



LUND UNIVERSITY

School of Economics and Management

Master programme in Economic History

## Poverty Reduction in Brazil: what is behind the decline during the 2000s?

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*Abstract:* Following a macroeconomic stabilization and consistent economic growth during the 2000s, Brazil experienced a continuous decrease on poverty incidence for the first time in its contemporary history. While the literature emphasizes the importance of economic growth alongside social development to fight poverty, the Brazilian experience also displays strong government action through expanding social coverage targeted to the poor. Considering a scenario where all factors are observed simultaneously, this study aims to shed light on the poverty dynamics during Luiz Inácio Lula da Silva's presidential term. Specifically, this study explores which factor has contributed the most for poverty reduction: the sectoral composition of growth, the public spending or the general improvement in the socioeconomic context. The findings suggest that inequality reduction alongside the increase in human capital attainment were the most important factors behind poverty decline followed by economic growth, especially through the tertiary sector. Government expenditures played a marginal role through education and health while federal cash transfers did not provide any significant effect.

*Key words:* Poverty, inequality, public spending, sectoral growth, Brazil

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## 1) Introduction

Poverty has been a long-lasting issue in Brazilian society. While the country struggled with political and economic crisis throughout the 1980s and 1990s, little was done to alleviate the problem. However, during the 2000s following a macroeconomic stabilization and consistent economic growth, Brazil have experienced for the first time on its contemporary history a continuous decrease on poverty incidence.

Fighting poverty, however, is not a simple task due to its multifactorial and multidimensional aspects. The Brazilian experience, for example, involved economic growth caused by the commodities' boom allied with a credible macroeconomic policy that kept inflation under control and created an environment for the expansion of the labor market. However, factors such as the falling inequality, increased human capital attainment and the expansion of public spending focused on the poor also hold their share of responsibility on poverty dynamics (Ferreira et al 2009, Marinho et al 2011, Annegues et al 2015).

Given this multitude of factors, attempts to estimate poverty dynamics and its determinants have been made in order to cast light into the subject. The vastness of this discussion reach as far back as the foundation of classic economics<sup>1</sup> and comprise not only poverty as an abstract term but also its possibilities of measurement<sup>2</sup> and estimation techniques<sup>3</sup>.

By aiming to contribute with the vast knowledge produced in the field, this study focus on estimating the poverty dynamics in Brazil during a period in which poverty indicators have reached a consistent downwards trend and promoted profound changes in Brazilian society. The idea, therefore, is to be able to determine what factors were the most important in order to explain the experienced poverty reduction.

The details regarding this approach will be further discussed on forthcoming sections, by now, it is just important to note that this study is mainly focused in a specific period on Brazilian contemporary history that comprises Luiz Inácio Lula da Silva's<sup>4</sup> term as President. That said,

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<sup>1</sup> Adam Smith (1776) have already suggested poverty as a relative concept and determined by society. These views are still shared by many modern economists and will be discussed throughout this study.

<sup>2</sup> Following the debate of poverty as a relative concept, several economists have proposed a multitude of measurements that consider this dimension, most notably Sen (1979)

<sup>3</sup> Estimation techniques evolved as much as statistical tools became more robust and widespread. However, from the 1990s and beyond, complex estimations using cross country information alongside sectoral economic growth and the use of socioeconomic variables became more popular among poverty studies. See Ravallion & Chen (1997)

<sup>4</sup> Luiz Inácio Lula da Silva (b. 1945) was born to a poor family in the small town of Caetés. Despite low formal education, Lula became a prominent union leader and, in 1980, was one of the founders of the Workers' Party. He became the Brazilian President in 2003 after running for office – and losing – in 1989, 1994 and 1998.

the conclusions from this study should be analyzed not as definitive statements regarding poverty dynamics but rather as findings supporting the empirical evidence from a given period.

This study is divided in 9 sections. The first one consists on the present introduction. Following this introductory section, this work proceeds with a section aiming to highlight the research question. On the third section, the context in which Brazil was immersed during the period of interest will be explored. By doing so, this study aims not only to provide the reader with a thorough description of this historical moment, but also to link its phenomena with the most up-to-date knowledge in poverty studies through a bibliographical review, which is to be presented on the fourth section. The fifth section explored the methodological framework underlying this study while presenting the data, variables and statistical methods. The results are presented on the sixth section. The discussion of the estimates is promoted in the seventh section where the findings are linked with the literature review and research question. The reference list as well as the appendix are presented separately on two additional sections in the end of this work.

## 2) Aim and Research Question

This study aims to shed some light into the poverty dynamics in Brazil during Luis Inácio Lula da Silva's term as the Brazilian President. The procedure consists in defining a poverty line and collecting data on economic growth, government expenditures and socioeconomic variables. By doing so, this study will rely on estimating poverty dynamics through first-differences on a linear panel data model.

Lula's term has left many legacies in Brazil. As the next section will demonstrate, the economic growth as well as the social transformations experienced throughout the period were unprecedented in the country's contemporary history.

One of the social transformations that mostly impacted Brazilian society during his term was the sustained poverty reduction; a phenomenon that was never verified since the democratization process that started in the late 1980s. This study, therefore, attempts to explore this achievement and to discuss the factors influencing it. Since this was a period with consistent economic growth, systematic increase in government expenditure and sensible improvement on socioeconomic indexes such as inequality, education and employment, the perception of what mattered the most and how much each factor mattered can be blurred. Therefore, this study is interested on answering the following question: What were the main drivers for poverty reduction in Brazil during the 2002-2009 period?

By answering, or at least exploring this question, this study contributes to the literature in a number of ways. Firstly, a time dimension will be added to poverty studies in Brazil, providing a more up-to-date research that relies in the most recent databases available. Secondly, by creating a model specification that addresses sectoral growth and disaggregated public expenditure as variables of interest, this study adds to the understanding of what exactly led poverty reduction during Lula's term allowing a more academically grounded ex-post analysis. Lastly, by understanding poverty dynamics for the Brazilian context, the comprehension of poverty in the Latin America as a whole can be enhanced since problems with poverty and inequality can be found throughout the region, providing more tools and information for multilateral organizations to address poverty issues regionally.

The next section will present the context in which Brazil was immersed during the period of interest and will be followed by a bibliographical review on the subject covering both general and specific aspects on the literature regarding poverty and its dynamics.

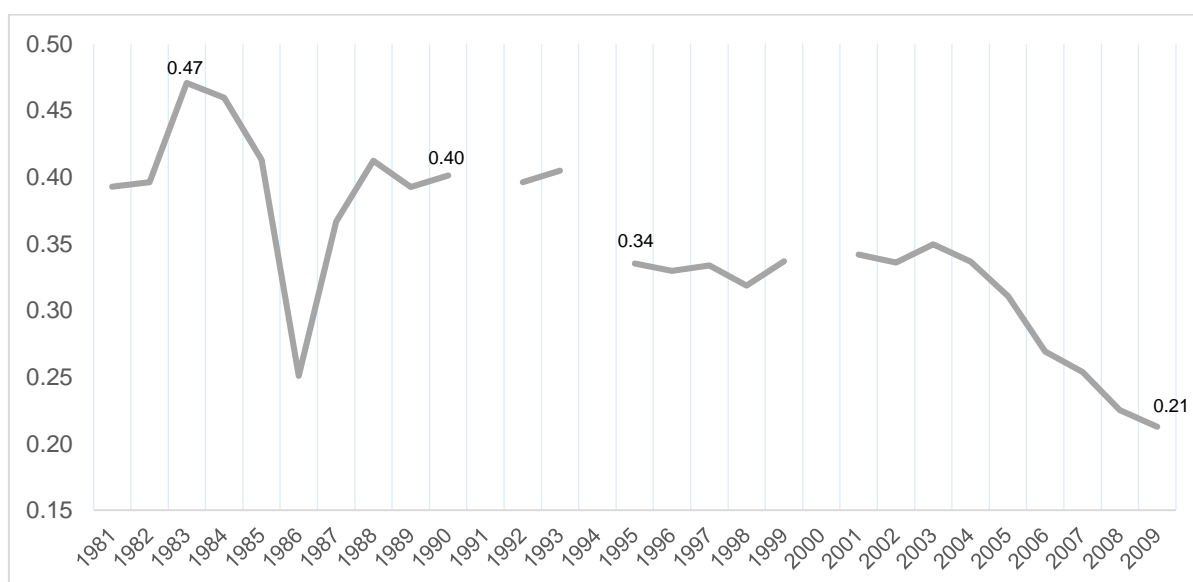


### 3) Context

As already mentioned in the last section, the period of interest for this study will comprise the years in which Luís Inácio Lula da Silva was the President of Brazil (2003-2010). However, due to data limitations<sup>5</sup>, the period of analysis will be from 2002 to 2009. By doing so, this study captures 7 years of Lula's presidency (2003-2009) and the last year of Fernando Henrique Cardoso's term.

The aforementioned period is of particular importance in contemporary Brazilian history for its remarkable social achievements, especially regarding poverty reduction, as the chart below aims to illustrate:

Figure 1 – Proportion of individuals considered poor within Brazilian population (1981-2009, in %)



Source: Authors calculations from the database of the Institute of Applied Economic Research (IPEA)

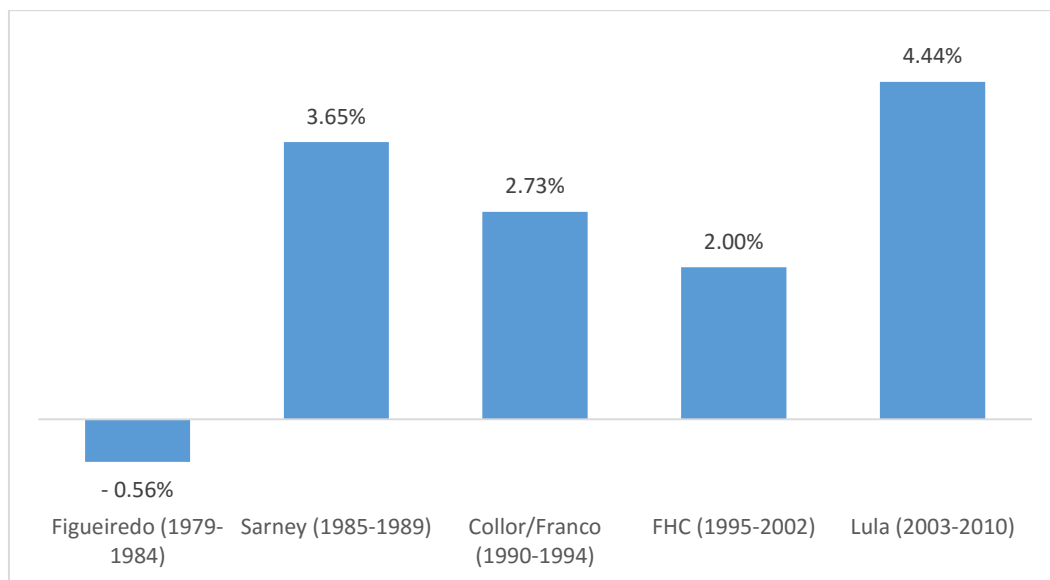
Despite the absence of data for some years, it is possible to see that the percentage of individuals considered poor in the population has remained stable – despite its volatility<sup>6</sup> - during the 80s until the early 90s. Even though there is no data available for the years 1991 and 1994, the trend in the early 90s can be considered downwards if we note that the proportion of poor was considerably lower in 1995 (34%) when compared to the beginning of the decade (40%). This standard was kept unchanged until the early 2000s, however, a consistent downward trend can be verified from 2003 and beyond, which coincides with Lula's term as the Brazilian President.

<sup>5</sup> These limitations are further discussed on Section 5.1)Data.

<sup>6</sup> The volatility observable during the 1980s is related with an economic program called "Plano Cruzado" when prices and salaries were frozen, the exchange rate was fixed alongside other minor measures. A thorough discussion about the impacts of this plan on poverty volatility can be found in Ferreira et al (2008).

The consistency in which poverty was reduced in Brazil during Lula’s term raises many questions regarding the reasons why only after more than two decades of social stagnation Brazil have finally reached a path of social justice and poverty reduction. This is a vast field to be explored, especially considering that poverty is a multidimensional and multifactorial problem, therefore, exploring poverty dynamics require the analysis of several indicators such as inequality, economic growth, human capital levels and government expenditures. One of the variables that draws the attention of many scholars is economic growth. The chart below casts light on its behavior in the last decades:

Figure 2 – Compound Annual Growth Rate (CAGR) of the GDP during the last 5 presidential terms



Source: See Figure 1

As it is possible to verify during Lula’s term, Brazil have experienced unprecedented economic growth. The CAGR is more than the double when compared to Fernando Henrique Cardoso (FHC) and it is consistently higher than Collor/Franco<sup>7</sup> and Sarney’s<sup>8</sup> terms. Figueiredo’s term, as Figure 2 shows, was a disaster economically speaking and reflects the economic turmoil experienced by several countries in Latin America throughout the 80s.

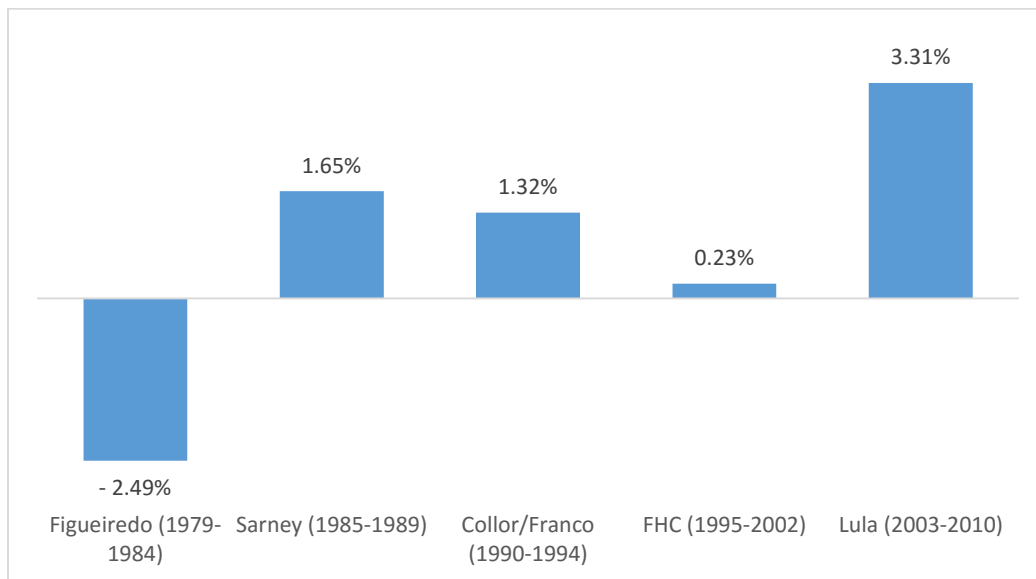
Figures 1 and 2, when jointly analyzed, provide an interesting case of negative correlation between economic growth and poverty reduction. This is one key relationship that will be explored in the present study and will be better clarified on the literature review on next section.

<sup>7</sup> Fernando Collor was elected President of Brazil in 1990. However, in 1992, after his resignation due to an imminent defeat in the battle against an impeachment process, the Vice-President Itamar Franco have risen to power.

<sup>8</sup> José Sarney had a full presidential term even though he was never elected President himself. He had risen to power after the elected President Tancredo Neves’ death shortly before taking the office.

The negative correlation becomes even clearer when analyzing the growth on GDP per capita, as Figure 3 shows below:

Figure 3 - Compound Annual Growth Rate of the GDP per capita during the last 5 presidential terms



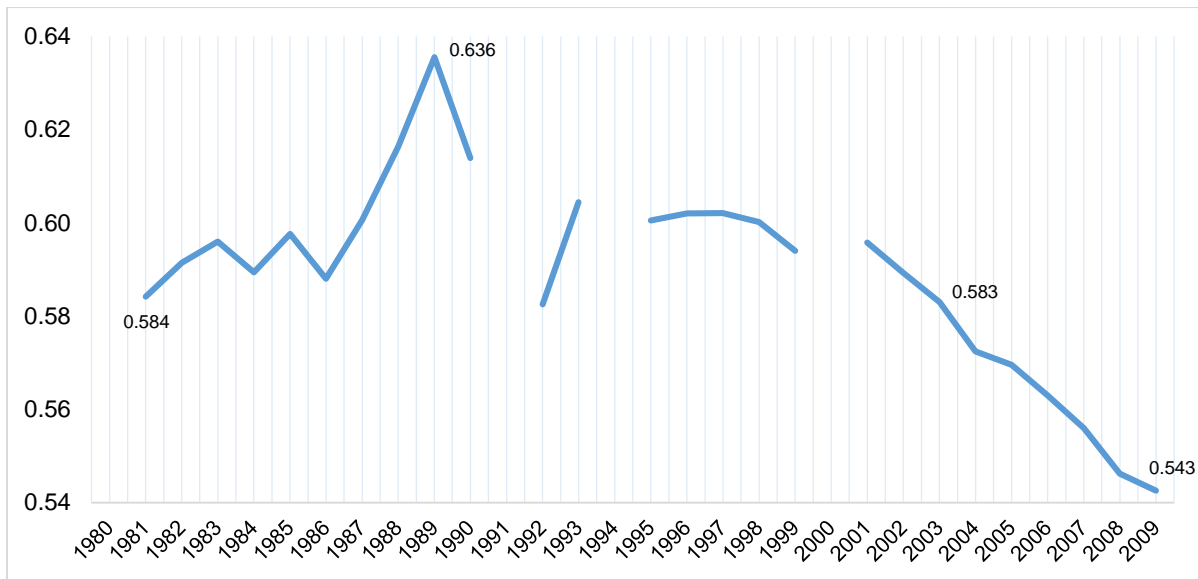
Source: See Figure 1

Again, Lula's term was, by far, the most successful on providing economic growth that have substantially increased the average wealth of the population while being at least three times bigger than FHC and at least two times bigger than any other President after Figueiredo. Table 3 when analyzed together with Table 2 leaves no doubt about the exceptionality of the period of interest for this study.

It must be noted, however, that the credits for the outstanding economic performance can hardly be attributed solely to Lula's administration. Some credit has to be given to the commodities' boom that have substantially influenced the Brazilian trade balance, producing consistent surpluses and ensuring the importance of agricultural performance on economic growth (Adler & Sosa, 2011; Adler & Magud, 2013). In other words, Brazil benefited from an exogenous shock.

However, despite the exogenous component of the economic growth, it is clear that Brazil presented a positive economic growth pattern during the period. Furthermore, other variables that capture social advances have also showed a promising trend such as the Gini index; that can be seen on Figure 4:

Figure 4 – Evolution of the Gini Index (1980-2009)



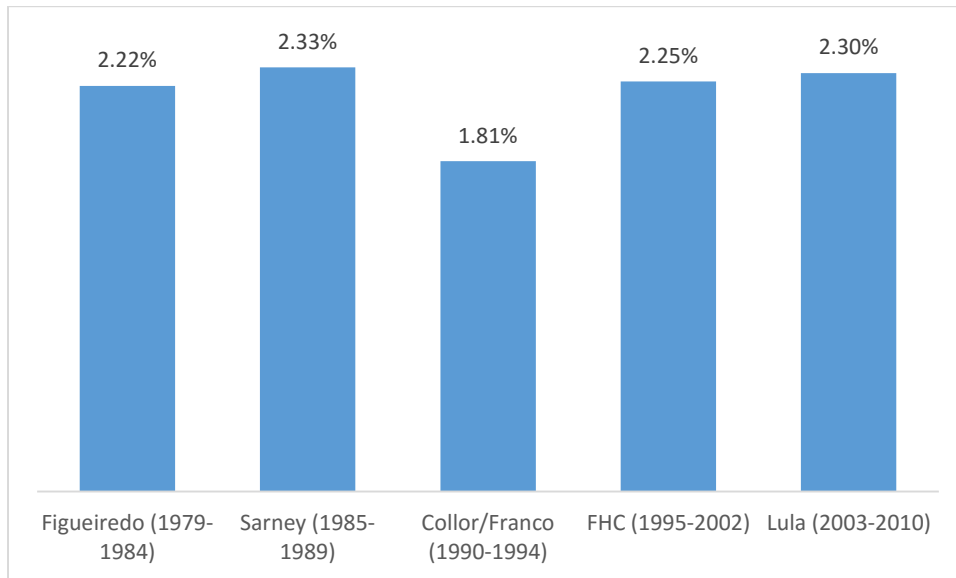
Source: See Figure 1

The Gini index in 2003 was 0.583. The surprise, however, is when it is verified that the index in 2003 was virtually the same from the index in 1981. The conclusion is that Brazil, in more than two decades, was unable to address its problems with inequality effectively. While following the same pattern as poverty, inequality only shows a consistent change on its trend during the 2000s. Even though this decrease is not exclusive on Lula's term as President, the trend was maintained during his years in power, constituting another important factor in Brazilian contemporary history.

Figure 4 is also from particular importance because through inequality reduction the effects of economic growth on poverty can be fostered. It is verified in the literature concerning the Brazilian case on Barreto (2005), Hoffmann (2005) and Marinho & Soares (2003) that redistributive policies are credited for enabling a better potential derived from economic growth. Therefore, clarifying its unprecedented reduction during Lula's term just add for the importance for this period when studying poverty dynamics in Brazil.

Besides inequality, other variables are also regarded in the literature as important poverty reducers. Namely human capital levels – measured especially through education – and unemployment rate. While the first variable aims to capture the effect that human capital have on ensuring a sustainable growth that can “trickle-down” faster to the poorest poor, the second captures the conventional wisdom that systematic economic growth leads to labor expansion. Figures 5 and 6 respectively represent these variables.

Figure 5 – Compound Annual Growth Rate of the average level of education for individuals with 25 years of age or older during the last 5 presidential terms

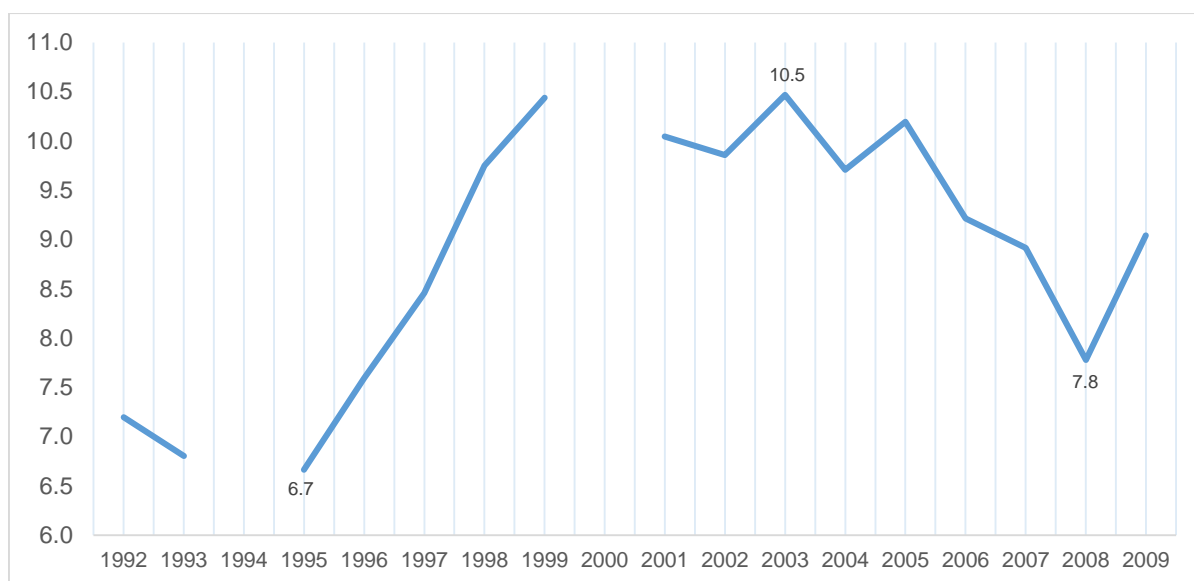


Source: See Figure 1

During Lula's term, even though educational levels were still increasing, it mostly followed a trend already observed in the previous presidential terms. It is worth to mention, however, that the human capital levels in Brazil remain low. Lula's term reached a disappointing historical peak of 7.2 years of average schooling for individuals older than 25 years of age, consisting roughly to an unfinished secondary school. At least, by comparing with Figueiredo's term (3.8 years of education on average), a substantial evolution can be noted but with big room for improvements.

Figure 6, as mentioned, aims to provide an overview through Brazilian unemployment rates. As it is possible to verify, there has been some volatility in the curve, but with a considerable decreasing trend for the period after 2003, reflecting somehow the effects of the sustained economic growth experienced through the period.

Figure 6 – Evolution of the Unemployment Rate in percentage terms (1992 – 2009)



Source: See Figure 1

With important variables concerning the socioeconomic development in Brazil being presented for the period of interest, interesting trends concerning poverty and its potential determinants could be verified. Brazil experienced a combination of economic growth, low unemployment, falling inequality, positive trend on human capital accumulation and, of course, poverty reduction. However, another aspect that draws the attention of this study concerns government expenditures.

Evidence from a number of studies was provided leading to the belief that government expenditures, when well targeted, can have significant effects in order to reduce poverty (Rocha 2005, 2006; Hoffmann 2005; Kageyama & Hoffmann 2006)<sup>9</sup>. In order to have an overview on this potential poverty modifier, Figure 7 containing the evolution of the State and Municipal Expenditures can be of help.

Unfortunately, the series available on the Institute of Applied Economic Research do not allow expanding this comparison through the early 1990s and 1980s without controversy. Since Brazil has experienced a hyperinflation period from 1992 to 1994 and has changed its currency multiple times during the 80s, any conversion would require a thorough discussion regarding deflation and conversion methods in order to provide a comparable series in the long-term<sup>10</sup>. However, from the period from 1995 and beyond, Brazil have adopted Real as its

<sup>9</sup> These are going to be further detailed on the section 4) Previous researches.

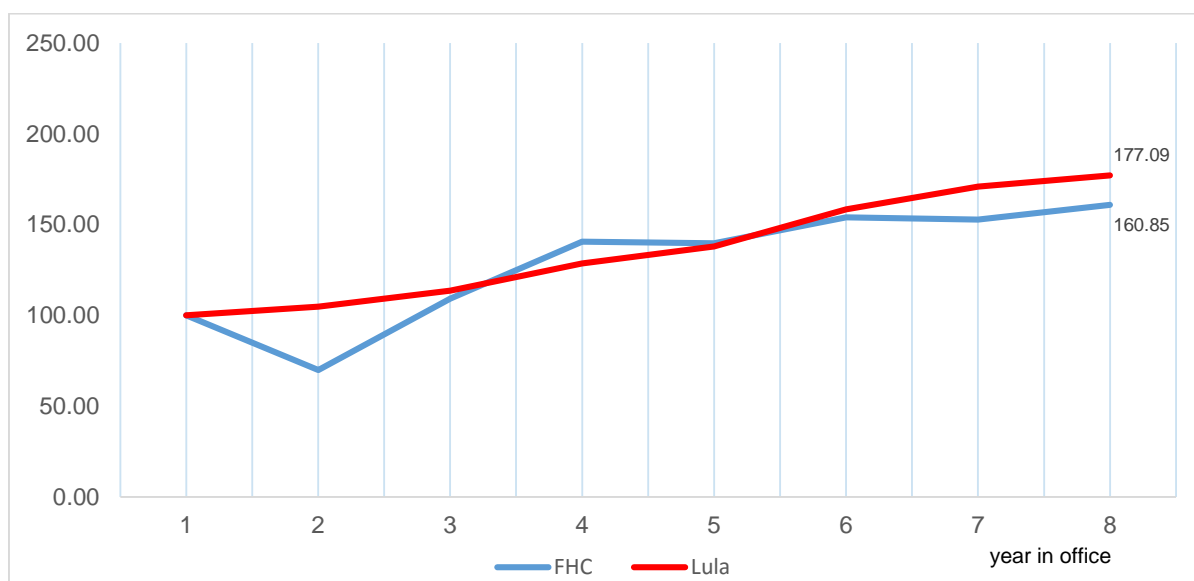
<sup>10</sup> Details about this debate are well presented by Courseil & Foguel (2002).

currency and the problems with hyperinflation were solved, which allows; at least, a comparison between FHC's and Lula's terms in the Presidency.

What has been defined as state and municipal expenditures in this section is the same that will be found on subsection 5.2.3. Details regarding the methodology are not going to be discussed here, however, in order to enhance the understanding of the following Figures, it is important to bear in mind that only expenditures concerning education and culture, health and sanitation and social assistance and social security that were accounted on state and municipal levels are being considered. For brevity, these expenses are going to be referred as SME.

It can be inferred from the analysis of Figure 7, that expenditures in state and municipal level increased at a higher rate during Lula's term when compared to FHC's term<sup>11</sup>. While these expenditures showed an average increase of 8.5% per year during Lula's, under FHC this increase was around 7% per year on average. This information, per se, does not allow stronger conclusions, after all, the economic growth under Lula was more intense, and therefore, it is expected from public spending to capture that increase in the general output.

Figure 7 – Evolution of aggregated SME for each President year in office (First year in office=100)



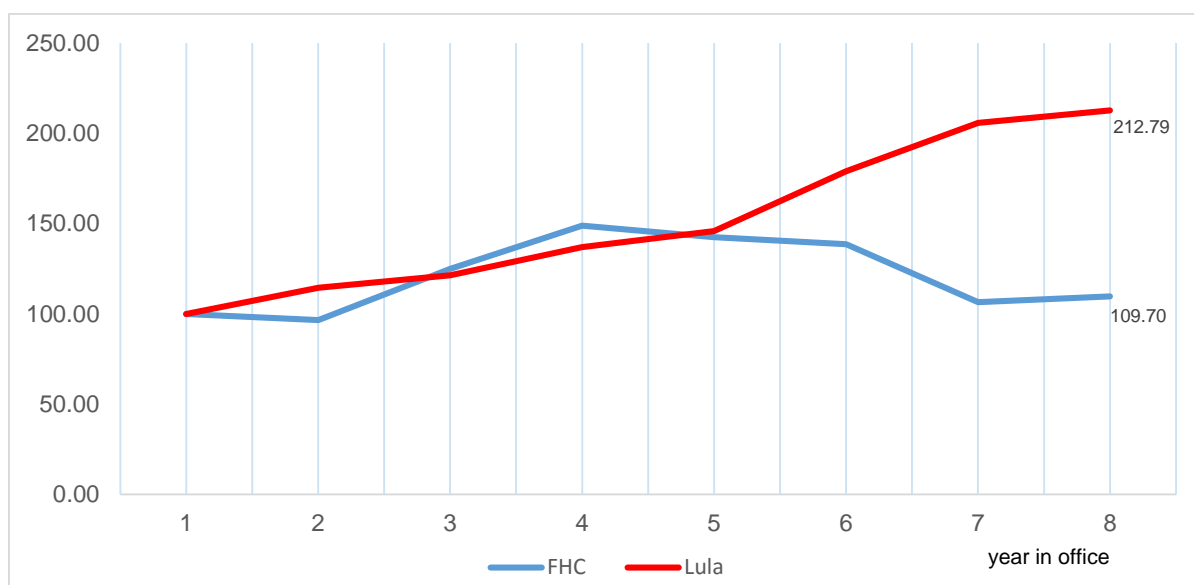
Source: Author's calculation from the State and Municipal Accounts/IBG<sup>12</sup>

<sup>11</sup> The Municipal Expenditures for the year of 1996 are not available on IPEA's database, causing a little distortion on the graphical analysis. However, the series is consistent for the following years and it is possible to observe on Figure 7 that the "regular" trajectory of public spending is retaken.

<sup>12</sup> The values that allowed this index can be found on Section 9.2 in the Appendix. All values are in Reais (R\$) of 1995.

However, when analyzing Figure 7 alongside Figure 8, it is possible to develop some insights. Even though the difference in the aggregated SME is not very sizable and does not allow further analysis, when we disaggregate the expenditures related to social security and social assistance, it is possible to observe that there has been a sizable difference in the composition of this expenditure between both presidential terms.

Figure 8 – State and Municipal expenditures on Social Security and Social Assistance for each President year in office. (First year in office=100)



Source: Author's calculation from State and Municipal Expenditure Accounts/IBGE<sup>13</sup>

Therefore, despite the similar evolution the general expenditure showed in both presidential terms, there is a clear bias towards Social Security and Social Assistance during Lula's term. It is interesting to note, however, that these expenditures are not directly controlled by the Federal office. That said, it is not possible to attribute the direct influence of the President in office for these expenditures. It could always be argued, though, that the main guidelines established by the Federal government can be partially adopted by the states and municipalities; especially if the Federal government succeeds in terms of popularity. It is not the aim of this study to establish transmission links between the Federal government and its lower entities, however, it would not be implausible to hypothesize that these trends are not random and follow a pre-established political agenda deriving from Federal guidelines.

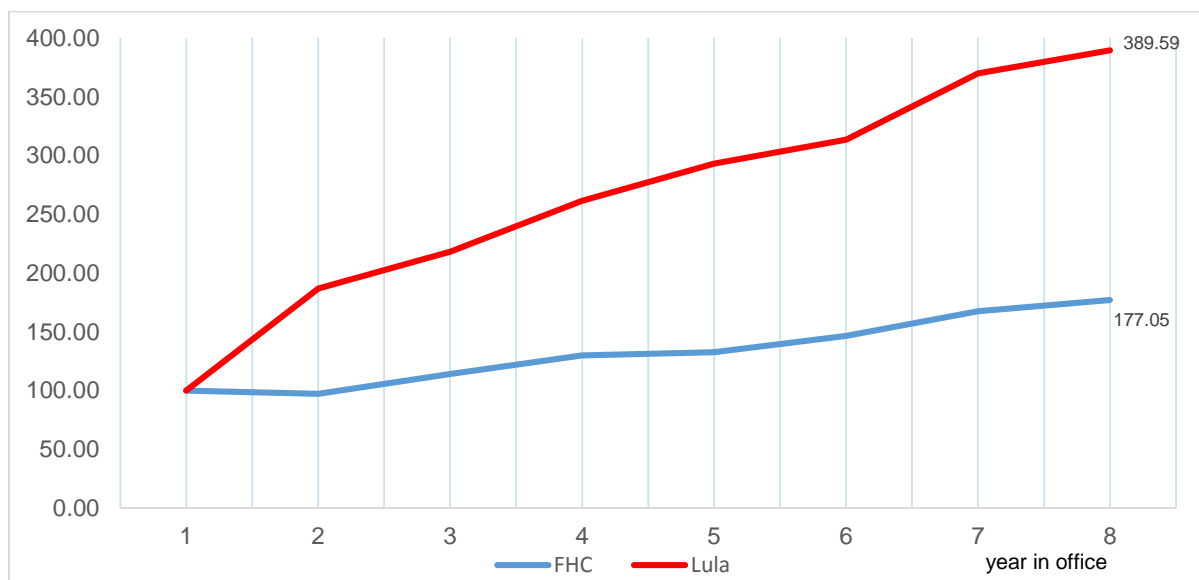
The brief discussion conducted in the last paragraph, however, does not have a place when analyzing Figure 9. Federal Expenditures on cash transfers are presented on the aforementioned Figure; therefore, they are more easily controlled by Federal guidelines and

<sup>13</sup> The values that allowed this index can be found on Section 9.2 in the Appendix. All values are in Reais (R\$) of 1995.



initiative. It is worth to remember that public spending is subject to Congress and Senate approval and cannot be expanded indefinitely following any populist behavior; however, Federal expenditures are subject only to the Federal agenda and can be less influenced by states and municipalities' interests. As Figure 9 allows us to perceive, the differences are blatant.

Figure 9 –Federal cash transfers for each President year in office (First year in office=100)



Source: Author's calculation from State and Municipal Expenditure Accounts/IBGE<sup>14</sup>

Similarly to Figure 7, a methodological discussion about how these numbers are organized and what is accounted on them will be further developed on subsection 5.2.3. However, for the understanding of Figure 9 it is important to note that three Federal programs are accounted on these expenditures, including Bolsa Família, the most famous between them. All of these programs consist in cash transfers to groups of interest, namely elderly, handicapped and the poor.

The sudden trend increase verified in the second year of Lula's presidency accounts for the creation on Bolsa Família. After this fact, the trend is stabilized but is clearly stronger than the trend observed in the former presidential term. If government expenditures are regarded as an important factor in the literature to fight poverty, this Figure provides a good case for the uniqueness of Lula's term since it is clear that there has been an unprecedented social expansion, making it an interesting period to be studied.

<sup>14</sup> The values that allowed this index can be found on Section 9.2 in the Appendix. All values are in Reais (R\$) of 1995.

This section ends after presenting the contextual reasons that make this period so important in Brazilian contemporary history. Moreover, the confluence of different factors and variables make it hard to point the main causes for poverty reduction solely by a descriptive and graphical analysis; therefore, a literature review is deemed necessary in order to explore the methods and the empirical evidence surrounding the subject.

#### 4) Previous Researches

With the development of more complex statistical tools, the study of poverty gained a new dimension and it became possible to understand its underlining causes and to develop policies that could target this issue more thoroughly.

One factor in which the discussion of poverty is based is the relationship between economic growth and poverty reduction. Conventional wisdom suggests that by expanding the real wages and the number of jobs, economic growth will have a poverty reducing effect. This line of thought is confirmed in the literature.

Anderson (1964), while investigating the relationship between economic growth and poverty reduction in the United States for the years 1947-1960, have provided evidence of a “trickle-down” effect. The “trickle-down” effect means that economic growth will primarily benefit individuals in the high-end of the income distribution; however, individuals in the lower-end of the distribution can also benefit from economic growth if this is consistent and prolonged enough. Interestingly, the author notes that the effects of economic growth are not linear throughout time or income distribution suggesting that, despite its importance, a decline on the rate of reduction of poverty deriving from economic growth is to be expected when analyzing the lowest-low end of the income distribution (p. 524).

Thornton et al (1978) later confirmed the results of the aforementioned study. The difference, however, lies on the impacts of economic growth on poverty. The authors indicate that “the contribution of economic growth has been overstated” (p.385) and suggest as a policy implication that “expanded programs directed specifically at poor families will be required if poverty is to be eliminated” (p. 394). It is important to note that Thornton and his associates are not denying the importance of economic growth, but instead they are questioning its poverty reducing effect and are opening the debate for new variables such as unemployment rates and government transfers.

Hirsch (1980), while following the same general framework in which economic growth matters, question the validity of Thornton et al (1978) findings while claiming that the previous models suffered from specification and identification problems. When estimating Thornton’s model with different dependent variables, the findings are remarkably different since on Hirsch’s model economic growth “acted to reduce significantly the incidence of poverty for all families, except those headed by females and elderly”. Furthermore, the author challenges the policy implications proposed by Thornton when suggesting that “the case for expanding transfers targeted directly to the poor rather than reliance on economic growth continues to be an open question” (p. 157).

Even though the aforementioned authors contribute to our understanding regarding the impacts of economic growth on poverty, it is important to note that growth was being measured on its aggregated form; in other words, there was no distinction between economic growths provided by different sectors. This specification is not wrong in theory, after all, the authors have found significant results and it would be hard to advocate in favor of spurious correlation. The problem, though, is not its correctness but instead, its completeness. By analyzing aggregated economic growth, the authors are bounded to an underlying assumption that the impacts of primary, secondary and tertiary sectors on poverty are the same.

By working with an aggregate specification for economic growth, models are unable to capture the “patterns of growth”. The idea of disaggregating this variable lies on the concept that there are certain types of growth that are more desirable for poverty reduction. Studies conducted through the 90s already incorporated this concept.

Ravaillon & Huppi (1991), for example, while studying the impacts of policy changes on the poor in Indonesia during the 1980s suggested that “the sectoral decomposition of the change in aggregate poverty indicates that gains to the rural sector were very important” (p. 80). With similar conclusions – but now for the Indian case – Ravaillon & Datt (1996) suggest that growth in “primary” and “tertiary” sectors (agriculture and services, respectively), reduced poverty in both urban and rural areas while the secondary sector (industry) did not have any significant impact.

Still concerning India, Ravaillon & Datt (2002) have further suggested that despite the importance of primary and tertiary economic growth on poverty reduction for the country, non-farm growth had its importance decreased in regions with lower levels of human capital and income distribution, highlighting the importance to acknowledge growth alongside other social indicators.

Gafar (1998) while studying the context of poverty in Guyana noted that “the empirical evidence suggests that economic growth and increases in per capita GDP are necessary to reduce inequality and poverty. But growth per se will not do the trick, it is the 'character' of growth (...) what matters” (p. 616). Adding to these findings, it was also suggested that policies focusing on “infrastructure, education and health” are indispensable to foster the poverty reducing effects of economic growth.

Findings focused on the importance of the “patterns of growth” can also be verified on Loayza & Raddatz (2006). In their study, a theoretical two-sector model was developed and later applied to cross-country empirical evidence. Their results suggest that the composition

of economic growth matters for poverty reduction and even go further by stating that the “growth’s sheer size does not appear to be a sufficient condition for profound poverty reduction” (p. 21). In fact, the authors believe that “the impact of growth on poverty reduction varies from sector to sector and that there is a systematic pattern to this variation” (p. 22).

Christiansen & Demery (2007) further corroborate to the aforementioned conclusions on their comprehensive study that focused on a sectoral decomposition of poverty change in Africa and concluded that “the contribution of a sector to poverty reduction depends on its participation effect and growth effect” (p. 77).

More recently, Ferreira et al (2009) while conducting a study regarding poverty dynamics in Brazil throughout the 80s and 90s have found “marked differences in the poverty reducing effect of growth across different sectors, with growth in the services sector being consistently more pro poor than either agriculture or industry” (p. 33). However, since this was a period of economic stagnation, their findings also suggest that the “largest sources of poverty reduction over this period (...) were driven by the substantial reduction in inflation rates and by the expansion in social security and social assistance spending by the Federal government” (p. 33).

The insights that the aforementioned works brought to poverty studies go beyond the simple acknowledgement that the “pattern of growth” is important. As it was briefly mentioned when referring to Ravallion & Datt (2002) and Gafar (1998), the importance of economic growth is also bounded to other socio-economic variables such as human capital levels and inequality indexes.

Ranis & Stewart (2002), for example, using data regarding several countries in Latin American and Caribbean explore the importance of socio-economic variables when studying poverty. The authors conclude that economic growth is a necessary but far from sufficient condition to foster poverty reduction. Nonetheless, the authors argue that “it is necessary to promote human development in order to create conditions for a virtuous cycle of economic growth that, in turn, will also foster human development”<sup>15</sup> (p. 23).

Even though the countries analyzed in Ranis and Stewart (2002) were Chile, Costa Rica, México, Nicaragua, Jamaica and Guyana, the conclusion could also apply for the Brazilian case if taken, for example, the study conducted by Menezes-Filho & Vasconcellos (2007). In their study, that aimed to shed more light into the poverty dynamics in Brazil and its interaction with socio-economic variables, it was evidenced that “the factors conducive to pro-poor growth

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<sup>15</sup> Freely translated from Spanish

are those that improve the level of income and decrease income inequality. Investments in human capital are the most important of these factors, as they tend to make growth more pro-poor and also increase the growth rate, increasing poverty reduction” (p. 241).

Still in the Brazilian case, there is an interesting debate around the importance of government transfers as a major policy when fighting poverty. As already suggested earlier in this section, Ferreira et al (2009) provides evidence leading the conclusion that government expenditures on social security and social assistance can play a major role on decreasing poverty even during economic stagnation/crisis. Other scholars share this perspective.

Kageyama & Hoffmann (2006) suggest that direct transfers of cash for individuals in the lowest level of the income distribution could “radically alter their condition”<sup>16</sup>. The authors, however, are not able to say whether the cash transfers reduced poverty or not, only implying that this is an alternative to reduce poverty among the poorest.

On the other hand, Rocha (2006), whose study aimed to understand poverty dynamics in Brazil between 2003 and 2004 using data from PNAD, presents stronger results. Her findings suggest that the biggest driver for poverty reduction was related to the “expansion of labor” among poor individuals and to “the real increase in the minimum wage and expanding coverage of social protection (...) which resulted in greater improvement in income distribution (...) also allowing the fall in inequality”<sup>17</sup> among the poorest ones (p. 265). The same understanding comes from Hoffmann (2006) where it is stated that the cash transfers were “fundamental to reduce poverty from 2002 to 2004”<sup>18</sup> (p. 79) despite the fact that poverty had a small reduction within the period. It is argued, therefore, that poverty would even have increased if it were not for the cash transfers targeted to poor people. These results are also in line with Rocha (2003).

Therefore, despite the importance of including the government’s participation on poverty dynamics, scholars still struggle understanding the magnitude of these programs while recognizing its relevance. However, the perception that cash transfers have a significant effect on poverty reduction – even if it is a marginal one – is not unanimous.

Marinho et al (2011) while exploring the poverty dynamics and the impact of cash transfers in Brazil from the period 2000 until 2008 through dynamic panel data models found that “(it) did not affect or did not contribute for the decrease of the poverty level on Brazilian states” (p.

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<sup>16</sup> Freely translated from Portuguese

<sup>17</sup> Freely translated from Portuguese

<sup>18</sup> Freely translated from Portuguese

283). It is argued that the creation of poverty traps alongside inefficiency on the distribution of the benefit are possible causes behind these findings. Schwartzman (2005, 2006) have already expressed concerns regarding the Brazilian Federal government's ability to enforce a good targeting of individuals alongside its capacity to track the program through time concluding that "these policies are not properly grounded in search, and are based on wrong assumptions" (p. 1, 2005).

Moreover, it should be pointed that the small value given to the beneficiaries might not be enough to leverage ones' income enough to leave the poverty threshold. Here it is worth to mention that programs such Bolsa Família, even though highly publicized as a bold attempt to fight poverty, represented around 0.5% of the Federal Budget in 2013, which indicates that in order to affect overall poverty in a significant way, the program should be expanded or have its average ticket increased. Considering that more than 13 million families were beneficiaries of the program in 2013 – representing roughly 25% of the Brazilian population – there is definitely not a problem with coverage, which leaves either the benefit or its efficiency as potential explanations for any given insignificant effect found on the literature.

In closing, it was possible to observe in the present section how poverty studies grew in importance and complexity throughout time. A simple analysis between poverty and aggregate economic growth is not sufficient anymore to enhance our comprehension on the subject. Studies, nowadays, are built considering not only a multidimensional and a multifactorial framework, but also rely on robust statistical tools in order to properly address questions surrounding poverty dynamics and its vast determinant ranging from sectoral economic growth to public spending.

That said, it is important to present the methodological framework that will be used in this study. In the next section, information regarding the databases, variables and methodology are going to be discussed while highlighting its descriptive statistics, adopted treatments and specification choices.

## 5) Methodological Aspects

This section is divided in three subsections. The first – Data - aims to clarify all the aspects surrounding the databases of choice while underscoring its representativeness and robustness. The second subsection – Variables and Descriptive Statistics - is longer and describes all the variables of interest for this study. Nonetheless, all the treatments applied to the variables are discussed within the subsection. The last subsection – Methods - is more technical and discuss subjects concerning the methods adopted in this study in order to specify a theoretical model that can be further estimated.

### 5.1) Data

All the data sources used in this study come from two different databases. The Brazilian Bureau of Statistics (IBGE) and the Institute of Applied Economic Research (IPEA).

The IBGE, through its Regional Account Statistics and the National Household Survey, provided figures related to economic growth and poverty respectively. On the other hand, IPEA, through its State and Municipal Expenditure Accounts, provided data on government expenditures at state and municipal levels. The Institute also provides data on conditional cash transfer programs maintained by the Federal government disaggregated by state.

Variables such as Gini index, unemployment rate, and educational level were also taken from IPEA's database. It is worth mentioning, though, that these variables were derived from the National Household Survey<sup>19</sup>, being IPEA the responsible to compute and organize the figures, but not to collect the data, which is IBGE function. All aforementioned variables are disaggregated by state. Another variable available on the IPEA's database is the yearly inflation rate; however, this was not derived from the National Household Survey, as expected.

The years of interest of this study were from 2003 to 2010. The aim is to capture the poverty dynamics during Lula da Silva's term as the Brazilian President. Unfortunately, this study was not able to collect data for these specific years since the Census was held in 2010, consequently, the Brazilian Household Survey – source of the cornerstone variable in this study, which is poverty - was not conducted; therefore, this study is bounded from the years 2003 to 2009. However, in order to keep an 8 year-long analysis, data regarding the Household Survey of 2002 was added to this study. It represents the last year of Fernando Henrique Cardoso's term as the President of Brazil and can be understood as the conditions in which Lula has gotten into power.

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<sup>19</sup> Also known by its portuguese acronym, PNAD.



Considering that all the data is disaggregated by state and is available for every year between 2002 to 2009, it is possible to build a strongly balanced panel consisting of 27 Brazilian states throughout 8 years that result in 216 observations in total. The results of this study will be drawn from this database thus, any subsequent analysis as well.

As noted, several variables are derived directly or indirectly from PNAD. However, since this is a survey-based dataset, some questions regarding its coverage, quality, sampling and suitability might arise. Moreover, the importance that this data source has to this study makes it indispensable a detailed critical analysis to ensure a good and calibrated data capable of providing significant, unbiased and representative results.

The Brazilian Bureau of Statistics (IBGE), with the only exception in the years when the Census is held, yearly conducts the PNAD. The survey collects annual information on demographic and socioeconomic characteristics of the population. Variables like age, education, gender and income among others are collected at both the individual level as well as the household level. In total, more than 300 variables are presented on samples including more than 300,000 individuals.

A thorough description of the PNAD sampling process can be found in Silva et al (2002) who demonstrates – through PNAD 1998 – that not considering strategies of clustering, weighting or stratification during the sampling process could impair the representativeness of the data thus, generating biased estimates and consequently interpretation problems.

In order to avoid such problems, IBGE already provides a weighted database. These weights, aim to correct for any biases on the sampling process and to ensure the representativeness of the database through a robust methodology that takes into consideration fertility, mortality and migration patterns of the Brazilian population when building projections that can be further used to calibrate the survey output. For a detailed explanation on the weighting process, IBGE (2013) is recommended.

Despite the aforementioned adjustments, authors such as Ferreira et al (2003) and Soares et al (2006) still criticize some aspects of the survey. While the first are skeptical concerning PNAD's representativeness in northern rural areas, the latter suggests that the questionnaire from which the inputs are drawn should be improved in order to better capture government transfers on individual's income. Despite the criticism, both authors consider PNAD on their respective frameworks while trying to make corrections within their own methods in order to minimize specific limitations of the dataset. The National Household Survey is, by far, the most comprehensive dataset publicly available that allows empirical studies of the Brazilian socio-

economic reality. This comprehensiveness allied with its possible explanatory power when properly explored puts PNAD as a reliable data source and imperative for the development of this study.

While the general aspects of the survey have been covered, it is possible to proceed with the analysis of the variables of interest for this study. As already mentioned earlier in the subsection, the descriptive statistics will be presented alongside the presented of each variable.

## 5.2) Variables and descriptive statistics

The variables of this study can be divided in four groups: poverty measures, economic growth, government expenditures and auxiliary covariates. These four groups are going to be detailed within this subsection while highlighting its descriptive statistics.

### 5.2.1) Poverty measures

The definition of a robust and representative poverty line is one of the cornerstones on poverty studies and permeates the whole subject alongside its possible measurements. However, the need to compute this index generates two immediate problems: accounting the poor and setting a poverty threshold.

To shed some light into the first immediate problem – accounting the poor - the framework developed by Foster et al (1984), could be used as a starting point. This measure for poverty is also known in the literature as the Foster-Greer-Thorbecke class estimator and is built as it follows:

$$FGT_{\alpha} = \frac{1}{N} \sum_{i=1}^H \left( \frac{z-y_i}{z} \right)^{\alpha} \quad (1)$$

Where:

“N” is the number of observations; “z” is the poverty threshold; “H” is the number of individuals with income below “z”; “y” is the income of each observation “i” and “a” is a weighting measure.

By analyzing (1), it is easy to note that when  $\alpha=0$ , the poverty measurement collapses to  $H/N$ , which is regarded in the literature as the Headcount Index. When  $\alpha=1$ , the measurement is called the Poverty Gap.

For the purposes of this study, the Headcount Index is going to be used. However, as it can be noted, this is an absolute way of measuring poverty since it accounts purely if a given individual is above or below a previously defined poverty threshold. Naturally, some criticism

might arise from this choice since an absolute measure might be regarded as an incomplete way of accounting for poverty.

In fact, poverty as a relative – rather than an absolute – concept has received a lot of attention in the literature surrounding the subject. Moreover, this discussion was presented even in the foundation of classic economics when Adam Smith (1776) poses that “necessaries” were more than just the minimum required for subsistence, but also what society regarded as a basic need:

*“By necessaries, I understand not only the commodities which are indispensably necessary for the support of life, but what ever the custom of the country renders it indecent for creditable people, even of the lower order, to be without.” (p. 676).*

Other authors such as Karl Marx (1887) argued that “(...) in a given country (...) the average quantity of the means of subsistence necessary for the laborer is practically known” (p. 121), also implying, as Adam Smith, that the measure of poverty is conditional to the collective perception.

Orshansky (1969) on his attempts to measure poverty in the United States also highlight that poverty “is a value judgement” and “lies in the eyes of the holder” (p. 244). Sen (1976), despite arguing against a purely relative perspective – he cites famine as a way of identifying poverty regardless any collective standard thus, with an absolute component -, perceived a purely absolute measure as the Headcount Index as “very crude” (p. 219).

In the light of the aforementioned literature, it seems contradictory to use the Headcount Index. However, even its critics have come to recognize its importance as Sen (1976) does when citing a collection of studies published between 1970-1971 that explored the poverty dynamics in India and have generated profound debates on the issue (p. 220). Nonetheless, this index is still widely used in contemporary literature as it is possible to verify not just for the Indian case on Ravallion & Datt (1996, 1998, 2002) but also for other developing countries on Ferreira et al (2003, 2008, 2009), Aryeetey & McKay (2007), Christiansen & Demery (2007) and Ravallion (2009), just to cite some well-renowned studies.

The use of an index that is widely found on the literature – contemporary or not – allows the study to be comparable in a more direct way as well as to analyze long-term trends and evolutionary aspects concerning the subject, therefore, it is also from methodological importance. Nonetheless, the Headcount Index can be estimated in a way that relative poverty is considered thus, minimizing the problems of purely absolute measurements. One way of

doing so is by correcting consumption data and calculating class-specific deflators, allowing heterogeneous populations to be jointly analyzed. With that in mind, it is possible to address the second problem underlying poverty measurements: setting a threshold.

It is important to define a constant living standard across sectors and regions over the period of analysis so poverty becomes comparable. A widely adopted method is the estimation of the income level necessary to acquire a basket of goods capable of providing a minimum food-energy intake. A prompt literature analysis reveals that estimations for both the caloric level as well as the cost of the food basket vary considerably across countries and sectors with no clear benchmark. However, most of the studies follow the WHO/FAO recommendations on caloric intake to a certain extent. Ferreira et al (2003), for example, uses WHO/FAO as a benchmark to estimate the cost of a food basket that provides 2288 calories intake per day when defining a poverty threshold for the Brazilian case. In their study, data regarding consumption patterns was considered in order to assess the cost of the aforementioned food basket in different regions of the country. After deflating the series geographically and temporally, the results were applied on poverty measurements.

This study will follow the same structure. It will consider the same caloric line of 2288 calories per day and will deflate the each Household Survey geographically according to Ferreira et al (2003) regional price index estimations<sup>20</sup>. By doing so, it is possible to compare incomes within each Household Survey. However, in order to also make the incomes per capita to be comparable across the years, each Household Survey was deflated temporally through the Consumer Price Index (IPCA) considering the baseline as Reais (R\$) of 2003. The proposed food basket was estimated to represent a monthly income of R\$ 106.41 per capita in any given household.

From that point, all individuals living in households with income per capita below the 106.41 reais threshold are accounted as poor. The headcount index is obtained following equation (1). It is important to note that only households with non-declared income were excluded from the analysis

Despite the fact that this methodology seeks to generate a robust poverty index, there are evidences that poverty dynamics are extremely sensitive to the chosen poverty index and threshold. Ravallion & Sen (1996) demonstrate for the case of Bangladesh that even when

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<sup>20</sup> Ferreira et al (2003) estimates geographic deflators based on the Living Standards Survey (PPV, in Portuguese) of 1996. In this survey, consumption patterns are analyzed across different Brazilian regions and the geographic deflator is generated through the comparison of a specific consumption pattern with the weighted average consumption pattern. Ferreira et al (2003) have chosen the metropolitan region of São Paulo as the “star” region; therefore, other regions are deflated according to São Paulo standards.

poverty estimators were taken from the same survey, they could still present some “worrying discrepancies” to the point that “past studies have come to different conclusions about the directions of change in poverty over time” (p. 785). These findings are in line with Kakwani (1993) on his study to test statistical inference in poverty measurement, concluding that “ (...) empirical results suggest that observed differences in values of poverty measures may lead to misleading conclusions without the statistical tests” (p. 638).

Therefore, in order to bring more robustness to any future finding, this study will also consider a second poverty measure that is available on the Institute of Applied Economic Research (IPEA) database and provides the number of people in households with per capita income below the poverty line. The poverty line was defined through “an estimate of the value of a basket of food with the least amount of calories needed to adequately supply a person, based on FAO and WHO recommendations”<sup>21</sup>. The estimated values are deflated geographically according to 24 different regions of the country and are calculated from the responses from the National Household Survey. Even though not available in the methodological annex of the series, it came to the knowledge of this study after questioning IPEA that the “caloric threshold” was set on 2100 calories per day. With the two measures computed, it is possible to note some differences on measurement concerning the differences in thresholds on Table 1.

*Table 1 - Headcount Index (%)*

Year	IPEA/PNAD	Author's
2002	40.26	33.66
2003	41.24	33.12
2004	39.49	32.19
2005	36.52	29.95
2006	31.87	25.60
2007	30.28	23.60
2008	26.86	20.29
2009	25.57	18.93

Source: Author's calculation from PNAD

Due to its lower caloric threshold, IPEA's headcount index is systematically higher than the index calculated by the present author. Despite these differences, the trend is the same, with consistent reduction year over year. Another difference between the indexes is the deflator. While the present author deflated the series geographically according to Ferreira et al (2003) regional deflator index – that, in turn, was derived from the Survey of Living Standards from

<sup>21</sup> Freely translated from portuguese. Description available in <http://www.ipeadata.gov.br/> in the comments section of the “Número de indivíduos pobres - Linha de Pobreza Baseada em Necessidades Calóricas” series.

1996/1997 – IPEA's series were geographically deflated according to Household Budget Survey (POF).

Before closing this section, I would like to underscore that poverty is being measured solely by income in this study. By doing so, an unexplored field is left open since income does not fully capture wealth. It is possible to illustrate this situation in a household where the income per capita is zero though the individuals living in the household can still suffice their basic needs due to accumulated wealth; therefore, are maintained above the poverty line based on past incomes, inheritance or any favorable initial allocation. This situation could apply, for example, to highly skilled but unemployed professionals or even to individuals who are unemployed but do not actively seek to join the labor force. Some studies have discussed this subject more thoroughly such as Barros et al (2003) while proposing an index that accounts for an individual HDI measurement. Following the same concern regarding the multidimensionality of poverty, Kageyama & Hoffmann (2006) adopted an index that considers income alongside non-monetary measurements such as the presence of a bathroom inside the house, piped water and electricity.

Interestingly, Deutsch & Silber (2005) attempted to compare the accuracy of alternative monetary and non-monetary poverty measurements using the Israeli 1995 census and suggested that multidimensional indexes are “not very different from the one that is observed when poverty measurement is based only on the income or the total expenditures of the household” (p. 145).

In the light of that discussion, this study recognizes the multidimensionality of poverty's concept. However, the adoption of an index to the detriment of others is necessary in order to set boundaries in which this study will be conducted. The Headcount index was chosen in this study and any results deriving from this choice must be interpreted carefully once the limitations associated to this decision are acknowledged.

In closing, this subsection aimed not just to clarify the choice for the Headcount index in the present study, but also to deepen the discussion on poverty measurements underscoring its strengths and weaknesses. For the next subsection, other variables of interest are going to be presented following a methodological and theoretical discussion when appropriate. By doing so, this section can fulfill its goal on bringing clarity and transparency for the choices made in this study.

### 5.2.2) Economic Growth

Variables regarding economic growth were taken the Regional Account Statistics that is maintained by IBGE.

The data is found disaggregated per state and per sector. The sectors, however, are represented by fifteen broad categories. In this study, similarly to Ferreira et al (2009), a breakdown between agriculture, industrial and services sector is what is being pursued, therefore, it is necessary to group these sectors accordingly. The categories are presented as follows:

- 1- Agriculture, livestock production, extractive agriculture and forestry;
- 2- Mining Industry;
- 3- Manufacturing Industry;
- 4- Construction Industry;
- 5- Electricity, gas and water provider industries;
- 6- Commerce;
- 7- Transport
- 8- Communications;
- 9- Financial Services;
- 10- Real State institutions;
- 11- Public Administration
- 12- Collective, social and individual services not provided by public administration;
- 13- Education and Health;
- 14- Lodging and Food;
- 15- Domestic Services.

While category 1 represents the Agricultural sector, categories 2 to 5 were grouped together as to represent the Industry sector. The remaining categories (6 to 15) were all designated as part of the Service sector.

It is important to note that all these categories are presented in their nominal values; therefore, they must be deflated temporally. There is some debate around the best way to deflate a GDP series for the Brazilian case; the Brazilian Bureau of Statistics, for example, recommends an official measure of GDP deflator available on their database. However, the recommendation is mostly due to the big structural shocks Brazil had on its economy during the 90's - especially between 1993 and 1995 – when a period of hyperinflation was experienced. An elucidative discussion regarding the use of different indexes can be found in Ferreira et al (2009).

Since this study does not aim to reach the time series as back as the 90's, any noise or distortion that the Consumer Price Index might contain due to structural shocks will not apply for this dataset, therefore, all the GDP series were temporally deflated according to the Consumer Price Index (IPCA) being the base unit Reais (R\$) of 2003. As the table below shows, we can note a consistent economic growth in the aggregated GDP.

*Table 2 – Yearly Brazilian GDP disaggregated by sector in billions (R\$ of 2003)*

Year	Agriculture	Industry	Services	Total
2002	93.31	371.46	913.26	1,378.03
2003	108.62	409.50	952.49	1,470.61
2004	107.06	466.33	975.18	1,548.57
2005	92.47	474.22	1,053.28	1,619.98
2006	95.12	498.71	1,140.64	1,734.47
2007	103.87	519.32	1,244.11	1,867.30
2008	117.62	554.88	1,316.22	1,988.72
2009	116.17	553.90	1,394.51	2,064.57

Source: Author's calculations from the Regional Account Statistics/IBGE

The Service sector is clearly the most important component of the Brazilian GDP. Nonetheless, the aforementioned presented the biggest growth the period, increasing 53% from 2002-2009. While the industry sector have also provided a consistent upward trend through the period, its importance to the aggregated GDP is more modest. Agriculture is the sector that presented the most inconsistent trend, though it had accumulated 24% of growth during the period. The volatility for this specific sector is expected once Brazil is a strong player in the global food market; therefore, is more susceptible to shocks from commodities' prices.

Sectoral composition also reveal some variation. Due to the faster pace in which the Service sector was growing in Brazil, it is natural that its participation was increased in comparison to the other two sectors, as it can be seen on Table 3 below.

*Table 3 – Sectoral composition of the GDP (%)*

Year	Agriculture	Industry	Services
2002	11.06	23.13	65.81
2003	12.07	23.41	64.52
2004	11.22	25.03	63.75
2005	9.92	24.64	65.45
2006	9.21	24.35	66.44
2007	9.21	23.72	67.07
2008	9.94	23.73	66.33
2009	9.40	22.70	67.90

Source: see table 2



In closing, the tertiary sector is clearly presented as the growth escalator in Brazilian economy. While the other sectors are far from negligible, Services retained its prominent role and increased its participation on the economic output. The verified differences through Tables 2 and 3 also help providing evidence that economic growth should be analyzed on its disaggregated form given the different magnitudes represented by each sector. That said, it could be anticipated that the “patterns of growth” will be a core concept on the present study’s framework.

In the next subsection Government Expenditures disaggregated by federative entity will be explored while following a similar analysis from the previous and present subsection.

### 5.2.3) Government expenditures

Provided by Institute of Applied Economic Research, the State and Municipal Expenditure Accounts provide information regarding municipal, state and federal level expenditures disaggregated by type.

For the present analysis, the government expenditures were classified in three different categories, being the first the “State and Municipal level Expenditures” (SME, for brevity) that comprises the expenditures of municipalities and states regarding health and sanitation, education and culture and social security.

The second category is defined as “Capital Transfers” (CT) and accounts for all investments, inversions and capital transfers made by municipalities and states concerning infrastructure.

The last category is the “Federal Transfers” (FT), where all the Federal expenditures concerning social security and social assistance are accounted. Unfortunately, the availability of these figures within IPEA is just for the month of December of each year. For the purposes of this study, however, this is not going to be a problem since a model specification relying on first-differences will be used<sup>22</sup>. This category comprises three main federal social programs:

- *Continued Social Assistance Benefit (BPC, in Portuguese)*: The BPC is a monthly transfer of a minimum wage for any disabled or elderly (65 or older) people who have a per capita income of less than 1/4 of the minimum salary. By 2009, 3.1 million of individuals benefited from the program, representing 1.65% of the Brazilian population.

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<sup>22</sup> The specification relying on first-differences aim to capture the variation of the variable across time rather than its sheer size. Since this dataset allows a comparison year over year at the same period, it is possible to capture a variation throughout time.

- *The Lifelong Monthly Income (RMV, in Portuguese)*: Established in 1974, is a monthly transfer of a minimum wage for elderly or disabled people who has at least 12 months of social security contributions. Since 1996, the Continued Social Assistance Benefit (BPC), which is independent of any contribution, has gradually replaced the RMV. However, transfers to people who were already beneficiaries before 1996 are still recorded as such. Since it is a benefit that is currently being replaced by the BPC, the number of individuals that are still registered as beneficiaries is considerably smaller than the other Federal programs – roughly 322,000 by 2009 – and represents solely 0.17% of the Brazilian population by the end of the period of interest.
- *Bolsa Família (BF)*: is a conditional cash transfer program focused on poor families. It has been established in 2004. The benefit varies according to the household income per capita and the number of children alongside their age. The fulfillment conditions such as school attendance and vaccination for the kids are necessary in order to be granted the benefit. As already briefly discussed on section 2.2, this is a social program that aims massive coverage. By 2009, the number of families that were registered as beneficiaries surpassed 11 million. In number of individuals, this represents more than 47 million citizens, roughly 25% of the total population.<sup>23</sup>

Following the same standard of the data provided by the State and Municipal Expenditure Accounts, these categories are presented in their nominal values and were deflated temporally using the IPCA index. The base unit, naturally, is the same throughout all the dataset (R\$ of 2003). Once the series were deflated, we can observe a consistent increase in government expenditure at all levels, as Table 4 shows:

*Table 4 – Disaggregated Government Expenditures in billions (R\$ of 2003)*

Year	SME	CT	FT
2002	149.64	9.59	0.50
2003	151.21	9.12	0.56
2004	158.56	9.41	1.04
2005	171.66	9.89	1.22
2006	194.44	11.92	1.46
2007	208.45	11.59	1.64
2008	239.54	13.97	1.75
2009	258.31	14.20	2.06

Source: Author's calculation from the State and Municipal Expenditure Accounts/IBGE

<sup>23</sup> Soares et al (2009) presents a thorough discussion regarding the BF's size and accuracy.

It was already presented in subsection 5.2.2 that Brazilian's economic activity have consistently grown during 2002 to 2009, therefore, it is natural that the same phenomena is verified on government expenditures, which usually corresponds to a fixed proportion of the GDP. However, it is important to note the sudden increase on FT after 2004 representing the Bolsa Família program. Despite this increase, the FT is still considerably lower when compared to CT and SME.

In the next subsection, variables concerning human capital, unemployment and inequality are going to be presented alongside the inflation index.

#### 5.2.4) Auxiliary Covariates

This subsection aims to present all the non-monetary covariates in order to capture effects of human capital, unemployment, inequality and inflation on poverty.

Human capital is going to be represented by the average years of education for the population with 25 years of age or more; meanwhile, inequality is going to be captured through the Gini index. Inflation and unemployment are going to be represented by its respective rates. All the variables were extracted from the IPEA database; however, as it was already commented in subsection 5.1, IPEA calculates and organizes the data on its database even though the collection is made from IBGE through the PNAD.

As Table 5 shows, unemployment rates have reached lowest rate in 2008, despite some volatility. Average educational level shows an upwards trend while the Gini index demonstrates that inequality is decreasing considerable throughout the period. The inflation rate, even though above the upper inflation target set by the Brazilian Central Bank in the years of 2002, 2003 and 2004 have maintained a downward trajectory and from 2004 and beyond, consistently staying between the limit rates (from 2.5% to 6.5%), reaching its record low on 2006.

*Table 5 – Alternative Covariates over time*

Year	Unemp. (years)	Educ. (years)	CPI (%)	GINI Index
2002	9.9	6.10	12.53	0.589
2003	10.5	6.30	9.30	0.583
2004	9.7	6.40	7.60	0.572
2005	10.2	6.50	5.69	0.570
2006	9.2	6.70	3.14	0.563
2007	8.9	6.90	4.46	0.556
2008	7.8	7.00	5.90	0.546
2009	9.0	7.20	4.31	0.543

Source: Institute of Applied Economic Research (IPEA)

Since all the variables to be used in this study were presented through the previous subsections. The next step in this study is to define a model specification that considers poverty dynamics over time and space during the period of interest.

### 5.3) Methods

As already discussed in previous subsections, the dataset consists in a panel of 27 states through 8 years, totalizing 216 observations.

Since this study is interested in evaluate spatial and temporal dynamics of poverty in Brazil, the estimation of a model that is able to capture these dimensions is needed. Therefore, let us consider the following specification:

$$\ln P_{it} = \beta_i^A \ln GDP_{it}^A + \beta_i^I \ln GDP_{it}^I + \beta_i^S \ln GDP_{it}^S + \gamma_i t + \mu_i + \varepsilon_{it} \quad (2)$$

(i=1,2,..., N; t=1,2,...,N)

Where P represents a given poverty measure; GDP accounts for the economic growth through the Gross Domestic Product; the superscripts A, I and S represents the agricultural, industrial and service sectors respectively; the subscript *i* represents the spatial dimension captured by each state and *t* is the time dimension measured in years. The error term is represented by  $\mu$  and  $\varepsilon$ , being the first the time-invariant component and the latter the time-variant one. Finally,  $\gamma$  denotes a time-trend.

Even though the equation (2) allows an estimation through ordinary least squares (OLS) with fixed effects, if it is taken as is, it might be perceived as a poor model. As Ravallion & Chen (1997) have already suggested, a more appropriate model to capture the effects of economic growth on poverty can be estimated through the growth in incomes rather than just the growth in output. Considering that Brazil is an extremely unequal country, it is expected that sheer growth rates might not translate into poverty reduction due to the asymmetric income distribution. In that case, an estimation that takes into consideration the GDP per capita would be a more suitable premise for this study. Once this change is made; the model can be rewritten as:

$$\ln P_{it} = \beta_i^A \ln GDP'_{it}^A + \beta_i^I \ln GDP'_{it}^I + \beta_i^S \ln GDP'_{it}^S + \gamma_i t + \mu_i + \varepsilon_{it} \quad (3)$$

(i=1,2,..., N; t=1,2,...,N)

Where GDP' represents the GDP per capita for any given sector, therefore, mean income is going to be accounted rather than absolute economic growth.

Equation (3), similarly to (2), can be estimated though OLS (Ordinary Least Squares) with fixed effects. The strategy behind this technique is to eliminate all time-invariant variables that are not accounted in the model thus, reducing a potential source of omitted variables bias.<sup>24</sup>

Similarly to fixed effects, first-differences also address the same issue. However, instead of demeaning the equation, first-differences are computed while taking advantage of a longitudinal dataset. Through equation (4), this procedure can be demonstrated:

$$Y_{it} = \alpha + X_{it}\beta + \mu_i + \varepsilon_{it} \quad (4)$$

Taking first-differences from (4):

$$Y_{it-1} = \alpha + X_{it-1}\beta + \mu_i + \varepsilon_{it-1} \quad (5)$$

Then, by subtracting (5) from (4):

$$Y_{it} - Y_{it-1} = X_{it}\beta + \mu_i + \varepsilon_{it} - X_{it-1}\beta - \mu_i - \varepsilon_{it-1}$$

Note that  $\mu_i$  is time invariant, therefore, its first difference is equal to the level. By rearranging the terms:

$$Y_{it} - Y_{it-1} = (X_{it} - X_{it-1})\beta + (\varepsilon_{it} - \varepsilon_{it-1}) \quad (6)$$

Therefore, first-differences also eliminate the time-invariant component from the equation, acting similarly to the model with fixed effects. It is worth mentioning that for  $T=2$ , both procedures will provide the exact same results. For  $T>2$ , the results are not going to be the exact same due to differences in the way the error term is computed between the two methods.

The choice between the two specifications mostly follow practical terms than formal ones. Studies adopting each of the methods can be found in the literature. For this study, however, the specification with first-differences was chosen. Given this choice, equation (3) is specified as:

$$\ln\Delta P_{it} = \beta_i^A \Delta \ln GDP'_{it}^A + \beta_i^I \Delta \ln GDP'_{it}^I + \beta_i^S \Delta \ln GDP'_{it}^S + \gamma_i + \Delta \varepsilon_{it} \quad (7)$$

Where  $\Delta$  represents the first-differences operator. All other variables follow the same description given on equation (3). Note that the time-invariant error component ( $\mu_i$ ) has been removed from the equation and should not be confused with the time-trend  $\gamma_i$ , that lost its  $t$  component during the first-differences procedure since  $\gamma_i t - [\gamma_i(t-1)] = \gamma_i$ .

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<sup>24</sup> The demonstration of fixed effects can be found on section 9.1 in the Appendix.

This specification, as already demonstrated, addresses the problem with omitted variable bias. However, by maintaining (7) unchanged, this study might be working with an unrealistic assumption implying that the proportional impact of each sector on poverty is the same. To illustrate, let us imagine an economy where only 1% of its output come from the industry sector and 99% comes from agriculture; in that case, it would be risky – not to say wrong – to assume that the proportional impact of industrial growth on poverty would be the same as agriculture due to its considerable differences in terms of representativeness.

In order to correct this assumption, Ravallion & Datt (1996) have proposed a specification that accounts for each sector's respective share in economy. This specification is also adopted by Ferreira et al (2009) while arguing that “the differential poverty impact of growth will naturally depend on the sector's size” (p. 25). By adding these considerations to the model, we reach the following specification:

$$\ln\Delta P_{it} = \beta_i^A s_{t-1}^A \Delta \ln GDP'_{it}^A + \beta_i^I s_{t-1}^I \Delta \ln GDP'_{it}^I + \beta_i^S s_{t-1}^S \Delta \ln GDP'_{it}^S + \gamma_i + \Delta \varepsilon_{it} \quad (8)$$

Where  $s_{t-1}^A$ ,  $s_{t-1}^I$  and  $s_{t-1}^S$  account for the share of agriculture, industry and services respectively. Note that each share is lagged ( $t - 1$ ) due to the loss of one panel of 27 states when first-differencing the series, therefore, this correction is needed to keep the panel strongly balanced and to ensure that each year's sectoral GDP per capita is properly weighted by its respective share in the given year.

The importance of having disaggregated economic growth is the possibility to further test if  $\beta^A = \beta^I = \beta^S$ . This is an important relation to this study because, if rejected, it provides evidence from the importance of the “pattern of growth” when studying poverty. If unable to reject, however, the equation would collapse solely to the relationship between poverty and economic growth as a whole. Even though this relationship is not theoretically wrong, it would definitely raise questions about the precision of the estimates since such specification would disregard any sectoral effect on poverty, which is counterintuitive to say the least.

While (8) allows the analysis of sectoral economic growth's impacts on poverty, this is not the only effect that aims to be explored by this study. As already defined in previous subsections, it is also interesting to capture effects concerning government expenditures and the auxiliary covariates. In order to facilitate future references of these additions, they are going to be divided in two equations, being (9) the equation that represents a model with the sectoral growth and government expenditures and (10) the equation representing the complete model with all the covariates proposed in this study:

$$\ln\Delta P_{it} = \beta_i^A s_{t-1}^A \Delta \ln GDP'_{it}^A + \beta_i^I s_{t-1}^I \Delta \ln GDP'_{it}^I + \beta_i^S s_{t-1}^S \Delta \ln GDP'_{it}^S + \sigma_{it}^J X_{it}^J + \gamma_i + \Delta \varepsilon_{it} \quad (9)$$

$$\ln\Delta P_{it} = \beta_i^A s_{t-1}^A \Delta \ln GDP'_{it}^A + \beta_i^I s_{t-1}^I \Delta \ln GDP'_{it}^I + \beta_i^S s_{t-1}^S \Delta \ln GDP'_{it}^S + \sigma_{it}^J X_{it}^J + \phi_{it}^K Z_{it}^K + \gamma_i + \Delta \varepsilon_{it} \quad (10)$$

Where the covariate X represents the government expenditures that are disaggregated according to the superscript J in State and Municipal Expenditures; Capital Transfers and Federal Transfers. The covariate Z represents all alternative covariates that are disaggregated through the superscript K representing the inflation rate, Gini index, average education level and unemployment rates.

Equation (10) represents the most comprehensive model that will be estimated in this study. The results will be presented in the next section alongside a discussion of the estimates. The equation of interest is (10), however, equation (8) and (9) are also going to be presented with estimated values so it is possible to how the dynamics of poverty change when adding other covariates.

Once the general methodological framework has been presented, it is also important to provide a description of the model fragilities and the way this study aims to address it in order to ensure consistent and robust estimates.

It was already mentioned in previous subsections that sectorial economic growth was collected repeatedly across time through the Regional Account Statistics. That leads to the possibility of correlation between a given sector's GDP and itself during subsequent time intervals. In other words, past GDP values might affect future GDP values. This possibility is hard to refute theoretically and it does not apply solely to the GDP figures. Government expenditures and auxiliary covariates such as education, unemployment, inflation rates and inequality levels might as well follow this pattern. Therefore, unless there is a sound theoretical background that refute such possibility, statistical tests that verify the existence of serial correlation are needed in order to ensure the efficiency of the estimator.

Wooldridge (2002) has proposed a test for serial correlation in linear panel models. Drukker (2003), while exploring the capabilities of this test found it to have "good size and power" and to be robust to in the presence of heteroscedasticity (p. 168).

The test procedure – which is not going to be demonstrated in the present study – consists in estimating the parameters of the given model in first-differences and collecting the error terms. After that, the error terms are regressed against the lagged variables of the first-differenced model. From that procedure, it is easy to note that the correlation between the error terms and the lagged error terms is being pursuit. The test is set with a null hypothesis

that there is no first-order autocorrelation, therefore, a good model will not reject the null, since the rejection would imply that the observations in  $t + 1$  are correlated with  $t$ ; that being the case, there would be serial correlation.

Serial correlation, as mentioned, impairs the efficiency of the estimator. However, unbiasedness and consistency are kept. That means that statistical tests might lose its power due to non-efficient standard errors. One of the assumptions for running an OLS through a Panel Data is that all observations are independent from each other; in other words, observations are independent across groups and within their own group. The first case refers to endogeneity and is addressed through first differencing the series; the second case refers to the serial correlation and requires a proper treatment. Therefore, a variance-covariance matrix that relaxes the assumption concerning independence within groups must be estimated for the coefficients to have robust standard errors. Should the error terms of a given linear panel model be serially correlated, this procedure will be adopted and will be properly discussed whenever necessity arises.

Alongside this specific test for serial autocorrelation, tests regarding the homoscedasticity of the residuals as well as a joint significance of the coefficients are also going to be presented in order to make it possible to analyze not only the results but also the robustness of the estimates.

This subsection ends after a thorough methodological discussion regarding the model specification and the tests in which this model will be subjected. In the next section, the results of the estimates are going to be presented and, naturally, discussed.



## 6) Results

Following the methodological framework, this section aims to present the models' estimates and discuss the robustness of the findings. As already mentioned previously, estimates are going to be presented using two different indexes: one provided by the Institute of Applied Economic Research and one calculated by the present author.

The subsections within this section will be presented according to the model's complexity. In the first subsection – regarding sectoral economic growth – poverty dynamics will be explored following the guidelines from equation (8). The second subsection discusses the guidelines from equation (9) while adding government expenditures to the analysis. Lastly, the final subsection presents the estimates of equation (10), which consider the socioeconomic perspective.

### 6.1) Patterns of Growth and Poverty

For clarity, the poverty index calculated by the present author is going to be denoted as Poverty Index 1 and the poverty index collected from IPEA is going to be denoted as Poverty Index 2.

In order to reach the best specification possible, the coefficients were allowed to vary by state for each sector. By creating state dummies interacting with the three sectors of the GDP and estimating a model with all these interactions plus the dummies' themselves, it is possible to reach a flexible specification that allows testing if there are any significant geographic differences that should be considered in the model. This method is the same as estimating a separate regression for each state and then testing equality between the coefficients of different equations.

For all the three sectors, the equality between states' coefficients was not rejected, implying that the model is consistent with some degree of pooling. That said, Table 6 below shows the results obtained from the pooled OLS regression with first differences for both poverty indexes and its respective statistics, following the guideline proposed on equation (8).

Table 6 – Estimates for equation (8)

$\Delta P_{it}, \log$	Poverty Index 1		Poverty Index 2		
	$\beta$	s.e.***	$\beta$	s.e.	
<b>Primary Sector</b>	0.191	0.178	0.605	0.274	**
<b>Secondary Sector</b>	-0.497	0.185	-0.624	0.241	**
<b>Tertiary Sector</b>	-0.958	0.222	-0.771	0.157	**
<b>Time trend</b>	yes	**	yes	**	**
Observations	189		189		
Adjusted R <sup>2</sup>	0.532		0.492		
F-test (P > F)	0.000		0.000		
$\beta^A = \beta^I = \beta^S$	0.002		0.001		
Heteroskedasticity	0.330		0.158		
Autocorrelation	0.002		0.127		

Source: Author's calculation (PNAD/IBGE)

\*\* 5% significance

\*\*\* Robust standard errors

\*10% significance

As it is possible to infer, the results are similar in terms of direction but differ in terms of statistical significance and magnitude. This is in line with the literature that emphasizes that the choice of a threshold has significant impacts on the results' interpretation (Ravaillon & Sen 1996; Kakwani 1993). While on estimates for Index 1 agriculture did not seem to be significant and services are clearly taking the leading role on reducing poverty, on Poverty Index 2 this relationship is less clear with services being somewhat more sizable but not as prominent as in the Index 1 estimates. However, it is important to mention that the results presented are not the elasticities themselves since the specification consider the sectors multiplied by its weights instead of the sectors themselves<sup>25</sup>.

In order to have an idea of magnitude, the results in terms of elasticities are presented on Table 13 on Section 9.2 in the Appendix. By analyzing the aforementioned table, the magnitudes between both models tend to converge, revealing that poverty responds significantly more to variations in the service sector when compared to both agriculture and industry. That said, the conclusion in terms of sectoral growth is that the tertiary sector presented itself not only as a growth escalator but also with a significant pro-poor pattern of growth. In the light of the commodities boom from which Brazil benefited during the period of study, these findings are noteworthy; it implies that while Brazil was collecting substantial commercial surpluses through exports from the agricultural sector, what was leading poverty reduction was, in fact, services. If anything, agriculture had a poverty increasing impact or, in the best-case scenario, was insignificant on poverty dynamics during Lula's term. It does not mean, however, that the commodities' boom was not beneficial for Brazilian society; after all,

<sup>25</sup> Since all the estimates in this study will include economic growth, its respective elasticities are all going to be presented on Section 9.2 in the Appendix and will be referenced throughout the text accordingly.

a booming sector demands services of all kinds, from transportation to legal support going through government services. What becomes evidenced, therefore, is that the sheer growth in agriculture promoted by the commodities' boom does not have a direct impact on poverty, but instead, the impacts – if any - are more likely to be indirect. Moreover, considering that the tertiary sector has an elasticity 3.5 times bigger than industry in both models, the transmission mechanism is also more likely to happen through services.

Once the general results were discussed, it is possible to move to the models' technicalities in order to evaluate their robustness. The F-test aims to evaluate the joint significance of the covariates estimated and defines a null hypothesis that the covariates are jointly equal to zero. Naturally, a test result that rejects the null hypothesis is pursuit. For this test, both models succeed in doing so; therefore, the covariates hold some explanatory power.

The F-test, even though similar, it is not the same as testing the  $\beta^A = \beta^I = \beta^S$  relationship. This goal here is to test if the patterns of growth apply for the present study. Both models succeed in rejecting the null that the coefficients are the same; therefore, a model specification accounting for sectoral growth is robust.

To test the existence of heteroscedasticity, the White's test is used. This test is set with null hypothesis on the existence of homoscedasticity. In that case, rejecting the null would imply in heteroskedastic errors. None of the models rejects this hypothesis, providing evidence of homoscedasticity thus; the estimates do not suffer from inefficiency at least from the residuals perspective.

The last test conducted concerns the existence of serial autocorrelation. The null hypothesis imposes no first-order autocorrelation. Rejecting the null is what is being pursuit for this test. Here, the models differ; while model with Index 1 rejects this hypothesis, suggesting the presence of serial autocorrelation, the model with Index 2 does not reject the null, retaining its estimators' efficiency. In the light of that, model with Index 1 was estimated with robust standard errors.<sup>26</sup>

Since both general results and robustness were evaluate in the present subsection, it is possible to move forward and include government expenditures into the analysis following the guidelines of equation (11). This is presented in the next subsection.

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<sup>26</sup> This procedure was already mentioned on section 5.3. Robustness in terms of serial correlation means a varianca-covariance matriz that imposes independence within the observations across groups, but is flexible within the same group. It should not be mistaken with robust standard errors for heteroscedasticity.

## 6.2) Government Expenditures and its effects

By adding government expenditures to the analysis, it is possible to see some convergence between the two models on Table 7 if compared to the results presented on Table 6.

Secondary and Tertiary sectors remained significant while Primary sector, despite considerable variation between models, did not provide statistical significance. The overall conclusions regarding sectoral growth, therefore, are the same.

When it comes to government expenditures, it can be verified is that both Capital and Federal Transfers have a poverty reducing effect but are not significant in statistical terms. The only expenditure that is significant is regarding State and Municipalities.

Table 7 - Estimates for equation (9)

<b><math>\Delta P_{it}, \log</math></b>	<b>Poverty Index 1</b>			<b>Poverty Index 2</b>		
	$\beta$	s.e. ***		$\beta$	s.e.	
<b>Primary Sector</b>	-0.022	0.164		0.344	0.264	
<b>Secondary Sector</b>	-0.468	0.169	**	-0.566	0.229	**
<b>Tertiary Sector</b>	-0.751	0.209	**	-0.590	0.169	**
<b>SME</b>	-0.308	0.076	**	-0.342	0.075	**
<b>Capital Transfers</b>	-0.019	0.024		-0.023	0.019	
<b>Federal Transfers</b>	-0.010	0.018		-0.037	0.348	
<b>Time trend</b>	yes		**	yes		
Observations		189			189	
Adjusted R <sup>2</sup>		0.572			0.560	
F-test (P > F)		0.027			0.000	
$\beta^A = \beta^I = \beta^S$		0.027			0.024	
Heteroskedasticity		0.493			0.234	
Autocorrelation		0.003			0.070	

Source: Author's calculation (PNAD/IBGE)

\*\* 5% significance

\*\*\* Robust standard errors

\*10% significance

In terms of robustness, the models do not differ considerable. Both are capable of confirming the pattern of growth and do not have problems with heteroscedasticity. However, when it comes to serial autocorrelation, it is possible to verify that the model with Index 1 experiences it. Therefore, robust standard errors are reported similarly to what was done in Table 6 in the last subsection.

A note, however, has to be made about serial autocorrelation in the specification with Index 2. As it can be inferred, the test result left an open possibility for autocorrelation if the statistical significance is relaxed to 10%. That being the case, a model with robust standard errors was calculated but it did not present substantially different results. All the variables kept their significance as presented on Table 7 and the statistical tests regarding the joint significance

of the covariates as well as the pattern of growth were maintained; therefore, the model on Table 7 was kept with conventional standard errors instead of robust ones.

In the light of the estimated models, it is possible to conclude that economic growth was a strong factor behind the reduction of poverty in Brazil during the years of interest of this study.

When analyzing Table 7 alongside the sectoral growth elasticities on Table 14, the conclusions concerning the role of the tertiary sector in comparison to industry and agriculture are essentially the same. Therefore, what is imperative on this section is to analyze the role of government expenditures.

At least preliminarily, government expenditures can foster poverty reduction. However, not all government expenditures might achieve significance on doing so. State and Municipal expenditures seems to have had a significant contribution but, by keeping this variable aggregated, it is hard to advance in any policy implication since these expenditures comprise a broad range of activities as it was discussed on subsection 5.2.3.

In order to bring more clarity to this question, Table 8 presents new estimates; but now, with a breakdown on State and Municipal Expenditures following the disaggregated data presented on subsection 5.2.3.

Table 8 – Estimates for equation (9); Disaggregated SME

		Poverty Index 1		Poverty Index 2		
$\Delta P_{it}, \log$		$\beta$	s.e.***	$\beta$	s.e.***	
SME	<b>Primary Sector</b>	-0.024	0.173	0.334	0.196	
	<b>Secondary Sector</b>	-0.446	0.171	* -0.537	0.222	**
	<b>Tertiary Sector</b>	-0.769	0.220	** -0.612	0.184	**
	<b>Education &amp; Culture</b>	-0.152	0.076	** -0.173	0.063	**
	<b>Health &amp; Sanitation</b>	-0.124	0.091	* -0.123	0.056	*
	<b>Social Assistance/Security</b>	-0.029	0.035	-0.042	0.029	
	<b>Capital Transfers</b>	-0.018	0.026	-0.024	0.021	
	<b>Federal Transfers</b>	-0.014	0.018	-0.043	0.022	
	<b>Time trend</b>	yes	**	yes	**	**
	Observations	189		189		
Adjusted R <sup>2</sup>	0.572		0.539			
F-test (P > F)	0.000		0.000			
$\beta^A = \beta^I = \beta^S$	0.028		0.026			
Heteroskedasticity	0.584		0.447			
Autocorrelation	0.003		0.058			

Source: Author's calculation (PNAD/IBGE)

\*\* 5% significance

\*\*\* Robust standard errors

\*10% significance

By comparing Table 7 with Table 8, it is possible to see that none of the coefficients that remained aggregated varied considerably neither in terms of size or significance, with the

Tertiary sector retaining its prominence on reducing poverty followed by significant effects coming from the Secondary sector. However, the estimates on Table 8 reveal that expenditures in Education & Culture and Health & Sanitation have a significance poverty reducing effect. Interestingly, the effects of social security and social assistance at the state and municipal level were not significantly different from zero at 5% confidence interval. Moreover, Federal Transfers remained insignificant. That said, Table 8 indicates that, during the period of interest, what have led poverty reduction is more related to economic growth and investment in human capital and health rather than the much-publicized social expansion experienced in Brazil. These results constitute an interesting finding since it allows understanding the efficiency of certain expenditures and opens the debate on the role of social security and social assistance in Brazilian society. In a short-term analysis, they do not seem to have significant impacts on poverty.

It must be noted, however, that by no means these results imply that the social expansion Brazil experienced did not improve the general condition of the ones most benefited from a more comprehensive social coverage. These results are bounded to many restrictions imposed by both the dataset and the model specification choice and should be interpreted carefully and account for the period of analysis alongside the subject of study. This discussion is going to be further developed on Section 7; after all, there is still the need to discuss the model in the light of the socioeconomic variables that are yet to be included. Next subsection aims to deepen the analysis on this issue.

### 6.3) Adding socioeconomic variables

This subsection refers to the estimation of equation (10). This is the most complete model proposed in this study and aims to analyze the joint impact of economic growth, government expenditures and socioeconomic variables on poverty. The inflation rate, the Gini index, the average educational level and the unemployment rate represent the socioeconomic aspects of this study, as already discussed. The results are presented on Table 9 .

As extensively demonstrated through all the Tables already presented, economic growth in the Tertiary sector continues as the most prominent poverty-reducing factor among other sectors of the economy.

Government expenditures show consistency between the two models, coinciding on its statistical significance and not presenting any sizable difference on their magnitude. Again, public expenditure related to Education & Culture and Health & Sanitation is significant while the state and municipal expenditure in social assistance and social security did not show any significant impact on poverty reduction throughout the period. The same applies to Capital

Transfers and to Federal Transfers, which could not achieve significant results in any specification in neither of the poverty measures.

The socioeconomic variables, however, provide an interesting explanatory power, being only the inflation rate the variable that is not statistically different from zero, which makes sense if we take remember that the period of interest was marked by a favorable macroeconomic scenario and monetary stability. Differently from other periods in Brazilian history, inflation did not have sizable nefarious effects on individual's income.

Table 9 - Estimates for equation (10); Disaggregated SME

		Poverty Index 1			Poverty Index 2		
$\Delta P_{it}, \log$		$\beta$	s.e.***		$\beta$	s.e.	
SME	Primary Sector	0.131	0.192		0.454	0.248	*
	Secondary Sector	0.014	0.134		-0.147	0.223	
	Tertiary Sector	-0.535	0.175	**	-0.451	0.166	**
	Education & Culture	-0.114	0.052	**	-0.131	0.053	**
	Health & Sanitation	-0.163	0.058	**	-0.162	0.059	**
	Social Assistance/Security	-0.016	0.025		-0.035	0.027	
	Capital Transfers	0.012	0.022		-0.002	0.018	
	Federal Transfers	0.011	0.022		-0.021	0.034	
Socio-economic variables	Inflation rate	0.028	0.017		0.012	0.018	
	Gini Index	0.801	0.231	**	0.504	0.135	**
	Educational Level	-0.756	0.280	**	-0.567	0.207	**
	Unemployment rate	0.126	0.029	**	0.126	0.027	**
Time trend		yes		yes			
Observations		189		189			
Adjusted R <sup>2</sup>		0.673		0.614			
F-test (P > F)		0.000		0.000			
$\beta^A = \beta^I = \beta^S$		0.024		0.029			
Heteroskedasticity		0.159		0.367			
Autocorrelation		0.007		0.466			

Source: Author's calculation (PNAD/IBGE)

\*\* 5% significance

\*\*\* Robust standard errors

\*10% significance

Educational level and the Gini index were, by far, the most important determinants to explain the dynamics of poverty during Lula's term, even surpassing the effects provided from economic growth. When interpreting the coefficients, however, one must be careful by noting that the Gini index and the unemployment rate have positive signs. In this case, it is important to bear in mind how these variables are measured; therefore, an increase in the Gini index – in other words, an increase in inequality – will have a poverty increasing effect. The same applies to the unemployment rate. As much as unemployment rates increase, society is bounded to experience an increase in poverty levels as a result.

By analyzing the model as whole<sup>27</sup>, it becomes clear that poverty reduction channels were mainly captured by inequality reduction and human capital attainment. Despite the important and systematic poverty reducing effect that comes from the Tertiary sector, the elasticities estimated leave little doubt about the variables that acted as the main drivers reducing poverty in the period.

That being the case, questions regarding the nature of these variables and the causes of their strong poverty impact might arise. It is not the aim of this study to provide a comprehensive explanation concerning the transmission links of these variables on poverty, however, given the information provided by the estimates, a brief discussion is beneficial.

When it comes to educational level, for example, one must always pay attention about its measurement. In this study, it is being considered the average years of education of an individual with 25 years of age or more; in other words, adults. If we take Figure 5 on Section 3, it will be possible to see that during Lula's term the average level of education increased; however, how much of it could it be attributed to Lula's administration? As we could see from Figure 5, the increase in educational levels did not present any structural change and was rigorously in line with previous presidential terms. This, allied with the results provided on Table 9, can be understood as evidence that the effects of education transcend any specific presidential term and are derived from long-term policies focused on education rather than a specific program led by a specific politician. In other words, this is part of a collective effort and could hardly be attributed to one term specifically. That said, there is a strong component in Brazilian poverty reduction that manifested itself more intensively during Lula's term but was not necessarily triggered by his administration.

On the inequality field, however, it can be suggested that this is an effect more closely related to Lula's Presidency. As it was verified on the estimated results, government transfers did not have any significant impact on poverty reduction but it must be stressed that these estimates are regarding solely the cash transfer's impact on poverty. It has been demonstrated by a number of authors that a more comprehensive social security network had profound impacts on inequality reduction in Brazil<sup>28</sup>, therefore, there are reasons to believe that the fall on the Gini index captures a dimension of the Federal Transfers that the model proposed in this study was, by construction, incapable of capturing. Since there was a considerable expansion of social programs and coverage during Lula's term, it is possible to credit his

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<sup>27</sup> for that Table 16 in the Appendix is also recommended

<sup>28</sup> See Rocha (2006), Hoffmann (2006) Soares (2006), Saboia (2007), Soares et al (2010) and Paiva et al (2013).



administration, to a good extent, for inequality reduction and, consequently, poverty reduction through that channel.

A brief mention to the unemployment rate is also necessary; however, the results are far from surprising. An expansion in the labor market is expected to be led by economic growth. Since the expansion of the labor market is associated with a stable macroeconomic scenario enhancing investments and developing new business, the estimates on Table 9 add to the evidence that consistent and credible expectations' management from the economic authority – especially Central Banks – also play an important role on the social aspects of the country (Ferreira et al 2009, Formby et al 2011).

In closing, it is important to underscore the consistency from the results regarding sectoral growth. Not only the pattern of growth was confirmed throughout all specifications, but also its results were consistent and suggested the tertiary sector as the sector with the most pro-poor dynamic. Since the literature is comprehensive in terms of economic growth's importance, it becomes imperative to analyze this variable more deeply. In order to do so, Table 10 considers the same model as in Table 9, but now, with disaggregated tertiary sector between services provided by public administration and non-public administration.

Table 10 - Estimates for equation (10); Disaggregated Tertiary Sector and SME

		Poverty Index 1			Poverty Index 2		
$\Delta P_{it}, \log$		$\beta$	s.e.***		$\beta$	s.e.	
Tertiary Sector	Primary Sector	0.066	0.187		0.402	0.254	
	Secondary Sector	0.018	0.133		-0.144	0.224	
	Non-public services	-0.272	0.359		0.239	0.283	
	Public services	-0.969	0.648	**	-0.804	0.412	**
SME	Education & Culture	-0.108	0.052	**	-0.127	0.057	**
	Health & Sanitation	-0.162	0.059	**	-0.161	0.059	**
	Social Assistance/Security	-0.017	0.023		-0.036	0.027	
	Capital Transfers	0.011	0.022		-0.002	0.018	
Socio-economic variables	Federal Transfers	0.002	0.026		-0.028	0.034	
	Inflation rate	0.026	0.072		0.011	0.018	
	Gini Index	0.790	0.232	**	0.494	0.136	**
	Educational Level	-0.699	0.269	**	-0.520	0.213	**
	Unemployment rate	0.124	0.029	**	0.124	0.027	**
	Time trend	yes		**	yes		
	Observations	189			189		
	Adjusted R <sup>2</sup>	0.676			0.643		
	F-test (P > F)	0.000			0.000		
	Heteroskedasticity	0.319			0.493		
	Autocorrelation	0.009			0.693		

Source: Author's calculation (PNAD/IBGE)

\*\* 5% significance

\*\*\* Robust standard errors

\*10% significance

While services provided by public administration comprise a wide range of activities from general public bureaucracy to education and health; non-public services comprise any other service that is performed by the private sector regardless of being traditional (hotel and accommodation and trade) or modern (financial services, transportation and logistics).

By analyzing the elasticities regarding economic growth<sup>29</sup>, it is blatant how public services had an impressive poverty reducing effect; still, the combination of the diverse socioeconomic variables outperform the effects of economic growth, however, by disaggregating the tertiary sector, it becomes clear that not only the pattern of growth between sectors is important, but also the pattern within sectors.

To explore the transmission links from growth on public services to poverty reduction would demand a completely new work and could not be fully covered by a paragraph in this subsection, however, a good starting point to understand the role public services had on poverty reduction could be by the evolution of public jobs during the period of interest. In 2002, the last year of FHC's term as President there were 4.1 million public employees at the municipal level. In 2009, this number had increased to 5.7 million people; an increase of almost 40% in just 8 years. In comparison, Brazilian population have increase from roughly 170 million habitants in 2002 to 190 million in 2009, representing an increase of 9.7%. Therefore, the expansion of public jobs during Lula's term was remarkable, which, in turn, have affected the performance of this sector within services and, of course, influenced the overall poverty dynamics.

This subsection ends by putting the overall results in perspective. Firstly, the most prominent roles on reducing poverty have derived from the improvements in socioeconomic conditions, especially through inequality reduction and human capital attainment. Following these variables, the sectoral economic growth leveraged by the tertiary sector was also a substantial driver behind poverty reduction alongside with the labor market expansion. Lastly, government expenditures provided a poverty reducing effect, however, solely at the state and municipal level while federal transfers have showed no significance at all on poverty dynamics in a direct way.

The next section aims to explore these overall conclusions more thoroughly while referring to the previous literature and research question.

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<sup>29</sup> See Table 17 in the Appendix

## 7) Discussion

This section aims to present the discussion of the results obtained in this study. This will be done by relating the findings with the literature and addressing the research question.

### 7.1) Service sector as a growth escalator

One of the most consistent findings in this study refers directly to the importance of the pattern of growth when explaining poverty dynamics in the period from 2002-2009.

As it was discussed throughout the literature review, if the patterns of growth are ignored, one might understate or even misinterpret the importance of the relationship between economic growth and poverty. The models estimated in the present study were all specified in order to consider this issue and the results suggested that it was relevant; in line with the literature such as Ravallion & Datt (1996), Loayza & Raddatz (2006) and Christiansen & Demery (2007). That said, it is important to underscore that this finding is not surprising, but actually, expected.

By specifying and testing the patterns of growth, this study concluded that the Service sector – during the period of interest - had the most prominent poverty-reducing effect when compared to either industry or agriculture. Interestingly, these results are in line with Ferreira et al (2009), despite the present study to be exploring a completely different period. While Ferreira et al (2009) explore the years from 1985 to 2004, this study presents results concerning the 2002-2009 period. In the light of these findings, it might be possible to argue that poverty dynamics during Lula's term in Presidency, at least concerning economic growth, followed the same pattern verified in previous periods. Moreover, it could be also concluded that the tertiary sector has long achieved prominence as the growth escalator in the Brazilian economy; even in a commodities' boom scenario.

Moreover, another interesting finding concerns the importance of considering not only disaggregated economic growth through sectors, but also disaggregated sectoral growth through activities. That statement is motivated by the surprising effect that services provided by the public administration had on explaining the role of economic growth on poverty dynamics. Not only the results were significant, but they were also sizable for the aforementioned activity, casting light into the importance to consider government impacts on economic activity through production and not solely through policy.

In closing, the lessons about the economic growth and its impact on poverty during Lula's administration can be summarized as:

- 1) Growth within-sector matters;
- 2) Services related to public administration emerges as a subject of interest for future studies.

In the next section, the results collected concerning government expenditures will be discussed.

## 7.2) The Government's role

Especially for the Brazilian case, much has been debated about the role that Federal transfers and other general government expenditures could have on fighting poverty.

This study have found that Federal and Capital transfers do not have any significant effect on reducing poverty. The only variable that provided a significant effect was related to States and Municipal expenditures. When exploring the latter more closely, the estimations suggests that expenditures related to Education & Culture and Health & Sanitation had a statistically significant effect on reducing poverty during Lula's term. However, not all state and municipal expenditures followed this trend, with expenditures related to social security and social assistance not being statistically different from zero.

Among the different coefficients, it is important to discuss the impact of Federal Transfers. While some studies such as Rocha (2003, 2006), Hoffmann (2005) and Kageyama & Hoffmann (2006) suggest that social programs such as Bolsa Família had significant impacts on poverty reduction, Marinho et al (2011), Carvalho Jr. (2006) and Schwartzman (2005, 2006) are more skeptical regarding its effects. The estimates in the previous section suggests that this study will be aligned with the latter perspective since no significant effects were found from Federal Transfers on poverty.

These results, in light of the model specification and the descriptive statistics are not shocking. Firstly, it is important to consider that programs as BPC and RMV cover less than 2% of the Brazilian population. Secondly, Bolsa Família, even though with a massive coverage of roughly 25% of the population, never accounted for at least 1% of the GDP through the whole period of interest. Thirdly, the average benefit Bolsa Família have paid to its beneficiaries was R\$ 70.19 per month<sup>30</sup> in 2009. That means, in US dollars of 2003, an average benefit of US\$ 29.19; in other words, less than a dollar a day. It is hard to believe that a program that provides such a small benefit will have any significant impact on poverty reduction through its cash hand out, especially when setting a poverty line based on a caloric-intake. However, this does not mean that the program is not efficient or that it does not alleviate

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<sup>30</sup> In R\$ of 2003. Calculated by the author based on IPEA's database

the condition in which the beneficiaries are found. It must be remembered that Bolsa Família is more than just a cash hand out; it is a conditional cash transfer program. In order for families to collect the benefit, their kids must be regularly vaccinated and attending to school. That said, the average improvement of children's healthcare and school attainment must be taken into account when evaluating the program. Considering that the program was established in 2004, until the end of the period of interest for this study it is not likely that any significant change on human capital levels could be perceived. As highlighted by Paes-Sousa et al (2013) "CCT's<sup>31</sup> are long term interventions"; therefore, the present study results should not be interpreted as advocating to the end of such programs.

When it comes to Capital Transfers, no significant effects were found. This is in line with Ferreira et al (2009). If anything, this result reveal that investments, inversions and capital transfers made by municipalities and states concerning infrastructure did not have a poverty reducing impact during the 80s, 90s or even during Lula's term as President.

States and Municipal expenditures, on the other hand, show significant results. The most interesting finding, however, lies on the disaggregation of this expense between Education & Culture, Health & Sanitation and Social Assistance/Security. The estimates suggest that the impacts of the expenditure in the first two categories were significant on poverty reduction, which is somehow impressive since these are expenditures that are usually regarded as long-term factors modifiers. The contribution, therefore, is to the understanding that investments in education in health, at least during Lula's term, provided short-term effects on reducing poverty.

In order to close this section, the main implications can be summarized as:

- 1) Federal Transfers did not seem to have any significant impact on poverty reduction. This result is attributed to the low average value of the benefit.
- 2) State and Municipal Expenditures were pro-poor, however, expenses in Education & Culture and Health & Sanitation are the main drivers behind this significance, evidencing a short-term effect of this expenditure on poverty.

The next subsection aim to present the discussion regarding the socioeconomic covariates.

### 7.3) Going beyond the monetary impacts

Empirical evidence suggests that inflation has a poverty increasing behavior. Even though this is easily understood in a scenario with uncontrolled inflation, in a scenario of

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<sup>31</sup> CCT stands for Conditional Cash Transfer

macroeconomic and monetary stability these effects are assumed to be less intense or to not be significant. Considering that Brazil have achieved a certain level of stability both in macro and in monetary terms during Lula's administration, the results of insignificant poverty increasing impacts of inflation are not surprising.

On the other hand, the Gini index, educational level and unemployment rate have provided significant results in both specifications. These findings go hand in hand with the international literature (Gafar 1998; Ravallion & Datt 2002; Ranis & Stewart 2002) as well as literature focused on the Brazilian case (Hoffmann 2005; Ferreira et al 2009; Marinho et al 2011; Goncalves & Machado 2015).

In fact, the Gini index alongside Educational Level were the ones with the most sizable elasticity to poverty. Here it is interesting to note that the wider social coverage established in Brazil through the 1988 Constitution might be playing a role on the index. As already mentioned in the last subsection, it is hard to capture any effects from Federal Transfer if they are analyzed just in terms of the cash given to the beneficiaries. However, when adding variables that aim to capture a bigger framework, the comprehensive social expansion is ought to have an impact in this elasticity.

That said, the main considerations for this subsection is:

- 1) The stable monetary policy prevented inflation to have significant poverty increasing effects;
- 2) A beneficial macroeconomic scenario allowed unemployment rates to follow a downward trend, granting the expansion of the labor market and its subsequent poverty reducing effect;
- 3) The fall in inequality is an important factor behind poverty reduction, in line with the literature;
- 4) General increase in the educational level kept playing its poverty-reducing role, even though it can be argued that the pace in which Brazil expands its educational system is extremely low. By keeping the rates as they were during Lula's term, Brazilian adults will only reach an average of 14 years of education<sup>32</sup> in 2039.

Considering the discussion promoted in this and previous subsections, this study end with some final remarks presented in the next subsection.

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<sup>32</sup> It represents a complete cycle of primary, elementary and high school.

## 7.4) Final Remarks

By analyzing the poverty dynamics in the period, this study provides evidence suggesting that inequality reduction and human capital attainment were the most fundamental drivers of the poverty reduction in Brazil during Lula's administration. These results are directly in line with the literature that strongly regard socioeconomic variables as more decisive on the dynamics of poverty such as Kageyama & Hoffmann (2006), Menezes-Filho & Vasconcellos (2007) and more recently, Anneques et al (2015).

Nonetheless, economic growth played an important role on reducing poverty, especially through the tertiary sector. Interestingly, however, was when disaggregating this sector between public and non-public services, to find that what is the strongly driving poverty decrease are the services provided by the public administration. Therefore, this study adds to the literature by providing an evidence that governments can act not only by expanding social coverage and ensuring a positive economic environment, but also by engaging on the expansion of the labor market through public services and influencing economic growth through activity and not solely through policy.

Government expenditures also played an interesting role, however, only when it comes to states and municipal entities, implying that a bigger decentralization of government expenditure can better address local problems and provide short-term impacts. Federal Transfers had a negligible influence on poverty and, if anything, these programs affect poverty not through the cash they grant to its beneficiaries but instead by the conditions it imposes to them.

Alongside the overall remarks, it is also interesting to note the extremely important role that the public sector has played on reducing poverty in Brazil during Lula's administration. It is possible to divide government action through 5 fronts. The first, inequality reduction via an active social agenda that ensures a comprehensive and well-targeted social assistance. The second, through consistent long-term policies focused on human capital attainment. The third, increased economic activity through services provided by the public administration. The fourth, through public expenditure in Education & Culture and Health & Sanitation. Lastly, by promoting a stable macroeconomic environment while ensuring inflation control and labor market expansion.

In closing, this study suggests that although economic growth is an important variable on promoting poverty reduction - as evidenced by Brazilian and international literatures - policies that focus on income redistribution have a greater elasticity to poverty; therefore, would be preferable in order to continue to address poverty issues consistently. As a suggestion for

future studies, exploring the transmission links between services provided by the public administration and poverty reduction might be interesting in order to understand how exactly the jobs expansion promoted during Lula's term impacted poverty and which services, specifically, led the trend.



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## 9) Appendix

### 9.1) Fixed Effects

In order to demonstrate the fixed effects procedure, let us take the fictive equation (11), as follows:

$$Y_{it} = \alpha + X_{it}\beta + \mu_i + \varepsilon_{it} \quad (11)$$

(i=1,2,..., N; t=1,2,...,N)

Where  $X_{it}$  is a vector of exogenous covariates;  $\mu_i$  and  $\varepsilon_{it}$  are the respective time-invariant and time-variant components.

In order to eliminate the time-invariant component, it is possible to conduct an OLS with fixed effects – or also called within estimation – when estimating the  $\beta$  parameter. This procedure is useful, for example, in cases that is not possible to infer or collect data in all time-invariant components.

In order to conduct the within estimation, individual-specific averages over time must be calculated, as (5) aim to illustrate:

$$\bar{Y}_i = \alpha + \bar{X}_i\beta + \bar{\mu}_i + \bar{\varepsilon}_i \quad (12)$$

Where:

$$\bar{Y}_i = \frac{1}{T} \sum_{t=1}^T Y_{it}; \quad \bar{X}_i = \frac{1}{T} \sum_{t=1}^T X_{it}; \quad \bar{\varepsilon}_i = \frac{1}{T} \sum_{t=1}^T \varepsilon_{it}; \quad \bar{\mu}_i = \frac{1}{T} \sum_{t=1}^T \mu_{it}$$

Therefore, equation (5) is capturing individual averages. By subtracting (5) from (4), we have:

$$Y_{it} - \bar{Y}_i = X_{it}\beta + \mu_i + \varepsilon_{it} - \bar{X}_i\beta - \bar{\mu}_i - \bar{\varepsilon}_i$$

By noting that  $\mu_i = \bar{\mu}_i$ , then:

$$Y_{it} - \bar{Y}_i = (X_{it} - \bar{X}_i)\beta + (\varepsilon_{it} - \bar{\varepsilon}_i) \quad (13)$$

Since  $\mu_i$  has been “removed” from the equation through this procedure, it means that the controls are implicitly made by all individual-specific factors over time. The interpretation of  $\beta$  becomes the effect of a within-unit change in the covariate X. It is worth mentioning that in

equation (6), X represents an exogenous vector of covariates, in other words, X represents any given number of covariates that could be added to the model.

As demonstrated, the estimation through OLS with fixed effects is capable of minimizing the problems with omitted variable bias while producing consistent results.

## 9.2) Tables

*Table 11 – Disaggregated State and Municipal Expenditures (R\$ of 2003)*

Year	Education & Culture	Health & Sanitation	Social Assistance/Security	Total
1995	23,231.13	13,347.02	14,658.59	51,236.74
1996*	15,673.22	5,989.57	14,150.54	35,813.33
1997	23,148.58	14,467.19	18,305.31	55,921.08
1998	32,382.99	17,810.22	21,828.25	72,021.46
1999	32,645.85	18,043.70	20,890.71	71,580.26
2000	37,040.81	21,551.05	20,318.93	78,910.80
2001	38,758.56	23,897.91	15,610.64	78,267.11
2002	38,888.24	27,446.16	16,080.80	82,415.21
2003	39,542.22	28,399.94	16,443.72	84,385.89
2004	38,166.64	31,510.18	18,810.12	88,486.94
2005	41,142.57	34,690.27	19,967.15	95,799.98
2006	46,292.29	39,688.05	22,532.69	108,513.03
2007	50,225.11	42,132.33	23,974.26	116,331.71
2008	56,901.19	47,333.01	29,449.85	133,684.05
2009	59,381.21	50,937.70	33,836.33	144,155.24
2010	61,160.78	53,284.70	34,990.56	149,436.04

Source: Institute of Applied Economic Research (IPEA)

\*the year of 1996 lacks of Municipal Expenditures

*Table 12 – Disaggregated Federal Transfers (R\$ of 2003)*

Year	BPC	BF	RMV	Total
1995	0.00	0.00	154.66	154.66
1996	35.47	0.00	115.01	150.48
1997	67.64	0.00	108.81	176.44
1998	94.53	0.00	106.58	201.11
1999	110.57	0.00	94.62	205.19
2000	135.74	0.00	90.96	226.70
2001	166.61	0.00	92.69	259.30
2002	191.36	0.00	82.47	273.82
2003	229.34	0.00	82.15	311.49
2004	279.41	228.14	74.52	582.07
2005	336.79	269.61	73.61	680.01
2006	413.64	326.73	74.51	814.88
2007	465.18	378.56	69.38	913.12
2008	523.04	389.63	64.52	977.20
2009	606.26	484.18	61.70	1,152.14
2010	674.17	482.39	57.00	1,213.56

Source: Institute of Applied Economic Research (IPEA)

Table 13 – Elasticities related to equation (8) estimates

$\Delta P_{it}, \log$	Index 1	Index 2
<b>Primary Sector</b>	0.020	0.062
<b>Secondary Sector</b>	-0.118	-0.149
<b>Tertiary Sector</b>	-0.631	-0.508

Source: Author's calculation (PNAD/IBGE)

Table 14 - Elasticities related to equation (9) estimates

$\Delta P_{it}, \log$	Index 1	Index 2
<b>Primary Sector</b>	-0.002	0.035
<b>Secondary Sector</b>	-0.112	-0.135
<b>Tertiary Sector</b>	-0.495	-0.389

Source: Author's calculation (PNAD/IBGE)

Table 15 - Elasticities related to equation (9) estimates; Disaggregated SME

$\Delta P_{it}, \log$	Index 1	Index 2
<b>Primary Sector</b>	-0.002	0.034
<b>Secondary Sector</b>	-0.106	-0.128
<b>Tertiary Sector</b>	-0.507	-0.404

Source: Author's calculation (PNAD/IBGE)

Table 16 - Elasticities related to equation (10) estimates; Disaggregated SME

$\Delta P_{it}, \log$	Index 1	Index 2
<b>Primary Sector</b>	0.013	0.047
<b>Secondary Sector</b>	0.003	-0.035
<b>Tertiary Sector</b>	-0.353	-0.297

Source: Author's calculation (PNAD/IBGE)

Table 17 - Elasticities related to equation (10) estimates; Disaggregated Tertiary Sector and SME

$\Delta P_{it}, \log$	Index 1	Index 2
<b>Primary Sector</b>	0.007	0.041
<b>Secondary Sector</b>	0.004	-0.034
<b>Non-public services</b>	-0.062	0.055
<b>Public services</b>	-0.417	-0.346

Source: Author's calculation (PNAD/IBGE)