              | 47.4   | 37.0 | 39.6                            | 34.2 | 43.5         | 36.6 | 41.5   | 34.6 |
| Share of adults per household                       | 0.55   | 0.59 | 0.50                            | 0.54 | 0.58         | 0.61 | 0.57   | 0.61 |
| Share of occupied adults per household              | 0.31   | 0.21 | 0.28                            | 0.23 | 0.34         | 0.26 | 0.34   | 0.26 |
| Population under poverty line threshold at R\$7 0:  |        |      |                                 |      |              |      |        |      |
| Number of hours worked                              | 46.4   | 30.6 | 38.6                            | 33.2 | 41.5         | 32.9 | 39.3   | 32.1 |
| Share of adults per household                       | 0.53   | 0.64 | 0.47                            | 0.53 | 0.56         | 0.65 | 0.54   | 0.63 |
| Share of occupied adults per household              | 0.18   | 0.06 | 0.21                            | 0.12 | 0.23         | 0.11 | 0.25   | 0.13 |

Note: Manaus refers to the municipality of Manaus; Amazonas excluding Manaus corresponds to the rest of the state of Amazonas (RAM) from which the municipality of Manaus has been excluded.

Source: Authors' calculations from 2000 and 2010 Brazilian Census microdata.

Table 4. Results on Azevedo et al. (2012a) Poverty Decomposition Factors

|  | Manaus       |               | Amazonas excluding Manaus |               | Urban Brazil |               | Brazil       |               |
|--|--------------|---------------|---------------------------|---------------|--------------|---------------|--------------|---------------|
|  | Headcount %  | Poverty gap % | Headcount %               | Poverty gap % | Headcount %  | Poverty gap % | Headcount %  | Poverty gap % |
| <b>Poverty line threshold at R\$ 140</b> |              |               |                           |               |              |               |              |               |
| 2000                                     | 32.0         | 16.4          | 74.4                      | 46.4          | 24.3         | 12.1          | 30.9         | 16.4          |
| 2010                                     | 18.1         | 10.5          | 53.9                      | 33.5          | 13.0         | 6.9           | 17.6         | 9.7           |
| <i>Total change</i>                      | <i>-13.8</i> | <i>-5.9</i>   | <i>-20.5</i>              | <i>-12.9</i>  | <i>-11.3</i> | <i>-5.1</i>   | <i>-13.3</i> | <i>-6.6</i>   |
| Share of adults per household            | 14.6         | 10.8          | 21.0                      | 19.4          | 14.4         | 10.1          | 15.9         | 13.6          |
| Share of occupied adults per household   | 15.9         | 5.4           | 21.7                      | 12.2          | 13.9         | 3.2           | 13.6         | 3.0           |
| Labor income                             | 43.6         | 42.9          | 25.8                      | 14.3          | 34.8         | 28.6          | 31.6         | 22.0          |
| Non-labor income                         | 25.9         | 40.9          | 31.4                      | 54.2          | 36.9         | 58.1          | 38.9         | 61.5          |
| <i>Total change</i>                      | <i>100.0</i> | <i>100.0</i>  | <i>100.0</i>              | <i>100.0</i>  | <i>100.0</i> | <i>100.0</i>  | <i>100.0</i> | <i>100.0</i>  |
| <b>Poverty line threshold at R\$ 70</b>  |              |               |                           |               |              |               |              |               |
| 2000                                     | 14.8         | 9.3           | 48.3                      | 29.6          | 10.9         | 6.3           | 15.5         | 9.0           |
| 2010                                     | 9.4          | 7.6           | 33.5                      | 23.0          | 6.4          | 4.5           | 9.3          | 6.3           |
| <i>Total change</i>                      | <i>-5.4</i>  | <i>-1.8</i>   | <i>-14.8</i>              | <i>-6.6</i>   | <i>-4.5</i>  | <i>-1.7</i>   | <i>-6.2</i>  | <i>-2.7</i>   |
| Share of adults per household            | 8.5          | 1.9           | 21.3                      | 16.5          | 9.2          | 1.7           | 13.9         | 10.3          |
| Share of occupied adults per household   | 1.7          | -27.3         | 15.5                      | -8.7          | 0.6          | -26.6         | 2.8          | -23.3         |
| Labor income                             | 49.6         | 19.6          | 17.8                      | -14.0         | 29.1         | -7.1          | 22.3         | -15.3         |
| Non-labor income                         | 40.2         | 105.8         | 45.4                      | 106.3         | 61.1         | 132.0         | 61.0         | 128.4         |
| <i>Total change</i>                      | <i>100.0</i> | <i>100.0</i>  | <i>100.0</i>              | <i>100.0</i>  | <i>100.0</i> | <i>100.0</i>  | <i>100.0</i> | <i>100.0</i>  |

Note: Results are obtained based on Azevedo et al., (2012a) Shapley-value estimate of the contributions that changes in demographics, employment, labor and non-labor income sources may have made to observed poverty and inequality changes. Manaus refers to the municipality of Manaus; Amazonas excluding Manaus corresponds to the rest of the state of Amazonas (RAM) from which the municipality of Manaus has been excluded.

Source: Authors' calculations from 2000 and 2010 Brazilian Census microdata.

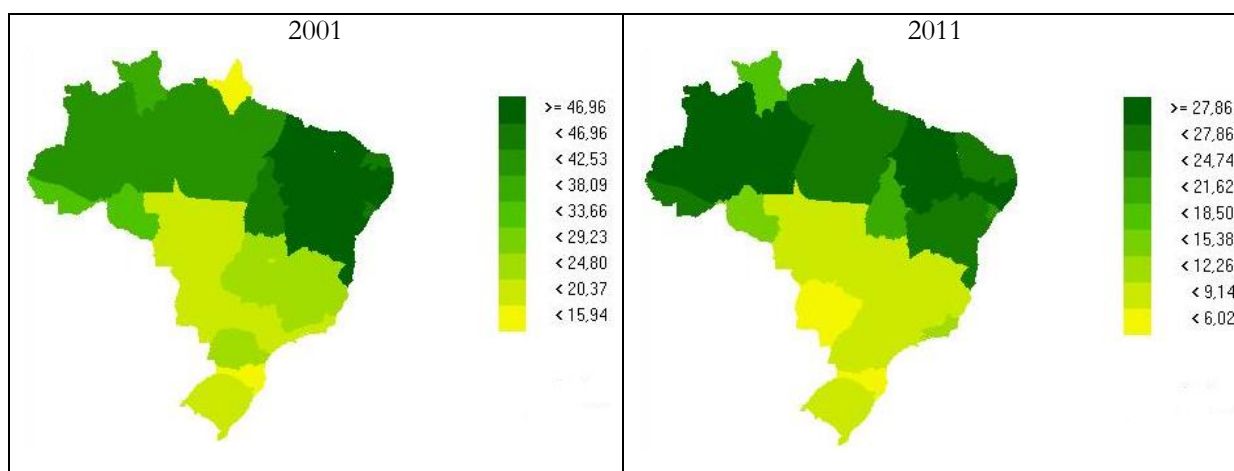
Table 5. Results on Azevedo et al. (2012a) Inequality Decomposition Factors

|  | Manaus       |              | Amazonas excluding Manaus |              | Urban Brazil |              | Brazil       |              |
|--|--------------|--------------|---------------------------|--------------|--------------|--------------|--------------|--------------|
|  | Gini index   | Theil index  | Gini index                | Theil index  | Gini index   | Theil index  | Gini index   | Theil index  |
| <b>Inequality</b>                      |              |              |                           |              |              |              |              |              |
| 2000                                   | 0.64         | 0.87         | 0.66                      | 1.06         | 0.63         | 0.84         | 0.65         | 0.90         |
| 2010                                   | 0.61         | 0.82         | 0.64                      | 0.92         | 0.59         | 0.76         | 0.60         | 0.80         |
| <i>Total change</i>                    | <i>-0.03</i> | <i>-0.06</i> | <i>-0.02</i>              | <i>-0.14</i> | <i>-0.04</i> | <i>-0.08</i> | <i>-0.04</i> | <i>-0.10</i> |
| Share of adults per household          | 16.7         | 35.3         | 14.3                      | 27.9         | 7.7          | 20.0         | 9.3          | 18.9         |
| Share of occupied adults per household | 6.7          | 11.8         | -52.4                     | -57.1        | -5.1         | -9.6         | -7.0         | -14.6        |
| Labor income                           | 86.7         | 126.5        | 4.8                       | 15.0         | 82.1         | 80.7         | 69.8         | 65.2         |
| Non-labor income                       | -13.3        | -73.5        | 133.3                     | 114.3        | 15.4         | 8.9          | 25.6         | 30.5         |
| <i>Total change</i>                    | <i>100.0</i> | <i>100.0</i> | <i>100.0</i>              | <i>100.0</i> | <i>100.0</i> | <i>100.0</i> | <i>100.0</i> | <i>100.0</i> |

Note: Results are obtained based on Azevedo et al., (2012a) Shapley-value estimate of the contributions that changes in demographics, employment, labor and non-labor income sources may have made to observed poverty and inequality changes. Manaus refers to the municipality of Manaus; Amazonas excluding Manaus corresponds to the rest of the state of Amazonas (RAM) from which the municipality of Manaus has been excluded.

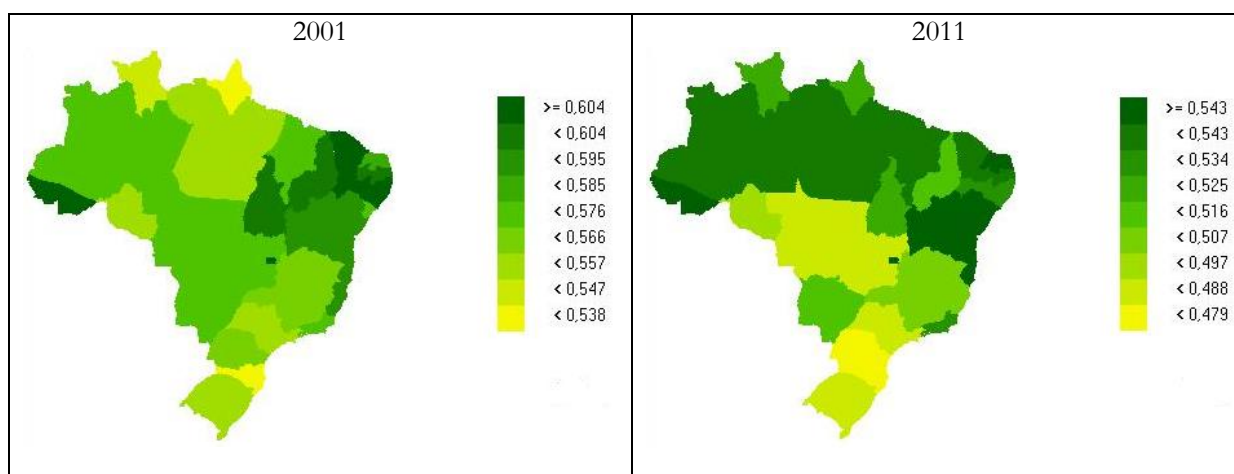
Source: Authors' calculations from 2000 and 2010 Brazilian Census microdata.

**Figure A1. Maps on Poverty Measures by State, 2001-2011.**



Note: Data from the Institute of Applied Economic Research Poverty Series (see [www.ipeadata.gov.br](http://www.ipeadata.gov.br)), which uses Brazilian household surveys (PNAD). Poverty is measured using the headcount index (with a poverty line based on an estimation of basic calorie intake needs).

**Figure A2. Maps on Inequality Measures by State, 2001-2011.**



Note: Data from the Institute of Applied Economic Research Poverty Series (see [www.ipeadata.gov.br](http://www.ipeadata.gov.br)), which uses Brazilian household surveys (PNAD). Inequality is measured using the Gini index.

**Table A1. Descriptive Statistics on Living Conditions**

|                                | Manaus |      | Amazonas<br>excluding<br>Manaus |      | Urban Brazil |      | Brazil |      |
|--------------------------------|--------|------|---------------------------------|------|--------------|------|--------|------|
|                                | 2000   | 2010 | 2000                            | 2010 | 2000         | 2010 | 2000   | 2010 |
| Number of persons per bedroom: |        |      |                                 |      |              |      |        |      |
| One or two                     | 40.4   | 48.8 | 20.7                            | 32.4 | 63.2         | 73.1 | 61.3   | 71.8 |
| Three                          | 28.8   | 25.7 | 27.3                            | 26.7 | 22.7         | 17.7 | 23.7   | 18.3 |
| More than three                | 30.8   | 25.5 | 52.0                            | 40.9 | 14.1         | 9.3  | 15.0   | 9.9  |
| Type of housing:               |        |      |                                 |      |              |      |        |      |
| House                          | 91.5   | 91.3 | 97.4                            | 97.4 | 89.9         | 89.7 | 91.3   | 91.2 |
| Flat                           | 4.3    | 7.4  | 0.2                             | 0.8  | 8.9          | 9.8  | 7.4    | 8.2  |
| Room                           | 3.8    | 1.2  | 0.9                             | 0.2  | 1.0          | 0.5  | 0.9    | 0.4  |
| Other (makeshift, etc.)        | 0.3    | 0.1  | 1.5                             | 1.6  | 0.3          | 0.1  | 0.4    | 0.2  |
| Type of access to water:       |        |      |                                 |      |              |      |        |      |
| Municipal supply               | 76.2   | 75.2 | 41.7                            | 49.3 | 89.4         | 91.3 | 76.3   | 81.1 |
| Water well                     | 13.4   | 24.0 | 16.5                            | 19.9 | 7.6          | 7.7  | 16.6   | 15.0 |
| Other (rainwater, etc.)        | 10.4   | 0.8  | 41.9                            | 30.9 | 3.1          | 1.1  | 7.0    | 3.9  |
| Access to electric lighting    | 99.0   | 99.6 | 65.4                            | 84.4 | 99.1         | 99.8 | 93.7   | 98.6 |
| Type of sanitation facility:   |        |      |                                 |      |              |      |        |      |
| Public network                 | 33.1   | 39.4 | 3.6                             | 6.0  | 54.8         | 61.7 | 45.4   | 52.3 |
| Septic tank                    | 36.2   | 22.1 | 12.6                            | 10.7 | 15.9         | 11.5 | 14.7   | 11.8 |
| Other                          | 26.6   | 37.5 | 61.9                            | 71.7 | 26.6         | 26.2 | 31.2   | 32.8 |
| No toilet                      | 4.0    | 1.0  | 21.9                            | 11.6 | 2.8          | 0.6  | 8.8    | 3.1  |
| Number of household assets:    |        |      |                                 |      |              |      |        |      |
| One or less                    | 8.8    | 2.9  | 59.5                            | 37.8 | 11.5         | 3.9  | 19.3   | 7.2  |
| Two to five                    | 85.3   | 84.5 | 40.2                            | 61.4 | 79.7         | 76.2 | 73.5   | 75.9 |
| All                            | 5.9    | 12.7 | 0.3                             | 0.7  | 8.8          | 19.9 | 7.3    | 17.0 |

**Table A2. Characteristics of Total Population**

|  | Manaus |       | Amazonas<br>excluding Manaus |       | Urban Brazil |        | Brazil |        |
|--|--------|-------|------------------------------|-------|--------------|--------|--------|--------|
|  | 2000   | 2010  | 2000                         | 2010  | 2000         | 2010   | 2000   | 2010   |
| Total population sample (millions)           | 1.33   | 1.59  | 1.22                         | 1.56  | 122.50       | 148.40 | 151.50 | 176.90 |
| Urban (% of total)                           | 99.4%  | 99.5% | 51.2%                        | 57.8% | 100.0%       | 100.0% | 80.8%  | 83.9%  |
| Men (% of total)                             | 48.5%  | 48.0% | 51.2%                        | 51.3% | 48.1%        | 47.6%  | 48.9%  | 48.3%  |
| Self-declared White/Asian (% of total)       | 32.3%  | 27.1% | 17.1%                        | 16.1% | 55.7%        | 50.4%  | 53.4%  | 48.2%  |
| Average years of schooling                   | 5.2    | 6.2   | 2.5                          | 3.8   | 5.2          | 6.2    | 4.7    | 5.8    |
| Average age                                  | 24.4   | 27.2  | 20.9                         | 23.4  | 28.7         | 31.7   | 28.2   | 31.4   |
| Average hh size                              | 5.4    | 5.0   | 7.3                          | 6.5   | 4.6          | 4.1    | 4.7    | 4.2    |
| Average number of children in hh             | 2.0    | 1.6   | 3.5                          | 2.8   | 1.5          | 1.1    | 1.7    | 1.2    |
| Always resident in municipality (% of total) | 63.2%  | 65.8% | 83.0%                        | 79.8% | 57.2%        | 56.7%  | 60.1%  | 59.0%  |
| Always resident in state (% of total)        | 73.1%  | 83.4% | 93.1%                        | 95.0% | 72.0%        | 82.0%  | 74.5%  | 83.4%  |
| Employed (% of working-age population)       | 49.1%  | 54.8% | 34.3%                        | 38.5% | 54.2%        | 60.2%  | 52.1%  | 57.8%  |

Note: The employed correspond in our analysis to the persons between 15 and 65 years old declaring a monthly labor income from their main job.

Source: Authors' calculations from 2000 and 2010 Brazilian Census microdata.



**Table A3. Characteristics of Workers**

|  | Manaus |       | Amazonas<br>excluding Manaus |       | Urban Brazil |       | Brazil |       |
|--|--------|-------|------------------------------|-------|--------------|-------|--------|-------|
|  | 2000   | 2010  | 2000                         | 2010  | 2000         | 2010  | 2000   | 2010  |
| Men (% of Total)                           | 60.6%  | 57.4% | 72.3%                        | 63.7% | 59.9%        | 56.0% | 62.3%  | 57.5% |
| Self-declared White/Asian (% of total)     | 33.2%  | 27.9% | 18.6%                        | 18.5% | 57.5%        | 52.5% | 56.1%  | 51.5% |
| Formal workers (% of total)                | 52.8%  | 60.8% | 25.2%                        | 26.4% | 57.3%        | 64.8% | 53.5%  | 61.6% |
| Average years of schooling                 | 8.1    | 9.0   | 4.9                          | 6.7   | 7.7          | 8.6   | 7.1    | 8.3   |
| <b>Mean hourly wages</b>                   | 7.2    | 10.0  | 4.2                          | 5.5   | 7.4          | 9.1   | 6.8    | 8.5   |
| Women's mean hourly wages                  | 6.4    | 9.3   | 4.0                          | 5.5   | 6.4          | 8.2   | 6.1    | 7.8   |
| Men's mean hourly wages                    | 7.8    | 10.5  | 4.2                          | 5.6   | 8.1          | 9.8   | 7.2    | 9.1   |
| <b>Sector of activity</b>                  |        |       |                              |       |              |       |        |       |
| Agriculture, forestry, fishing, mining (%) | 1.6%   | 1.2%  | 38.2%                        | 31.0% | 5.8%         | 5.1%  | 13.9%  | 11.5% |
| Manufacturing (%)                          | 16.5%  | 17.0% | 7.1%                         | 5.7%  | 14.8%        | 15.2% | 13.7%  | 14.3% |
| Construction and utilities (%)             | 9.3%   | 9.8%  | 6.0%                         | 7.4%  | 9.4%         | 9.8%  | 8.7%   | 9.3%  |
| Wholesale and retail trade (%)             | 22.2%  | 21.6% | 11.4%                        | 14.1% | 20.0%        | 20.6% | 17.9%  | 18.9% |
| Transportation and storage (%)             | 6.6%   | 6.6%  | 4.0%                         | 4.5%  | 5.3%         | 5.3%  | 4.8%   | 4.9%  |
| Communication, finance and business (%)    | 8.0%   | 11.3% | 2.1%                         | 3.7%  | 9.6%         | 10.7% | 8.5%   | 9.6%  |
| Public administration (%)                  | 18.2%  | 16.8% | 20.2%                        | 22.8% | 17.4%        | 17.4% | 16.0%  | 16.3% |
| Other services (%)                         | 17.6%  | 15.6% | 11.0%                        | 10.8% | 17.7%        | 16.0% | 16.5%  | 15.1% |

Note: The sample of workers corresponds in our analysis to the persons between 15 and 65 years old declaring a monthly labor income from their main job. Our definition of formal workers corresponds to private or public employees whose contract is registered or signed (“assinada carteira de trabalho”) as stipulated by Brazilian law, the military and civil servants, and employers and own-account workers with social security.

Source: Authors’ calculations from 2000 and 2010 Brazilian Census microdata.

**Table A4. Contribution of Growth and Redistribution to Poverty Reduction Excluding Households Declaring Zero Income, 2000-2010.**

|                                       | Manaus       | Amazonas<br>excluding<br>Manaus | Urban Brazil | Brazil       |
|---------------------------------------|--------------|---------------------------------|--------------|--------------|
| <b>Using the R\$ 140 poverty line</b> |              |                                 |              |              |
| <b>Headcount ratio %</b>              |              |                                 |              |              |
| 2000                                  | 27.2         | 69.6                            | 21.6         | 27.6         |
| 2010                                  | 12.9         | 47.7                            | 10.4         | 14.7         |
| <i>Total change</i>                   | <i>-14.3</i> | <i>-21.9</i>                    | <i>-11.2</i> | <i>-13.0</i> |
| <i>Growth</i>                         | <i>-9.1</i>  | <i>-18.5</i>                    | <i>-6.2</i>  | <i>-7.3</i>  |
| <i>Redistribution</i>                 | <i>-5.2</i>  | <i>-3.4</i>                     | <i>-5.0</i>  | <i>-5.7</i>  |
| <b>Poverty gap index %</b>            |              |                                 |              |              |
| 2000                                  | 10.6         | 36.3                            | 8.8          | 12.3         |
| 2010                                  | 4.8          | 24.5                            | 4.1          | 6.5          |
| <i>Total change</i>                   | <i>-5.8</i>  | <i>-11.8</i>                    | <i>-4.7</i>  | <i>-5.8</i>  |
| <i>Growth</i>                         | <i>-3.9</i>  | <i>-12.3</i>                    | <i>-2.6</i>  | <i>-3.6</i>  |
| <i>Redistribution</i>                 | <i>-1.9</i>  | <i>0.6</i>                      | <i>-2.1</i>  | <i>-2.3</i>  |
| <b>Using the R\$ 70 poverty line</b>  |              |                                 |              |              |
| <b>Headcount ratio %</b>              |              |                                 |              |              |
| 2000                                  | 8.8          | 38.5                            | 7.6          | 11.5         |
| 2010                                  | 3.6          | 24.5                            | 3.5          | 6.1          |
| <i>Total change</i>                   | <i>-5.2</i>  | <i>-14.0</i>                    | <i>-4.1</i>  | <i>-5.4</i>  |
| <i>Growth</i>                         | <i>-3.2</i>  | <i>-14.9</i>                    | <i>-2.2</i>  | <i>-3.1</i>  |
| <i>Redistribution</i>                 | <i>-2.0</i>  | <i>0.9</i>                      | <i>-1.9</i>  | <i>-2.3</i>  |
| <b>Poverty gap index %</b>            |              |                                 |              |              |
| 2000                                  | 3.0          | 16.3                            | 2.8          | 4.6          |
| 2010                                  | 1.6          | 12.5                            | 1.6          | 3.0          |
| <i>Total change</i>                   | <i>-1.3</i>  | <i>-3.8</i>                     | <i>-1.2</i>  | <i>-1.6</i>  |
| <i>Growth</i>                         | <i>-1.2</i>  | <i>-7.1</i>                     | <i>-0.9</i>  | <i>-1.4</i>  |
| <i>Redistribution</i>                 | <i>-0.2</i>  | <i>3.3</i>                      | <i>-0.3</i>  | <i>-0.2</i>  |

Note: Results are obtained using a Shapley-Shorrocks estimate of the Datt-Ravallion (1992) decomposition on growth and redistribution components (see Azevedo et al., 2012b). Manaus refers to the municipality of Manaus; Amazonas excluding Manaus corresponds to the rest of the state of Amazonas (RAM) from which the municipality of Manaus has been excluded.

Source: Authors' calculations from 2000 and 2010 Brazilian Census microdata.

Table A5. Results on Azevedo et al. (2012a) Poverty Decomposition Factors Excluding Households Declaring Zero Income

|  | Manaus       |               | Amazonas excluding Manaus |               | Urban Brazil |               | Brazil       |               |
|--|--------------|---------------|---------------------------|---------------|--------------|---------------|--------------|---------------|
|  | Headcount %  | Poverty gap % | Headcount %               | Poverty gap % | Headcount %  | Poverty gap % | Headcount %  | Poverty gap % |
| <b>Poverty line threshold at R\$ 140</b> |              |               |                           |               |              |               |              |               |
| 2000                                     | 27.2         | 10.6          | 69.6                      | 36.3          | 21.6         | 8.8           | 27.6         | 12.3          |
| 2010                                     | 12.9         | 4.8           | 47.7                      | 24.5          | 10.4         | 4.1           | 14.7         | 6.5           |
| <i>Total change</i>                      | <i>-14.3</i> | <i>-5.8</i>   | <i>-21.9</i>              | <i>-11.8</i>  | <i>-11.2</i> | <i>-4.8</i>   | <i>-13.0</i> | <i>-5.9</i>   |
| Share of adults per household            | 14.0         | 10.7          | 21.0                      | 22.4          | 14.1         | 10.8          | 15.4         | 14.3          |
| Share of occupied adults per household   | 15.3         | 2.9           | 21.1                      | 9.1           | 13.2         | 0.2           | 12.9         | -1.0          |
| Labor income                             | 43.5         | 43.4          | 24.2                      | 7.6           | 34.8         | 26.6          | 31.7         | 18.6          |
| Non-labor income                         | 27.2         | 43.1          | 33.6                      | 61.0          | 37.9         | 62.4          | 40.0         | 68.1          |
| <i>Total change</i>                      | <i>100.0</i> | <i>100.0</i>  | <i>100.0</i>              | <i>100.0</i>  | <i>100.0</i> | <i>100.0</i>  | <i>100.0</i> | <i>100.0</i>  |
| <b>Poverty line threshold at R\$ 70</b>  |              |               |                           |               |              |               |              |               |
| 2000                                     | 8.8          | 3.0           | 38.5                      | 16.3          | 7.6          | 2.8           | 11.5         | 4.6           |
| 2010                                     | 3.6          | 1.6           | 24.5                      | 12.5          | 3.5          | 1.6           | 6.1          | 3.0           |
| <i>Total change</i>                      | <i>-5.2</i>  | <i>-1.3</i>   | <i>-14.0</i>              | <i>-3.8</i>   | <i>-4.1</i>  | <i>-1.2</i>   | <i>-5.4</i>  | <i>-1.6</i>   |
| Share of adults per household            | 8.5          | -1.3          | 23.0                      | 31.0          | 9.3          | 3.3           | 14.3         | 14.5          |
| Share of occupied adults per household   | -2.3         | -50.6         | 14.6                      | -45.0         | -3.3         | -54.6         | -1.6         | -59.4         |
| Labor income                             | 49.3         | 13.8          | 12.8                      | -66.8         | 26.4         | -32.3         | 18.6         | -53.3         |
| Non-labor income                         | 44.5         | 138.1         | 49.6                      | 180.8         | 67.7         | 183.6         | 68.8         | 198.2         |
| <i>Total change</i>                      | <i>100.0</i> | <i>100.0</i>  | <i>100.0</i>              | <i>100.0</i>  | <i>100.0</i> | <i>100.0</i>  | <i>100.0</i> | <i>100.0</i>  |

Note: Results are obtained based on Azevedo et al., (2012a) Shapley-value estimate of the contributions that changes in demographics, employment, labor and non-labor income sources may have made to observed poverty evolutions. Manaus refers to the municipality of Manaus; Amazonas excluding Manaus corresponds to the rest of the state of Amazonas (RAM) from which the municipality of Manaus has been excluded.

Source: Authors' calculations from 2000 and 2010 Brazilian Census microdata.

**Table A6. Results on Azevedo et al. (2012a) Inequality Decomposition Factors Excluding Households Declaring Zero Income**

|  | Manaus       |              | Amazonas excluding<br>Manaus |              | Urban Brazil |              | Brazil       |              |
|--|--------------|--------------|------------------------------|--------------|--------------|--------------|--------------|--------------|
|  | Gini index   | Theil index  | Gini index                   | Theil index  | Gini index   | Theil index  | Gini index   | Theil index  |
| <b>Inequality</b>                      |              |              |                              |              |              |              |              |              |
| 2000                                   | 0.61         | 0.81         | 0.60                         | 0.89         | 0.62         | 0.80         | 0.63         | 0.85         |
| 2010                                   | 0.58         | 0.75         | 0.59                         | 0.79         | 0.58         | 0.73         | 0.59         | 0.76         |
| <i>Total change</i>                    | <i>-0.03</i> | <i>-0.05</i> | <i>-0.01</i>                 | <i>-0.09</i> | <i>-0.04</i> | <i>-0.08</i> | <i>-0.04</i> | <i>-0.09</i> |
| Share of adults per household          | 16.7         | 37.1         | 16.7                         | 34.1         | 7.9          | 20.0         | 7.5          | 18.9         |
| Share of occupied adults per household | 6.7          | 4.8          | -300.0                       | -128.0       | -7.9         | -14.4        | -10.0        | -21.6        |
| Labor income                           | 93.3         | 137.1        | -50.0                        | -11.0        | 84.2         | 83.2         | 75.0         | 66.9         |
| Non-labor income                       | -13.3        | -77.4        | 433.3                        | 204.9        | 15.8         | 10.4         | 27.5         | 35.8         |
| <i>Total change</i>                    | <i>100.0</i> | <i>100.0</i> | <i>100.0</i>                 | <i>100.0</i> | <i>100.0</i> | <i>100.0</i> | <i>100.0</i> | <i>100.0</i> |

Note: Results are obtained based on Azevedo et al., (2012a) Shapley-value estimate of the contributions that changes in demographics, employment, labor and non-labor income sources may have made to observed inequality changes. Manaus refers to the municipality of Manaus; Amazonas excluding Manaus corresponds to the rest of the state of Amazonas (RAM) from which the municipality of Manaus has been excluded.

Source: Authors' calculations from 2000 and 2010 Brazilian Census microdata.

