Master Thesis

Master International Economics and Business Studies

Inequality in Brazil

A decomposition analysis

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1. Introduction

"*Everyone has a second house near the beach, and otherwise they rent one there*." This is something a young lawyer said while we were visiting his firm in Sao Paulo in 2006. Of course our response was that this is not the image we got from visiting Brazil on an international research project. We have not been to favela's but seeing them from a small distance is striking as well. Especially when just ten minutes before we drove past some beautiful villa's. But this is Brazil, one of the most unequal countries in the world. People who do have money do not want to talk about the large inequality in their country. When asked about it they will at most say three sentences and then they change the subject. Brazilians are proud to be so and do not like to think or talk about the flaws of their beautiful country.

Much research has been done into the inequality of Brazil, one of the most unequal countries in the world. Ranging from descriptive studies to studies that asses the causes of inequality or the effects it has on the country and its people.

In 2004 a World Bank country study was published called *"Inequality and Economic Development in Brazil*". This country study addresses three main questions: why do inequalities matter for Brazil's development? Why does Brazil occupy a position of very high inequality in the international community? And, what should public policy do about it. Background papers collected in this country study investigate the determinants of Brazil's inequality by looking at both inequality of outcome and inequality of opportunity. Finding determinants of inequality and assessing their importance to overall inequality are subjects of investigation in many papers written in the past decades.

In 2006 Ferreira et al. published a paper with a decomposition analyses of Brazil trough time, starting in 1981 up to 2004. After that many more papers where published on the development of inequality in Brazil focusing mainly on the effects of policy. Data shows that inequality in Brazil has been declining in the years since 2004. But how did the underlying determinants develop? What happened to the trends that Ferreira et al. (2006) uncovered in their research?

This thesis aims to answer the following research question:

How did the trends in determinants of inequality in Brazil develop since 2004?

In order to answer this main research question the thesis is divided into 7 parts, this introduction being section one. Each of the following sections will answer some sub-questions that together will lead to an answer to the main research question. The sub-questions are listed in box 1.

Section two elaborates on the research that has been done before. It gives some general theory on inequality within and between countries. The methodology used to find determinants of inequality is discussed. Then a summary is made of determinants found in earlier research and a selection of variables is made for the decomposition. Section three explores several measures of inequality. The desired axioms of a good inequality measure are discussed and the measures to be used in the decomposition are selected. Section four gives the context in which the decomposition should be viewed. This section shows the development of Brazil's inequality through time. It also compares Brazil's inequality tot the rest of Latin America and the World. Section five contains the actual decomposition after first reviewing the equations to be used and giving some information on the data used in the decomposition. Section six analyzes the trends in determinants of inequality in Brazil. Section seven contains the conclusions of this thesis and gives some further research questions.

Box 1: Sub Questions

Section one (introduction)

- What is this thesis about?
- Why this subject?

Section two (on inequality)

- Why are some countries more unequal than others?
- Why is Brazil so unequal?
- What are the determinants of inequality?
- How to find/quantify determinants of inequality?

Section three (measures)

- What are the desired axioms for inequality measures?
- How to measure inequality?

Section four (context)

- What is the current inequality situation in Brazil?
- How did inequality in Brazil develop through time?
- How does Brazil's inequality compare to Latin America and the World?

Section five (decomposition)

- How much of inequality in Brazil can be explained by:
    - Age of the family head
    - Educational attainment of the family head
    - Gender of the family head
    - Family type
    - Race of the family head
    - Region of the family home
    - Urban or rural location of the family home-

Section six (trends)

- What are the trends in determinants of inequality in Brazil?

Section seven (conclusion)

- Conclusions and questions for further research

2. On Inequality

This section explores why inequality is higher in some countries than in others, with special attention to Brazil. Secondly it looks at determinants of within country inequality found in earlier research and the methodology used to find the determinants. Lastly in this section a selection is made of variables to use in the decomposition in section five.

2.1 Why are some countries more unequal than others?

Much research has been done on why some countries are more equal than others and many reasons and causes have been explored.

One of the variables of possible influence is ethnic fractionalization. Countries with dispersion in ethnic groups are more likely to have a higher level of inequality. Another important influence is ascribed to education and skill levels. If these levels of input are very heterogeneous in a country, chances are that inequality in output (income, consumption, wealth, living conditions) is large as well.

A third point of attention is drawn to politics. A country with a majoritarianistic government is likely to be more unequal than a country with proportional representation. However, economists are not quite sure whether this causal relationship might go the other way around. Since a country with proportional representation most likely has more redistribution than a majoritarian country would (Glaeser 2005).

Figure 2.1: Kuznets' curve

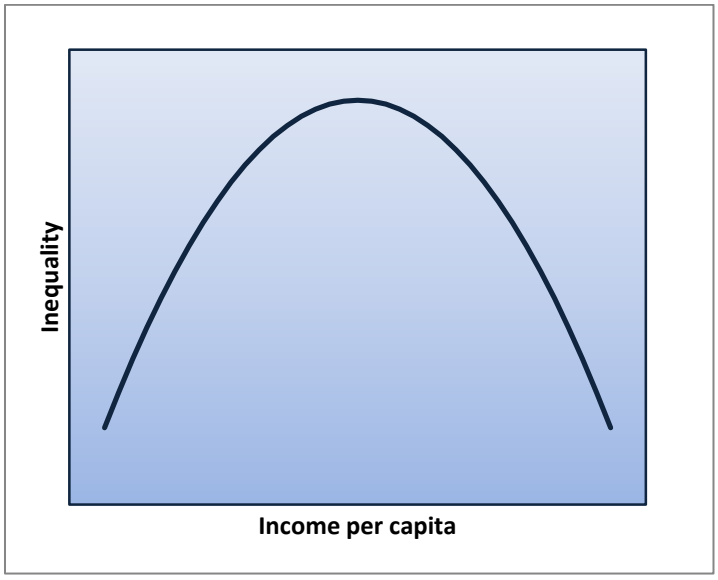


Figure 2.1 shows the world-renowned Kuznets' curve. It shows the relationship between income per capita and inequality. At first the income per capita is low and everyone is poor. But as economic development goes on some people escape from poverty while others do not, increasing inequality. This also shows that a more unequal society is not by definition less preferable to a more equal society. There are more factors to consider, a perfectly equal but very poor society is not likely to be preferred by most above a little richer but more unequal society. At a certain stage of development, more and more people escape poverty making it a more equal society again.

Kuznets (1955) found that rural-urban migration and industrialization have a significant influence on the development of inequality as countries develop. Before industrialization most people worked in agriculture in rural areas. The average income was low and inequality was low as everyone had a low income. In cities the average income was higher and the income was spread less equally across the population there. As society industrialized, more and more people moved from rural areas to urban areas, working more and more in non-agricultural sectors. Even when keeping the absolute income levels constant in both the agricultural sector and the non-agricultural sector (while it is more likely that the gap would grow), the relative income share of the population that kept working in the agricultural sector would fall. The agricultural workers would keep the same level of income while the average income per capita grows, leaving them with a smaller piece of the pie. This shows in figure 2.1 as the rising inequality when income per capita is rising in the first stage.

As a society develops the income share of the poorest people falls. Empirical evidence shows that in developed countries the income inequality declined, suggesting that the inequality within at least one of the sectors declined. Considering the industrial developments in the agricultural sector that widened the inequality it is most likely that the distribution in the urban areas became more equal, specifically on the lower end. Much can be said for the explanation that after a turbulent start of urbanization, more and more people where native in the cities, being better able to use the advantages and opportunities that city life brought. More political power of the urban low-income group could counteract the worst effects of industrialization and support the claims of the masses for a fairer share of the country's income. With these developments the pie is shared more equally across the population. This shows in figure 2.1 as the decline in inequality as income per capita grows further.

This is how the Kuznets' curve would go across time in the same country or area. A comparable analysis can be made across countries or areas at a certain point in time. At the start of the graph the poor African countries would show, the Latin American countries would be positioned in the

middle and high point of the graph while the developed Western countries would mainly be found at the right end of the graph with a relatively low level of inequality.

This relationship shows us that income per capita has an in country as well as a between country aspect when it comes to inequality.

2.2 Why is inequality so high in Brazil?

Brazil is one of the most unequal countries in the world in terms of income inequality, why is that? The previous section showed in general why some countries are more unequal than others, this section focuses on the inequality in Brazil; why is Brazil so unequal compared to other countries?

Velez et al. (2004) find that the unequal distribution of assets plays a large role in the relatively large inequality in Brazil. Educational attainment is distributed more unequal than in the United States, Mexico or Columbia. One explanation for Brazil's high inequality is therefore simply the skill gap in the Brazilian labor force. When combined with the relatively large wage-skill premium in Brazil compared to other countries this explains even more. The distribution of agricultural land is another important factor in inequality, though Brazil is less of an outlier here than it is in terms of inequality in income.

Next to the important factors of unequal distribution of assets, amplified by price differentials, the importance of historical, political and cultural factors should not be underplayed. Segmentation and discrimination still play a relatively important role in Brazil. Velez et al. (2004) conclude that although more than half of the labor earning differentials come from educational differences, the impact of segmentation and discrimination has the same order of magnitude. Segmentation especially has a large influence, with regional differences accounting for almost half of the labor market segmentation.

Public transfers (mainly retirement pensions) are another important factor in explaining Brazil's high inequality in the past. Velez et al (2004) showed that in Brazil public pensions are highly regressive compared to those in the United States.

Bourguignon et al. (2002) showed that if Brazil's educational distribution would be replaced by that in the United States (ceteris paribus) the overall income inequality would be reduced by 28% of the total difference between the two countries. They also showed that the wage

differentials in Brazil account for another 32% of the total difference in inequality. 39% of the total difference is taken away when the distribution of the non-labor incomes (mainly pensions) in the United States is imposed on Brazil. The actual observed difference after controlling for the above amounts to only 1% of the original difference in inequality between Brazil and the United States.

It is important to note that the distribution of welfare is not the same as the distribution of income. Social policy programs may well be in kind through the public provision of social services instead of by a monetary transfer. Velez et al. (2004) show that overall public policy in Brazil decreases inequality in welfare compared to inequality in income. The regressive effects of indirect taxation are compensated by the considerable progressive effects from direct taxation and social public expenditure (excluding pensions).

2.3 Determinants of inequality within a country

Inequality measures the dispersion within a certain distribution. The determinants of that distribution are therefore also the determinants of the inequality. In order to find out the exact determinants of income inequality within a country, a full general equilibrium model of that economy would have to be made and tested. This is quite challenging and historically empirical researchers have used shortcuts to find the determinants of inequality.

2.3.1 Methodology

One way to find the determinants of inequality is by dividing the population into population subgroups and decomposing the inequality measures accordingly, then attributing explanatory power to those variables with large between group inequality. This methodology was developed by Bourguignon (1979), Cowell (1980) and Shorrocks (1980) and was reviewed by Cowell and Jenkins (1995).

Another way to find the determinants of inequality is by dividing income into several income sources and decomposing inequality by income source to see which source contributes the most to inequality and find out why. This method was developed by Shorrocks (1982).

Yet another way is by decomposing changes in equality into changes in group composition, group mean and group inequality. Mookherjee and Shorrocks (1982) developed this methodology using scalar decompositions.

It is convenient to work with a single number. Scalar indices can shed some light on the structure of inequality, the relevant variables that influence it and the importance of covariates. Decompositions of changes in scalar measures do however suffer from serious shortcomings. Information on an entire distribution is put into one single number, this is informational inefficient. The decompositions do not control for each other and it is impossible to separate asset redistribution form changes in returns.

As data availability and computational power increase, more researches are published on entire distributions. From Oaxaca-Blinder decompositions (Oaxaca, 1973 and Blinder, 1973) to some progress with partial equilibrium approaches, steps are made towards general equilibrium approaches (which still get much criticism).

In section five a single number is used to decompose the inequality in Brazil . Even though it has obvious limitations, as discussed above, this method can shed some light on the relevance of variables and the development of this relevance through time.

2.3.2 Determinants

Table 2.1 gives a small overview of determinants of inequality within a country found in papers written before. Several papers investigate different determinants and use different methods to derive or assess these variables. At the end of this section a selection of variables is made that will be used in the decomposition in section 5 of this thesis.

Table 2.1: Determinants of inequality

Age	Sex	Edu	Race	U/R	Reg	HHT	Inc S	Paper	Countries
X	X		X				X	Cowell and Jenkins (1995)	USA
X	X	X	X	X	X	X	X	Ferreira et al. (2006)	Brazil
		X	X	X	X			Elbers et al. (2008)	USA, Brazil, South Africa etc
		X		X	X	X	X	Barros et al. (2010)	Brazil
		X*	X		X*		X*	Bourguignon et al. (2007)	Brazil
		X		X		X	X	Hailu and Soares (2009)	Brazil

* Both the parents' and the individual's

Cowell and Jenkins (1995) use inequality-decomposition analysis to population subgroups to investigate how much of inequality in the USA can be explained by differences in age, sex, race and income source.

Ferreira et al. (2006) present a preliminary investigation of the determinants of Brazil's distributional reversal in the years 1981-2004 using standard decomposition techniques. Static decompositions are carried out concentrating on seven attributes of Brazilian households: its regional location; its urban/rural status; its demographic composition; as well as the age,

gender, race and educational attainment of the household head. By looking at decompositions for three years: 1981, 1993 and 2004 underlying trends in determinants of inequality are uncovered.

Elbers et al. (2008) propose an alternative measure to interpreting inequality between groups by looking at education, race, rural/urban and regional differences. They find that looking at their normalized measure makes comparisons across settings easier when parameters are very different. They do however look at the same type of determinants and find explanatory value for them, be it in a different gradation than other measures do. The determinants they investigate are: education, race, urban/rural location of the household home and region of the household home.

Barros et al. (2010) investigate the determinants of Brazil's decline in income inequality in order to find policy implications. They find that demographic changes affected income inequality only a little. The influence of shifts in non-labor income have a large effect mostly trough public transfers (income source). Increasing non-labor income of the poor has shown to take up a sizable fraction in the reduction of inequality both in the seventies and in the first seven years of this millennium. Reductions in wage inequality are still the most important variable but they are losing importance now compared to the seventies.

They also investigate the relationship between education and labor earnings in Brazil. They look at inequality in education and the sensitivity of the translator used tot transform education inequality into labor earnings inequality (quantity and price effects). Inequality in years of education can decline, but the sensitivity of labor earnings to education levels can change as well.

Another point of influence according to Barros et al. (2010) is spatial segmentation, both urban/rural and regional has impact on labor earnings. There is a trend towards greater integration, both between federal states and between urban and rural areas in Brazil. The earnings gap between urban and rural areas is the largest but it has been declining in the past years.

Bourguignon et al. (2007) propose a measure of the contribution of unequal opportunities to earnings inequality. They find that parental education is the most important circumstance affecting earnings, but the occupation of the father and race also play a role. The effort variable

own education has the usual positive and significant effect on earnings, migration also has a positive and significant effect on earnings.

Hailu and Soares (2009) find that the decline in Brazil's inequality can be explained by declining family size, better access to education and cash transfers to the poor.

Out of the eight determinants in table 2.1, seven are used in the decomposition analyses in section five. The choice of variables follows Ferreira et al. (2006) who have done the decomposition for Brazil for earlier years. In this way a comparison through time can be made and developments in determinants of inequality can be analyzed.

3. Measures of Inequality

This section explores several measures of inequality. Firstly five desired axioms for inequality measures are listed and explained. Secondly five types of measures are discussed and subjected to these axioms. Overall the different measures for inequality are usually highly correlated and results point in the same direction. But not all types of measures are suitable for every type of research. Moreover, using various measures can confirm trends and detect possible measurement errors or changes in data collection.

3.1 Desired axioms of inequality measures

The desired criteria that a perfect inequality measure should satisfy are listed below (Cowell 2011). If a measure does not fulfill all these axioms it does not mean that it cannot be useful. It only means it cannot be used for all types of tests usually done in inequality research.

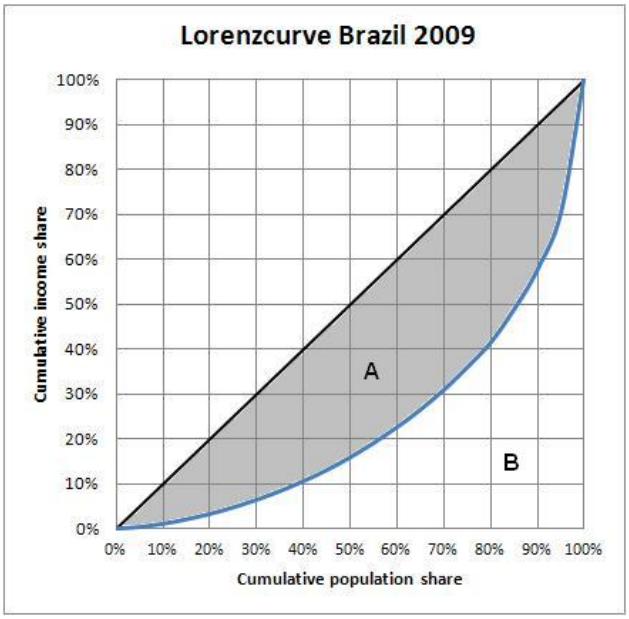
- Anonymity: it does not matter *who* has the income. Whether person A has 40% and B has 60% or the other way around should not influence the outcome of the measure.
- Scale invariance: it does not matter how large the pie is. The measured inequality should not change if the everyone's income changes with the same percentage.
- Population replication invariance: it does not matter with how many people the pie is shared. If two countries with an identical income distribution are merged, the measured inequality should be the same.
- Pigou-Dalton transfer principle: it actually measures inequality. Transferring income from rich to poor should decrease the measured level of inequality.
- Additive Decomposability: total inequality is a function of inequality in subgroups. There should be a coherent relationship between the total inequality in a country and inequality in its subgroups

3.2 Lorenz curves and Gini-coefficients

The single variable that is most widely used to show the degree of inequality is the Gini-Coefficient. It usually measures how income or wealth is distributed in a certain area or country. The outcomes range from 0 to 1 (or 0 to 100 when used as an index) where a value of zero corresponds to perfect equality and a value of 1 to perfect inequality. In other words when there

are 2 people in a certain area and the value of the Gini is 1 the rich person has everything and the poor person nothing at all.

Figure 3.1: Explaining Gini, Lorenz Curve Brazil 2009



Source: Numbers from PovCalNet

The Gini can be calculated as a ratio of areas on the Lorenz curve diagram. In this diagram the population is ranked from poor to rich cumulatively on the horizontal axis while the vertical axis shows the cumulative income that these people earn. The curve that results from this is the Lorenz curve. Next to this curve a perfect equality line is drawn. The area between this perfect equality line and the Lorenz curve is A and the area under the Lorenz curve is B. The Gini coefficient is defined as G = A/(A+B). Since A+B = 0.5 → G = A/0.5 = 2A = 1-2B. Figure 3.1 shows the Lorenz curve for Brazil in 2009.

If x_i is a point on the horizontal axis, and y_i is a point on the vertical axis then the area B can be approximated with trapezoids and:

$$Gini = 1 - \sum_{i=1}^{n} (x_i - x_{i-1})(y_i + y_{i-1})$$

There are several advantages and disadvantages for the use of the Gini. The main advantages are that it is a simple single variable that is easy to interpret and comparable across time. Because of these advantages it has been the most widely used variable to measure inequality making it even more interesting to compare. However as with most convenient single variable measures there is important information about inequality that one cannot get from the Gini. Is the reason for a

high Gini that the poor are very poor or that the rich are particularly rich? Two economies can have similar incomes and Gini's but still have very different income distributions. The Lorenz curves will in such cases have different shapes but still yield the same coefficient. This problem can thus be covered by also looking at the shape of each Lorenz curve when comparing Gini's. A second problem lies in the way the Gini itself is computed. Not every country collects the data in the same way and some countries even collect other types of data, like data on consumption instead of on income. Because of these differences one should be careful in comparing Gini's between countries. Caution should even be taken with respect to data collection when comparing Gini's of the same country over time.

Even though the Gini satisfies a couple of important principles such as anonymity, scale independence, population independence and the transfer principle there is one other inequality axiom that it does not comply with. The Gini cannot be additively decomposed or averaged.[1] For a large, economically diverse country (such as Brazil) a much higher coefficient will be calculated for the country as a whole than would be calculated for each of its regions.

3.3 Income shares

Another way to measure inequality is by looking at the income share that various subgroups of the population have. For instance the income share of the poorest 10% or 20%. Sometimes this uncovers extra information because it shows where the inequality originates from: are the rich extremely rich or the poor extremely poor? The advantage of this income share number compared to the Lorenz curve, which shows this as well, is that comparing single numbers across time or countries is simply easier. The measure of income shares satisfies four out of the five axioms for inequality measures. It cannot be additively decomposed and it only satisfies the Pigou Dalton principle in the weak form.

3.4 General entropy class measures

Generalized Entropy (GE) class measures satisfy all the desired axioms of inequality measures as Bourguignon (1979) and Shorrocks (1980) have shown. Originally they were used in information theory. Maximum entropy occurs when subjects cannot be distinguished by their resources. When looking at income inequality this means that income earners cannot be distinguished by the income they earn, then there is perfect equality.

[1] Except under conditions data hardly ever satisfy (subgroups are not allowed to overlap in income).

General formula for GE measures:

$$GE(\alpha) = \frac{1}{n\alpha(\alpha-1)} \sum_{i=1}^{n} \left[\left(\frac{y_i}{\bar{y}} \right)^{\alpha} - 1 \right]$$

Where:

y_i = the income of i

$\bar{y} =$ the mean income of group n

$\alpha =$ the weight given to distances between incomes at different parts of the income distribution

For real values $\alpha \neq 0,1$

The outcome of a GE measure can vary between 0 and ∞, where 0 would be perfect equality. The parameter α can take any real value (except for exactly zero or one). It represents the weight given to distances between incomes at different parts of the income distribution. The most commonly used values for α are 0, 1 (both approaching) and 2 which are usually called the Theil-L, Theil-T and half the square of the coefficient of variation. The resulting formulas are shown below.

Theil L-index (mean log deviation):

$$E(0) = \frac{1}{n} \sum_{i=1}^{n} \log \frac{\bar{y}}{y_i}$$

The Theil-L index has a sensitivity to income transfers from poor to rich. The contribution to inequality of a person or group with exactly the mean income is zero because the log of one is zero. The contribution of an individual or group to the total inequality is relatively large if their income is small. The E(0) is more sensitive to changes in the lower tail of the distribution.

Theil-T index:

$$E(1) = \frac{1}{n} \sum_{i=1}^{n} \frac{y_i}{\bar{y}} \log \frac{y_i}{\bar{y}}$$

The Theil-T index has a sensitivity to income transfers from poor to rich. The contribution to inequality of a person or group with exactly the mean income is zero because the log of one is zero. The contribution of an individual or group to the total inequality is smaller than with E(0) if their income is small. The E(1) is relatively more sensitive to changes in the upper tail of the distribution.

Half the square of the Coefficient of Variation:

$$E(2) = \frac{1}{2n\bar{y}^2} \sum_{i=1}^{n} (\mathrm{y_i} - \bar{\mathrm{y}})^2$$

Even more than the Theil-T index, half the square of the coefficient of variation is relatively more sensitive to changes in the upper tail of the distribution.

3.5 Atkinson's inequality measure

Atkinson's inequality measure is a normative welfare-based measure of inequality. It can give more than the partial and ordinal ranking that distributional measures can give. If one country has a higher Theil-T index it is clear that it is more unequal but it is not clear by how much. With the Atkinson index complete and cardinal ranking is possible. This does come at the cost of having to make more stringent assumptions as to how to represent welfare.

The robustness of the outcome of the Atkinson index is weak compared to the distributional measures and needs checking with other welfare-based measures in order to be strong. The Atkinson index satisfies all but one of the desired axioms of inequality measures. It cannot be additively decomposed.

The Atkinson index is directly related to the class of additive Social Welfare Function (SWF) which states that social welfare is represented by average utility. The utility according to Atkinson takes the following form:

$$U(y) = A + B\,\frac{y^{1-\varepsilon}}{1-\varepsilon}, \qquad \varepsilon \neq 1$$

The Atkinson index:

$$A_\varepsilon = \left[\frac{1}{n}\sum_{i=1}^{n}\left(\frac{y_i}{\bar{y}}\right)^{1-\varepsilon}\right]^{\frac{1}{1-\varepsilon}} \quad \varepsilon \geq 0, \varepsilon \neq 1$$

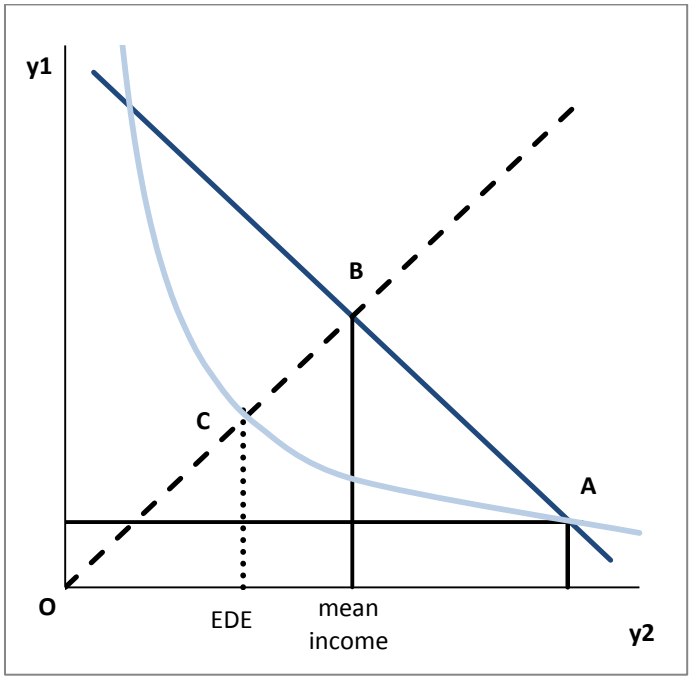
Where ε represents the level of inequality aversion. ε reflects a value judgment by giving relatively more weight to increases in lower incomes as it increases. When ε is close to 0 it gives

the linear utility function, as it approaches 1 it becomes more sensitive to lower tail changes. The measure is useful to determine which end of the distribution contributed most to inequality.

The Atkinson index is also closely related to GE measures from the previous section. For each value of ε there is a GE index where $\alpha = 1 - \varepsilon$ that ranks two distributions in the same way as the Atkinson index for that ε would.

There is another more intuitive way to look at Atkinson's inequality measure; by looking at the Equally Distributed Equivalent (EDE) income. If every person in the economy would have the EDE income, total welfare would be the same as it is with the actual distribution. The figure below presents this concept of EDE. Each axis reports the income of one individual. The current state in the economy is such that point A prevails, where individual y2 has more income than y1. When ε = 0 (no aversion against inequality at all) the utilitarian SWF prevails and there is no possible way to have the same level of welfare with less total income.

Figure 3.2: Atkinson's inequality measure



When there is a certain level of aversion against inequality a convex SWF prevails. Now it is possible to find a point with equally distributed income at a lower level of total income but at the same level of welfare. At point C the incomes of individual y1 and y2 are the same (on the 45 degree line) and the total welfare is the same as in situation A (on the same SWF). Total income is lower in this situation but this is compensated by the utility gain from equality of the

distribution. Inequality aversion is positive and therefore this economy is willing to pay the price of a smaller cake in order to have more equal slices.

With the EDE income equal to point C in the graph, equality can be measured by the ratio OC/OB. When each individual has the same income this is equal to 1 (or if the SWF is utilitarian). The Atkinson Inequality index can then be expressed as:

$$A_\varepsilon = 1 - \frac{OC}{OB} = 1 - \frac{y_{EDE}\sqrt{2}}{\bar{y}\sqrt{2}} = 1 - \frac{y_{EDE}}{\bar{y}}$$

This index shows how much income an economy is disposed to give up in order to have equal incomes.

3.6 Summing up

Table 3.1 gives a summary of the inequality measures discussed in the past sections. Only the entropy class measures satisfy all the desired axioms for inequality measures since they are the only ones that comply with the additive decomposability axiom. The Theil-T index and the Theil-index are both used in the decomposition analysis in section 5.

Table 3.1: Inequality measures

Inequality Measure	Anonymity	Scale Invariance	Population Replication Invariance	Pigou-Dalton Transfer principle	Additive Decomposability
Gini coefficient	X	X	X	X	
Income Shares	X	X	X	1/2	
Theil L coefficient	X	X	X	X	X
Theil T coefficient	X	X	X	X	X
1/2 square of Coefficient of Variation	X	X	X	X	X
Atkinson's measures	X	X	X	X	

4. Ordem e progresso for all?

Brazil's flag is green with a large yellow diamond in the center bearing a blue celestial globe with 27 white five-pointed stars. The globe has a white equatorial band with the motto ORDEM E PROGRESSO which means Order and Progress. Brazil is the ninth economy of the world in GDP/PPP terms (2010, World Bank). But is this progress and economic welfare a reality for all Brazilians? Sometimes Brazil is referred to as Belindia, a combination of a small rich country and a large poor country; Belgium and India (Beghin 2008).

This section elaborates on the inequality in Brazil. Firstly the current situation is given by showing some of the inequality measures discussed in section three. Secondly the history of Brazilian inequality is drawn by showing the development of inequality over time. Lastly Brazil's inequality is put into context by comparing it to other Latin American countries and the rest of the world.

4.1 Inequality in Brazil

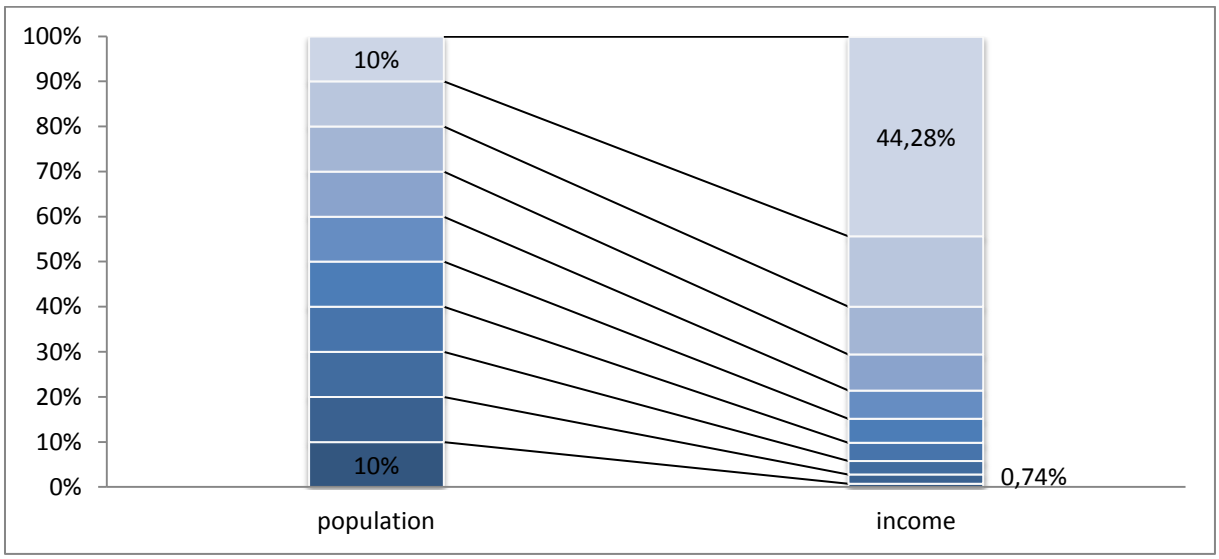
Brazilian inequality is very high; with a Gini coefficient of 0.54 in 2009 the country ranked 8th in the top ten most unequal countries in the world.[2] This while the Human Development Indicator (HDI) is not bad at 0.718 (place 84 in HDI ranking), especially when considering that up from 0.800 a country is considered to be very high developed. When one would adjust the average income for inequality Brazil drops 13 places instantly, holding everything else constant, to place 97 (HDR 2011 page 136). Compared to other countries with high inequality Brazil is highly developed. Most high inequality countries have a relatively low level of development

There are over 203 million people in Brazil (July 2011, CIA world fact book), and their living conditions vary dramatically across the country's regions and states, as well as within them. Income disparities are significant across regions and between rural and urban areas.

[2] Of all countries that had a Gini reported in the Human Development Report 2011

The income shares of the population deciles show a very clear picture of the situation. The poorest 10% of the Brazilian population has to make due with 0.74% of total income. At the same time the richest 10% has 44.28% of total income to their disposal.

Figure 4.1: Brazil's income in deciles (2008)



Source: Author's calculations based on PNAD data

Table 4.1 shows the average income for the income deciles. The average income in the whole of Brazil was R$ 703.45 in 2008 (authors calculations based on PNAD data)[3]. The poorest 10% of Brazil's population has less than 10% of the average income per capita in their country. The richest 10% has almost 6 times the average income to spent. The average income occurs in the group of 70% to 80%.

Table 4.1: Average income per capita for income deciles (2008)

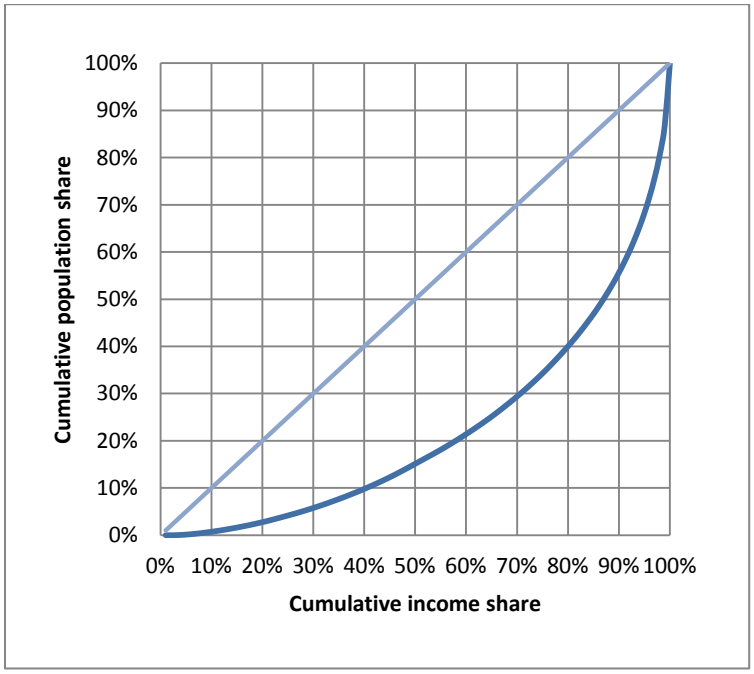
Average income per capita	
poorest 10%	R$ 51.95
10%-20%	R$ 143.06
20%-30%	R$ 212.00
30%-40%	R$ 283.63
40%-50%	R$ 374.20
50%-60%	R$ 442.27
60%-70%	R$ 561.57
70%-80%	R$ 747.13
80%-90%	R$ 1,097.99
richest 10%	R$ 3,114.96

Source: Author's calculations based on PNAD data

[3] This average includes zero incomes, if excluded the average income would be R$ 719.82

Another way to see the income inequality is by looking at the Lorenz curve or Gini coefficient. The figure below shows the Lorenz curve for Brazil for 2008. The Gini that comes with this curve is 0.56 (authors calculations based on PNAD data)[4]. The average income shows as the point where the slope of the convex line is equal to the slope of the equality line. Here that would be somewhere around 75%.

Figure 4.2: Lorenz curve Brazil (2008)

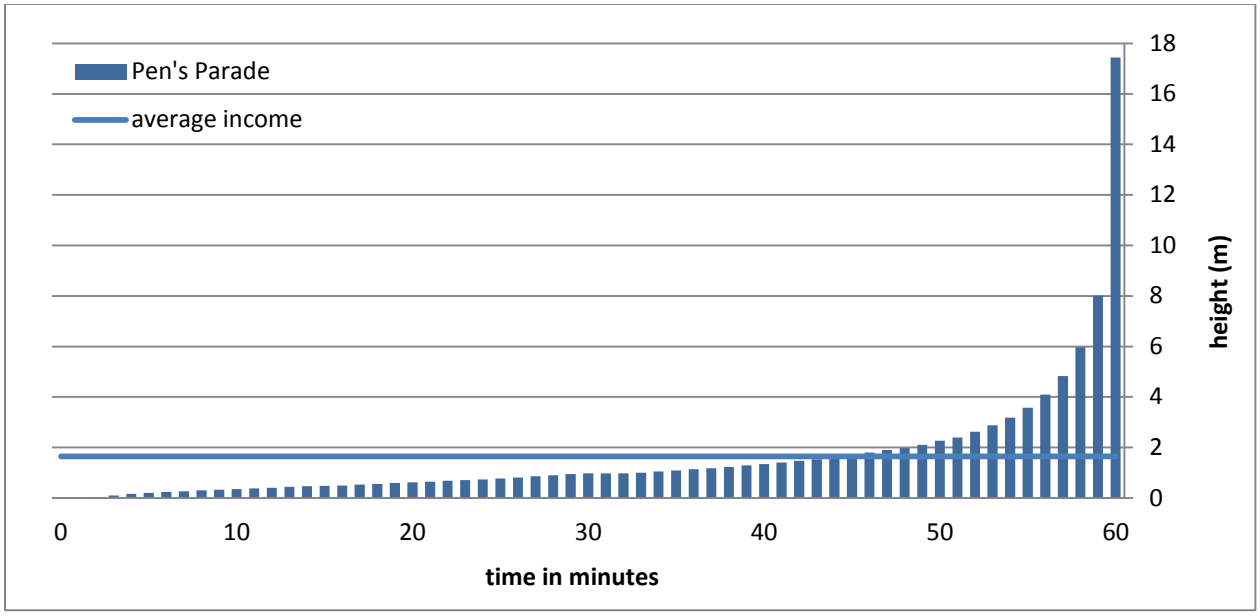


Source: Author's calculations based on PNAD data

The most intuitive way to see the average income compared to the mean is by looking at what is commonly known as Pen's Parade (Pen 1971). All people in Brazil are ranked from poor to rich and walk by in one hour. Their height represent the income they have, so the dwarfs walk by first and the giants last. The average height of a Brazilian is 1.71 meter for men and 1.59 meter for women (IBGE 2010). The average height for all Brazilians used for figure 4.3 Pen's Parade is 1.65 meter.

[4] This Gini includes zero incomes, if excluded the Gini would be 0.54

Figure 4.3: Pen's Parade for Brazil (2008)



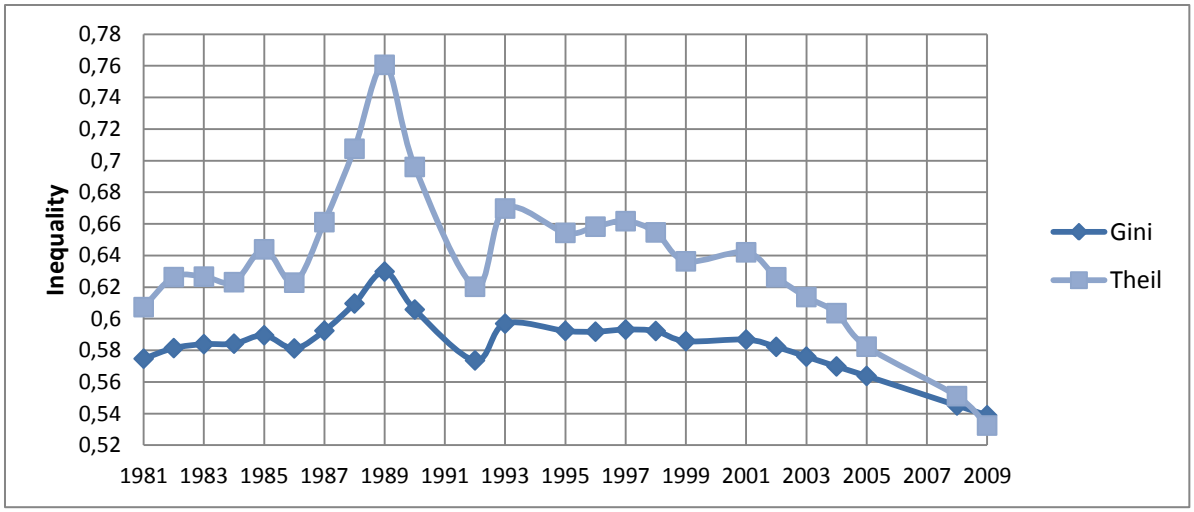
Source: Author's calculations based on PNAD data

The "average" person would not walk by after 30 minutes because at that time we would see people that are about half as long as the average person. Only after 45 min the people walking by are the average height of 1.65 m. In minute 60 the average person that passes is almost 18 meters long!

4.2 How did Brazilian inequality develop? A history of inequality

Brazil's inequality was at a high (or low!) point in 1989; ranking 2nd in the list of most unequal countries in the world, only behind Sierra Leone. In 2009 it ranked 8th with a Gini coefficient of 0.54. As figure 4.4 shows, inequality has been fluctuating over time in Brazil. From the starting point of the graph at a Gini of 0.57 in 1981 up to 0.63 in 1989, and then in goes down to 0.54 in 2009. The Theil index shows the same pattern as the Gini, confirming the trend. Even though Brazilian inequality is still high, progress is made towards steadily lowering it.

Figure 4.4: Brazil's history of inequality (1981-2009)

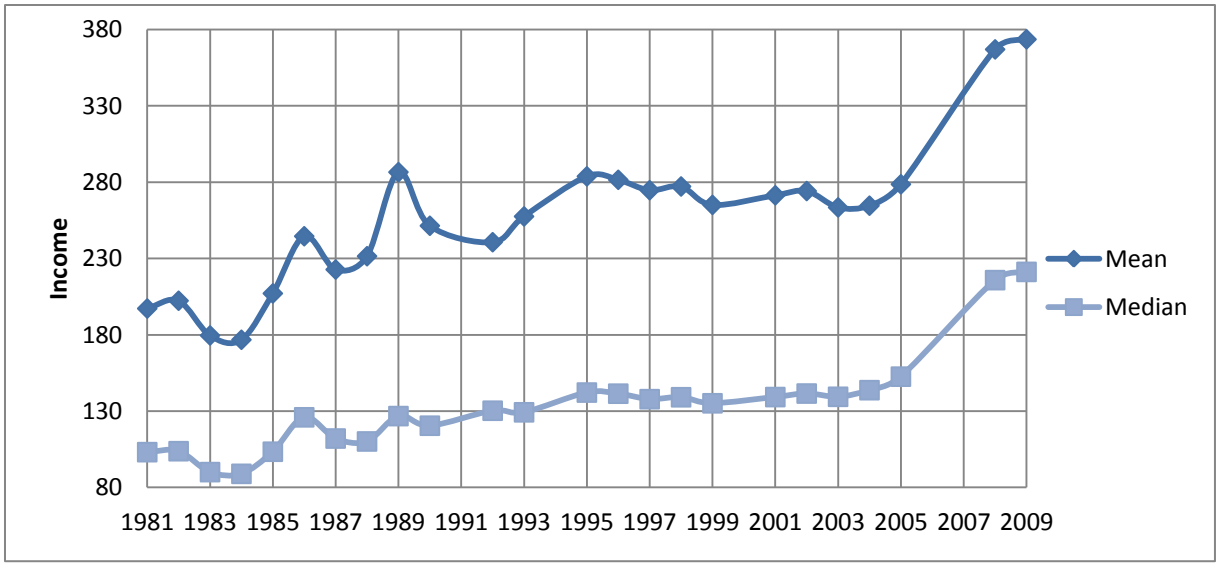


Source: Data from PovCalNet

According to Ferreira et al. (2006) there are three main stages to be discovered in Brazil's inequality evolution. The first period from 1981 to 1989; a steady increase. The second period between 1989 and 1993; a volatile peak period. The last period up to 2004; a steady decline. This decline has definitely continued after 2004. Causes for the rise in Brazilian inequality can be found in rising inflation and increasing average returns to schooling. The reasons for the decline are the reverse: declining inflation and decreasing average returns to schooling, combined with convergence of rural and urban income and 'new' social assistance transfers.

Hailu and Soares (2009) argue that both improvements in education and the direct cash transfers from the state to families and individuals caused Brazilian inequality to decline steadily since 1998. They also suggest that the improved income distribution may indirectly be one of the reasons why the financial and economic crisis did not hit Brazil as hard as other countries. The virtuous pattern of improved income distribution spurred the growth of the domestic market and changes in the structure of demand in the last decade. These, in turn softened the blow of the crisis for Brazil.

Figure 4.5: Mean and Median Monthly income (2005 PPP)

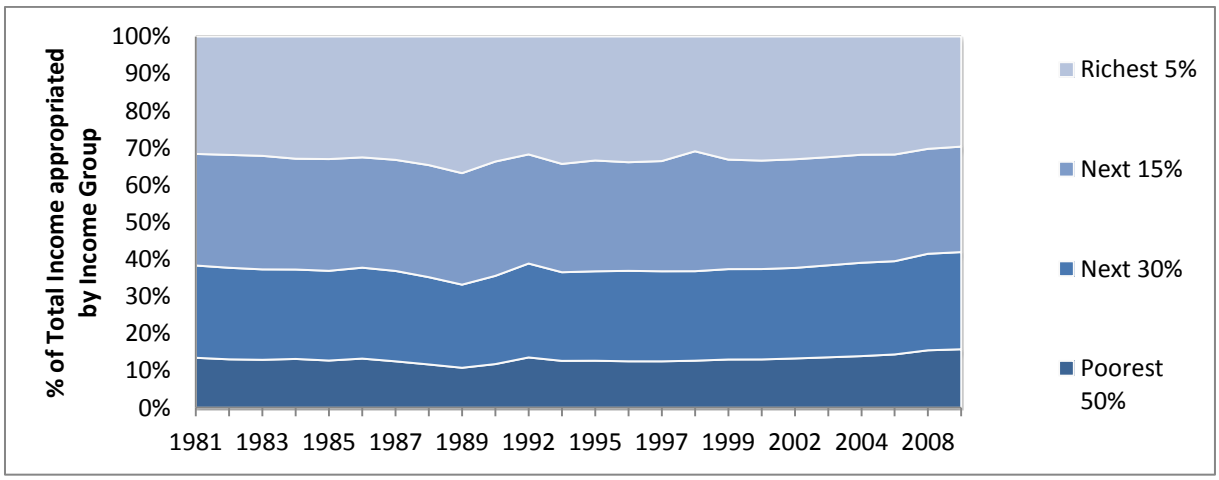


Source: Data from PovCalNet

The median to mean ratio for Brazil ranges from 0.424 in 1989 to 0.592 in 2009. This means that the distribution was extremely skewed to the right, making it so that the poorest 50 percent of the population earn a lot less than 50 percent of the national income. From 1993 on the mean and median income are converging, showing improvement in regard to inequality.

Figure 4.6 gives the development of inequality for some income groups. The rise in inequality in 1989 clearly shows in the division between the groups. Until 2000 nothing really happened but after that very slowly a small shift is visible, transferring relative income towards the poorest and away from the richest. Compared to the overall development the transfer is relatively small.

Figure 4.6: Development of income groups in Brazil (1981-2009)



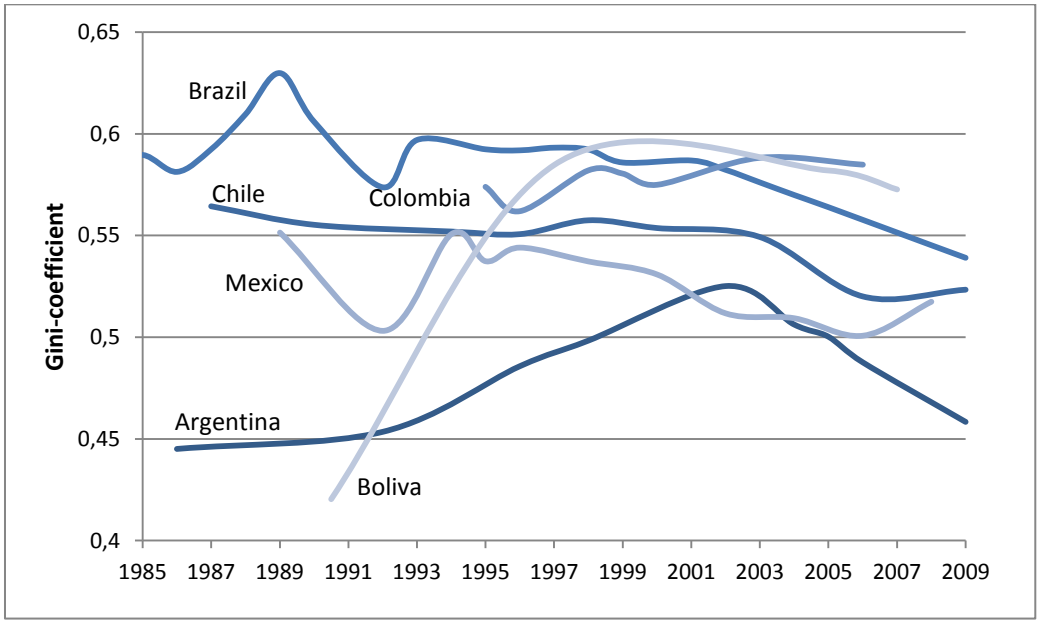
Source: Data from PovCalNet

4.4 Brazilian inequality in context; Latin America & The World

Latin America has a history of high inequality. But even compared to other Latin American countries Brazil has had a relatively high rate of inequality in the past decades. Figure 4.7 shows that until the end of the nineties Brazil was the most unequal country in Latin America when looking at the Gini-coefficient.

Even now only four countries in the region of Latin America and the Caribbean supersede Brazil in inequality: Haiti, Colombia, Honduras and Bolivia. All of these countries have a lower Human Development Index, only one is considered to have high human development like Brazil; Colombia (HDR 2011).

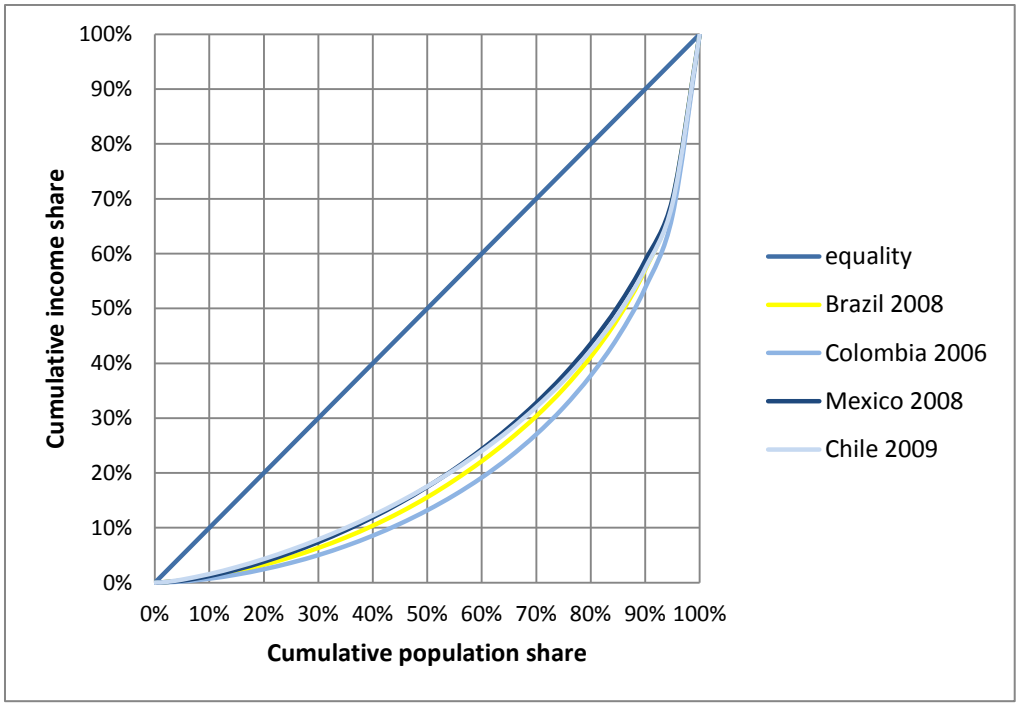
Figure 4.7: Inequality in Latin America, six selected countries (1986-2009)



Source: Data from PovCalNet

Most Latin American countries have seen rising inequality two decades ago but started a steady decline in the past ten years. Gasparini and Lustig (2011) find that there are two main factors behind the decline in income inequality in Latin America from the late 1990's. The first one is a fall in the earnings gap of skilled and low skilled workers, the second an increase in government transfers. The fall in earnings gap was mainly caused by improved macro-economic conditions, market reforms, improvements in the provision of basic education and stronger labor institutions. The increase in social spending was probably due to the improved fiscal situation and the increased concern on social issues. Most Latin American countries adopted or expanded conditional cash transfer programs, evidence suggests they are well targeted to the poor.

Figure 4.8: Inequality in Latin America, Lorenz Curves of Brazil, Mexico and Colombia

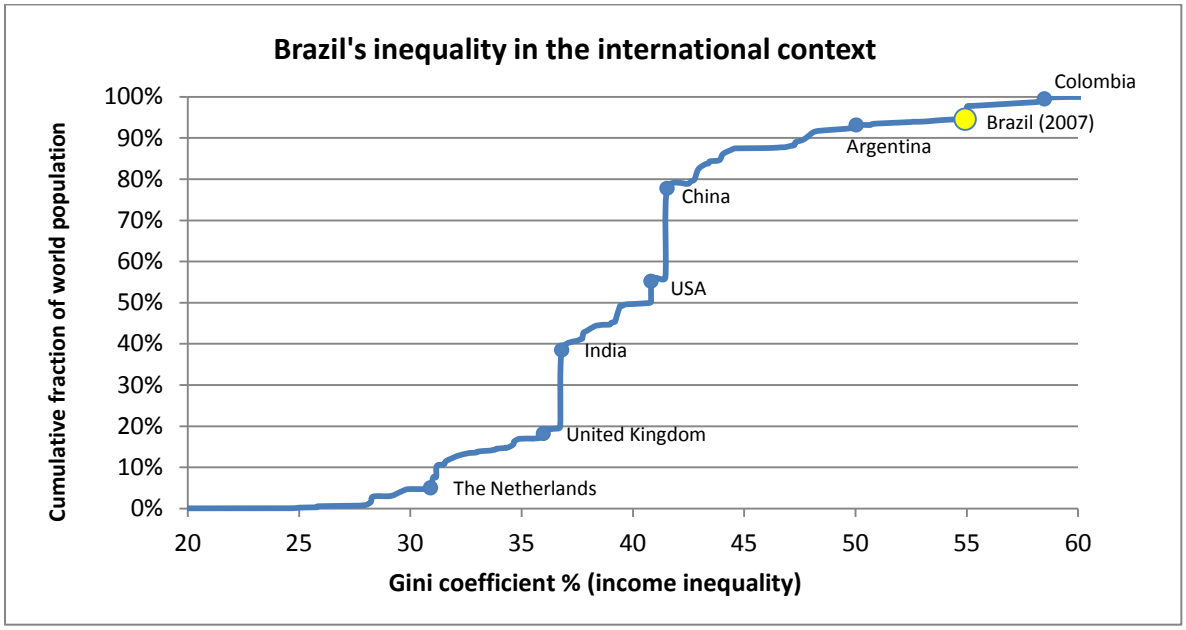


Source: Data from PovCalNet

Figure 4.8 gives the Lorenz Curves for four Latin American Countries. The graph shows that Colombia is more unequal than Brazil and both Mexico and Chile have a lower inequality. The line that represents the inequality in Colombia is further away from the line of perfect equality on every point of the graph than any of the other countries. Between Chile and Mexico it is not clear from the graph which country is more equal than the other because their Lorenz-curves intersect.

The graph is not large enough to clearly show it but under a microscope the Lorenz-curves of Mexico and Chile intersect twice. The first intersection is at around fifty percent of the cumulative population. This shows that the poorest fifty percent of the people in Chile and Mexico have the same share of the total country's income. The distribution within the poorest fifty percent is different though. In Mexico the inequality within this group is larger than in Chile. The poorest people in Mexico have a smaller part of total income. Where the gap starts to close (between twenty and thirty percent) the population has a larger part of income compared to the same group in Chile. The second intersection is just before ninety-five percent of the population, the gap starts to become smaller at eighty percent. This shows that the richest twenty percent of people in Chili are relatively richer than the richest twenty percent of people in Mexico.

Figure 4.9: Brazil's inequality in the international context



Note: Includes 133 countries. Data from 1996-2007
Source: Data from World Bank indicators

Figure 4.9 shows the cumulative distribution of Gini coefficient for 133 countries, where the weight given to its country is proportionate to its population. When comparing Brazil's inequality to that of other countries in the world some comparability problems arise. In some countries data are only collected for urban areas while in others income inequality estimates are unavailable and consumption inequality measures are used. This creates some upward bias for the case of Brazil.

Velez et al (2004) constructed this figure for 1999. Back then Brazil resided in the 99th percentile of the world's population when looking at inequality. Now (2007) Brazil places in the 98th percentile, a little better but not much . Brazil has become more equal, figure 3.4 clearly shows this, but other countries have done so too. Brazil is still one of the most unequal countries in the world.

Figure 4.9 shows that Brazil is accompanied by other Latin American countries in the highest inequality region. The top part of the inequality chart is dominated by African and Latin American countries. Comoros, Haiti and Angola are the top tree most unequal countries for which the World bank judges it has reasonable reliable data.

5. Decomposing Brazil's Income Inequality

The purpose of this decomposition is to see how Brazil's inequality can be broken down into parts of inequality that can be explained by a particular characteristic. To achieve this, the sample of family heads is divided into groups according to a certain variable and inequality within and between these groups is calculated.

Seven characteristics are examined:

- Age of the family head
- Educational attainment of the family head
- Gender of the family head
- Family type
- Race of the family head
- Region of the family home
- Urban or Rural location of the family home

The exact definitions and partitions of the groups can be found in the respective sections that deal with each characteristic. Choices in the partitions follow Ferreira et al. (2006) as much as possible, to add more value to the comparison of outcomes over time.

The measures used to calculate the inequality decomposition are the Theil-T index and the Theil-L index, discussed in section 3.4. The equations for decomposition are described in the next section.

The decompositions will shed some light on the relevance of these seven variables for inequality. The outcomes cannot be added up to show a total percentage of inequality explained, since the correlation between the variables is not accounted for in the decomposition. Section 5.4 shows this correlation between variables by examining the variables education and race together.

5.1 Equations for decomposition

In section 3.4 the entropy class of measures was explored. They satisfy all of the axioms for inequality measures, one of them being that they are decomposable. These measures form the basis for the decomposition of inequality in this section.

Cowell and Jenkins (1995) show that overall inequality equals between group inequality plus within group inequality:

$$I_{Tot} = I_B + I_W$$

Where I_B:

$$I_B = \frac{1}{\alpha^2 - \alpha}\left[\sum_{j=1}^{k} n_j \left(\frac{\bar{y}_j}{\bar{y}}\right)^{\alpha} - 1\right]$$

With:

α = weight of the General Entropy measure;

n = population share;

$\bar{y}$ = mean income;

$\bar{y}_j$ = mean income of group j;

Where I_W:

$$I_W = \left[\sum_{j=1}^{k} w_j \; E(\alpha)j\right]$$

With: $w_j = y_j^{\alpha} n_j^{1-\alpha}$ where n_j is the population share and $y_j$is the income share of each subgroup j.

Cowell and Jenkins (1995) suggest an intuitive summary measure of explained between group inequality, R_B:

$$R_B = \frac{I_B}{I_{Tot}}$$

This measure shows the share of total inequality that can be explained by a particular characteristic. In the next section the explanatory power of seven characteristics is computed using this measure. The two Theil indices will be used for that with E(0) being the Theil-L index or mean log deviation and Theil-T being E(1).

5.2 The data

The data used are derived from household-level micro-data from the Pesquisa Nacional por Amostra de Domicílios (PNAD) for 2008, produced by the Instituo Brasileiro de Geografia e

Estatística (IBGE). These data were collected from a representative national sample of households, with the sample size for 2008 comprising of almost 400,000 individuals, over 125,000 families. The PNAD survey reports each year on a large number of variables pertaining to individuals, families and households.

The definition of income used in the decomposition of Brazil's income inequality in 2008 is gross monthly family income per capita and the population contains all family heads. The choice for family income instead of household income is based on the fact that in the PNAD 2008 there is no variable for household weight but there is a family weight assigned to all families. In this manner the relative importance of the different families in the total sample is respected. Most households consist of one family, in approximately 5.7% of families the family head is not the household head. Inequality is slightly higher when looking at families instead of households since the income per capita is averaged over the total household when there are multiple families living in the same household. The inequality between the families within the household is ignored when looking at the household as a whole.

The PNAD dataset for 2008 consists of data on 391,868 individuals. These individuals belong to 125,224 families. For 3,359 of these families data on family income per capita are not available, these families are excluded from the analysis. For 2,920 families the income per capita reported is zero. While these families are included in the calculations of mean and median incomes they are excluded from the calculations of inequality measures.[5] Data on 118,945 families are left to analyze and decompose Brazil's income inequality.

For a step by step overview of how the data was prepared for analysis, see appendix A.

5.3 Decomposition

In the next subsections seven characteristics of a family or family head are examined. Both the within group inequality and the between group inequality are computed and analyzed to determine how much of Brazilian inequality is accounted for by that particular characteristic.

5.3.1 Age of the family head

The families are grouped into six categories according to the age of the family head. The categories are consistent with those in Ferreira et al. (2006) in order to sustain comparability. The dataset gives every age, not age groups.

[5] E(0) and E(1) cannot be computed including zero incomes.

The table below shows these categories with their population share, income share and mean income. It also shows the inequality within the several groups and between the groups.

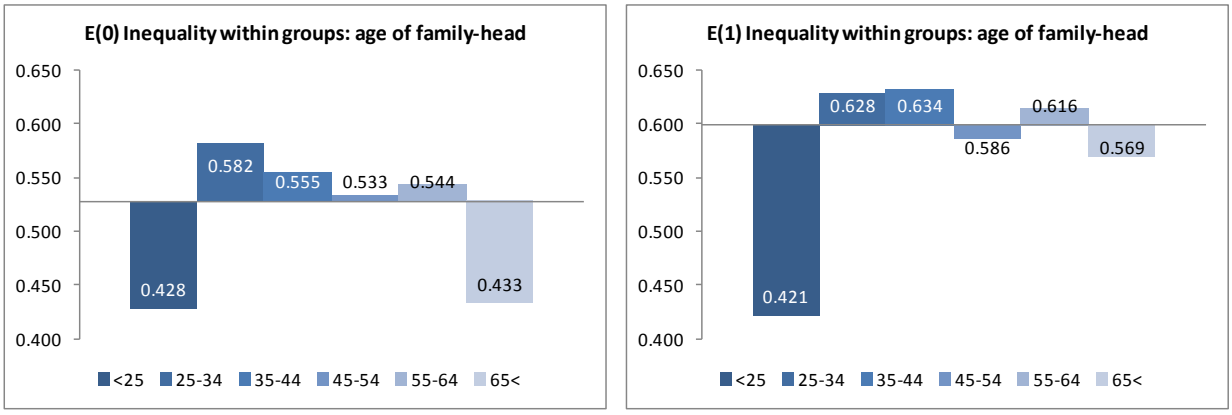
Table 5.1: Inequality within and between groups, age of the family head

Age	pop%	inc %	ŷ	E(0)	E(1)	contr E(0)	contr E(1)
<25	6%	3%	R$ 404	0.428	0.421	0.025	0.014
25-34	20%	16%	R$ 588	0.582	0.628	0.115	0.102
35-44	23%	20%	R$ 623	0.555	0.634	0.127	0.126
45-54	21%	23%	R$ 780	0.533	0.586	0.112	0.133
55-64	15%	19%	R$ 922	0.544	0.616	0.081	0.118
65<	16%	19%	R$ 871	0.433	0.569	0.067	0.107
Between	-	-	-	-	-	**0.023**	**0.022**
Total	100%	100%	R$ 720	0.551	0.621	0.551	0.621

Source: Authors calculations based on PNAD

The average age of a family head in the sample is almost 47 years. The average income of a family seems to increase as the family head is older except for the oldest age group. The oldest group consists of retirees, so it is not surprising they do not earn the highest average income. The most equal group is the group with the lowest income, under 25. The most unequal group is the group from 25 to 34 years old, closely followed by the group between 35 and 44.

Figure 5.1 : The difference between E(0) and E(1), age of the family head



Source: Authors calculations based on PNAD

The figures above show the inequality within groups, both for E(0) and E(1). The horizontal line represents the total within group inequality. When comparing between the two inequality measures it becomes apparent that if a group has a higher than average E(0) it does not necessarily mean it has a higher than average E(1). E(0) is relatively more sensitive to changes in the lower tail of the distribution, so E(0) is relatively lower if the poorest have a little more.

The inequality within the several age groups is much larger than the inequality between the groups. The contribution of between group inequality to total inequality amounts to:

$$R_B E(0) = \frac{I_B}{I_{Tot}} = \frac{0.023}{0.551} = 4\% \qquad R_B E(1) = \frac{I_B}{I_{Tot}} = \frac{0.022}{0.621} = 3\%$$

5.3.2 Educational attainment of the family head

Educational attainment is measured by years of schooling and is split into six categories. The division is different from the division in Ferreira et al. (2006), they use five groups. The use of an extra group could lead to an overestimation of between group inequality compared to Ferreira.

The table below shows these categories with their population share, income share and mean income. It also shows the inequality within the several groups and between the groups.

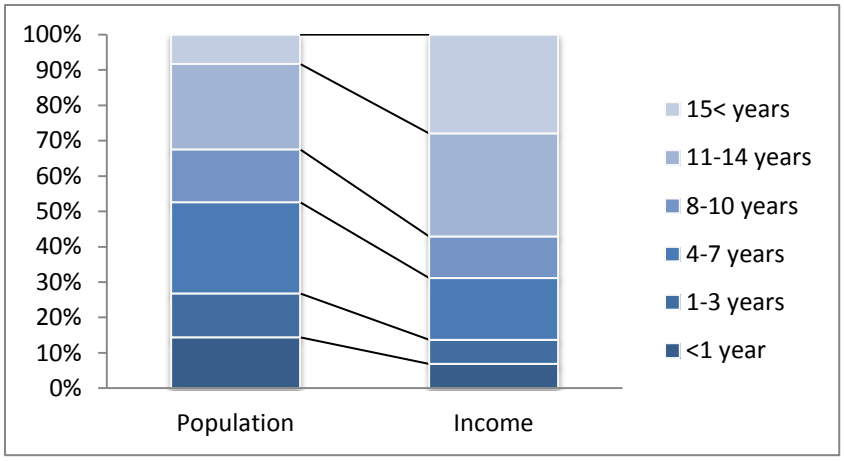
Table 5.2: Inequality within and between groups, educational attainment of the family head

Education	pop%	inc %	ŷ	E(0)	E(1)	contr E(0)	contr E(1)
<1 year	14%	7%	R$ 345	0.309	0.282	0.044	0.019
1-3 years	12%	7%	R$ 397	0.352	0.334	0.044	0.023
4-7 years	26%	17%	R$ 487	0.380	0.400	0.098	0.070
8-10 years	15%	12%	R$ 569	0.402	0.462	0.060	0.054
11-14 years	24%	29%	R$ 868	0.409	0.461	0.099	0.134
15< years	8%	28%	R$ 2,429	0.416	0.411	0.034	0.115
Between	-	-	-	-	-	**0.171**	**0.206**
Total	100%	100%	R$ 720	0.551	0.621	0.551	0.621

Source: Authors calculations based on PNAD

Even without calculating the Theil-indexes it is apparent that education is heavily correlated with income. For every group that has had more schooling, the mean income rises. The group that has fifteen years of schooling or more has around the same income share as the group below them even though it only has one third of its population share. Figure 4.2 shows the differences in percentage population and percentage income between the various educational groups very clearly. More than half of the family heads in Brazil has had less than 8 years of schooling (53%).

Figure 5.2: Inequality between groups, educational attainment of the family head



Source: Authors calculations based on PNAD

The most equal group is the group with the lowest income and less than 1 year of education. The most unequal group is the group that had 11 to 14 years of schooling. When looking only at E(0) the group with the highest education is most unequal. Doing the same for E(1) (less sensitivity towards the lowest income part of the group) results in the highest inequality for the group with 8 to 10 years of schooling, closely followed by the group with 11 to 14 years of education.

A relatively large part of Brazil's inequality can be explained by differences in educational attainment of the family head. The contribution of between group inequality to total inequality amounts to:

$$R_B E(0) = \frac{I_B}{I_{Tot}} = \frac{0.171}{0.551} = 31\% \qquad R_B E(1) = \frac{I_B}{I_{Tot}} = \frac{0.206}{0.621} = 33\%$$

5.3.3 Gender of the family head

The table below shows the categories male/female with their population share, income share and mean income. It also shows the inequality within the several groups and between the groups. The division into the two groups speaks for itself in this case.

Table 5.3: Inequality within and between groups, gender of the family head

Gender	pop%	inc %	ŷ	E(0)	E(1)	contr E(0)	contr E(1)
Male	66%	67%	R$ 731	0.553	0.632	0.363	0.422
Female	34%	33%	R$ 698	0.545	0.599	0.187	0.199
Between	-	-	-	-	-	**0.000**	**0.000**
Total	100%	100%	R$ 720	0.551	0.621	0.551	0.621

Source: Authors calculations based on PNAD

Most of the family heads in Brazil are male (66%). Even without calculating the Theil-indexes it is apparent that the gender of the family head does not have a large influence on inequality. Families with a male family head have an income that is only slightly larger on average than those head by a female. This does not mean that the average income of a male and female worker are the same. The definition of family head to people is likely to be dependent on the person that brings in the biggest income (Ferreira et al. 2006). The gender inequality index in Brazil is quite high at 0.449 in 2009 (HDR 2011 page 140).

The most equal group is the group of families that is headed by a female. The difference is not very large especially when looking at E(0). In E(1) the disparity is a bit larger suggesting that the male group is more unequal when the contribution to inequality is more sensitive to changes in the higher tail of the distribution.

The inequality in Brazil cannot be explained by difference in gender of the family head. The contribution to total inequality is zero:

$$R_B E(0) = \frac{I_B}{I_{Tot}} = \frac{0.000}{0.551} = 0\% \qquad R_B E(1) = \frac{I_B}{I_{Tot}} = \frac{0.000}{0.621} = 0\%$$

5.3.4 Family type

The families are grouped into five categories according to type of family.

- Couple, no kids: there are at least two persons in the family and all persons are over 14.
- Couple with kids: there are at least two persons in the family that are over 14 and there is at least one person under 14 in the family.
- Single parent family: there is only one person over 14 in the family and there is at least one person under 14 in the family.
- Single person family: there is only one person in the family
- Other

The PNAD dataset gave 10 categories with regards to family type. These categories do not exactly match the division used by Ferreira et al. (2006). They were grouped according to their division as far as possible in order to sustain comparability.

The table below shows the five categories with their population share, income share and mean income. It also shows the inequality within the several groups and between the groups.

Table 5.4: Inequality within and between groups, family type

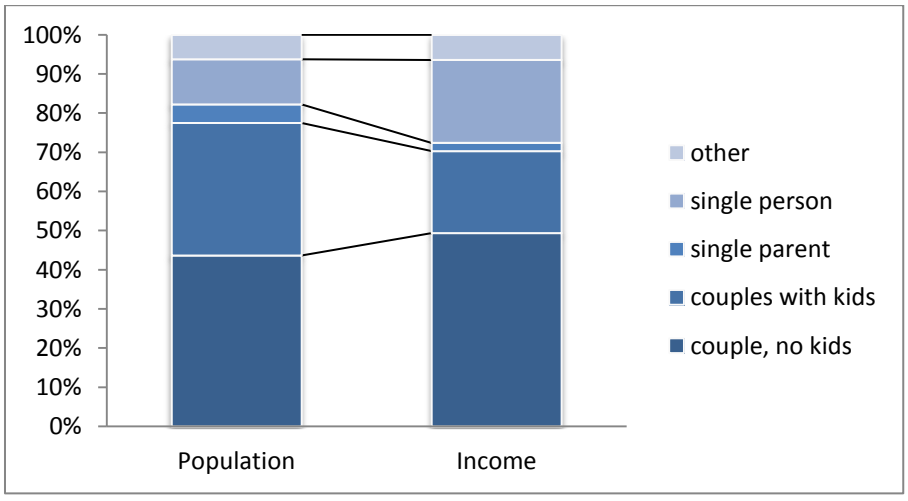
Family type	pop%	inc %	ŷ	E(0)	E(1)	contr E(0)	contr E(1)
couple, no kids	44%	49%	R$ 814	0.447	0.507	0.195	0.251
couples with kids	34%	21%	R$ 446	0.490	0.533	0.166	0.112
single parent	5%	2%	R$ 317	0.522	0.549	0.025	0.011
single person	12%	21%	R$ 1,319	0.532	0.667	0.061	0.141
Other	6%	6%	R$ 742	0.452	0.512	0.028	0.033
Between	-	-	-	-	-	**0.075**	**0.073**
Total	100%	100%	R$ 720	55%	R$ 1	0.551	0.621

Source: Authors calculations based on PNAD

Families without children have a higher per capita income than families with children. This is not surprising since children under fourteen generally do not bring in (much) income. Families with only one person above the age of fourteen are the poorest. Single person families have a larger per capita income than couples without kids but the inequality is larger. This is to be expected since the average of two incomes (some 0) will even out the average compared to one single person. The most equal are the couples without kids. The highest inequality exists in the group of single person families.

Figure 5.3 shows the differences in percentage population and percentage income between the various family type very clearly.

Figure 5.3: Inequality between groups, family type



Source: Authors calculations based on PNAD

A fairly large part of Brazil's inequality can be explained by differences in family type. The contribution of between group inequality tot total inequality amounts to:

$$R_BE(0) = \frac{I_B}{I_{Tot}} = \frac{0.075}{0.551} = 14\% \qquad R_BE(1) = \frac{I_B}{I_{Tot}} = \frac{0.073}{0.621} = 12\%$$

5.3.5 Race of the family head

The families are grouped into three categories according to their race. The mixed race heads of families are put together in one group with black and Indian family heads. This is standard practice in studies of Brazil. The PNAD gives black, brown and Indian race separately now, but in order to sustain comparability over time they are grouped here.

Table 5.5 shows the three categories with their population share, income share and mean income. It also shows the inequality within the several groups and between the groups.

Table 5.5: Inequality within and between groups, race of the family head

Race	pop%	inc %	ŷ	E(0)	E(1)	contr E(0)	contr E(1)
black/mix	50%	34%	R$ 484	0.447	0.481	0.225	0.163
white	49%	65%	R$ 954	0.538	0.609	0.264	0.396
yellow	1%	1%	R$ 1,291	0.574	0.580	0.004	0.007
Between	-	-	-	-	-	**0.058**	**0.056**
Total	100%	100%	R$ 720	0.551	0.621	0.551	0.621

Source: Authors calculations based on PNAD

Half of the people in Brazil are considered to be white and half of the people are of a black or mixed race. Only 0.7% of Brazil's population is considered to be yellow in race. The average income of a black/mixed race person is lower than the average income in Brazil. The mean income of white or yellow race people is higher than average.

The most equal group is the black/mixed race group. They have the lowest income but share it more equally than the other groups. The highest inequality exists in the yellow race group but this group is closely followed by the white race group.

The E(0) measure is larger for the yellow race group and the E(1) is bigger for the white race group. This means that when the contribution to inequality is more sensitive to the lower incomes the yellow race group is more unequal. When relatively more weight is given to the higher end of the group, the white race group is more unequal.

Race has a fairly large influence on the inequality in Brazil. The total contribution of race of the family head to total inequality amounts to:

$$R_B E(0) = \frac{I_B}{I_{Tot}} = \frac{0.058}{0.551} = 11\% \qquad R_B E(1) = \frac{I_B}{I_{Tot}} = \frac{0.056}{0.621} = 9\%$$

5.3.6 Region of the family home

The families are grouped into five categories according to the region of the family home. The regions chosen are the five official, standard geographical regions in Brazil: North, North-East, South East, South and Centre-West.

The table below shows these categories with their population share, income share and mean income. It also shows the inequality within the several groups and between the groups.

Table 5.6: Inequality within and between groups, region of the family home

Region	pop%	inc %	Ŷ	E(0)	E(1)	contr E(0)	contr E(1)
North	7%	5%	R$ 496	0.474	0.530	0.034	0.026
North-East	27%	16%	R$ 446	0.582	0.693	0.155	0.114
South-East	43%	52%	R$ 859	0.486	0.567	0.209	0.292
South	16%	18%	R$ 842	0.438	0.500	0.068	0.091
Centre-West	7%	9%	R$ 852	0.575	0.682	0.043	0.060
Between	-	-	-	-	-	**0.041**	**0.037**
Total	100%	100%	R$ 720	55%	0.621	0.551	0.621

Source: Authors calculations based on PNAD

Almost half of the population lives in the South-East region of Brazil. The average income in the North and North-East region is lower than the average income in Brazil. The income in the South-East, South and Centre-West are higher than average. So it seems the North part of Brazil is poorer than the South part of Brazil. The most equal region of Brazil is the South. The region with the highest inequality is the North-East closely followed by the Centre-West.

The region of the family home has some influence on inequality. The contribution of region to total inequality amounts to:

$$R_B E(0) = \frac{I_B}{I_{Tot}} = \frac{0.041}{0.551} = 7\% \qquad R_B E(1) = \frac{I_B}{I_{Tot}} = \frac{0{,}037}{0.621} = 6\%$$

5.3.7 Urban or rural location of the family home

The families are grouped into two categories according to the location of the family home, either Urban or Rural.

The table below shows these categories with their population share, income share and mean income. It also shows the inequality within the several groups and between the groups.

Table 5.7: Inequality within and between groups, location of the family home

Location	pop%	inc %	ŷ	E(0)	E(1)	contr E(0)	contr E(1)
Urban	85%	92%	R$ 783	0.530	0.603	0.450	0.557
Rural	15%	8%	R$ 364	0.460	0.499	0.070	0.038
Between	-	-	-	-	-	**0.031**	**0.026**
Total	100%	100%	R$ 720	0.551	0.621	0.551	0.621

Source: Authors calculations based on PNAD

The largest part of the Brazilian population lives in urban areas, only 15% of the people live in areas that are considered to be rural. The average income of families living in rural areas is not even half the average income of families that live in urban areas. The inequality within the group of families that live in rural areas is smaller than the inequality within the group of families living in urban areas. In rural areas they have a lower average income but it is spread more evenly among the families.

The rural or urban location of the family home has some influence on inequality. The contribution of location to total inequality amounts to:

$$R_B E(0) = \frac{I_B}{I_{Tot}} = \frac{0.031}{0.551} = 6\% \qquad R_B E(1) = \frac{I_B}{I_{Tot}} = \frac{0.026}{0.621} = 4\%$$

5.4 Combining race and education

Section 5.3.2 and 5.3.5 showed the within and between group inequality for the variables race and education. They both proved to have a significant influence on average income and therefore on income inequality. In this section both these variables are combined to show how much inequality is left within the groups when accounting for both education and race.

Table 5.8 shows the population shares of the groups. The total column states that 50% of the Brazilian population is of black/mixed race. The total row shows that 14% of the Brazilian population has less than one year of schooling. The first cell states that 10% of the Brazilian population is of black/mixed race and has less than one year of schooling. The combination shows that there is a disproportionate share of people with a black/mixed race that have less than one year of schooling. The opposite goes for people with a yellow race and over fifteen years of schooling.

Table 5.8: Race & education, population percentage by group

Race \ Education	<1 year	1-3 years	4-7 years	8-10 years	11-14 years	15< years	Total
black/mixed	10%	7%	13%	8%	10%	2%	50%
White	5%	5%	12%	7%	14%	6%	49%
Yellow	0.05%	0.03%	0.13%	0.09%	0.19%	0.16%	0.66%
Total	14%	12%	26%	15%	24%	8%	100%

Source: Authors calculations based on PNAD

Table 5.9 shows the income shares of the groups. Combined with table 5.8 some conclusions can be drawn on the income inequality between groups. For example: 14% of the Brazilian population are white with 11-14 years of schooling and they earn 19% of the total income. Only 6% are white with fifteen or more years of schooling but this group earns 22% of the total income in Brazil. In general, and as expected from the decompositions before, income increases with education. The average income for people of a black/mixed race are lower than of white race, while yellow earn an even higher income.

Table 5.9: Race & Education, income percentage by group

Race \ Education	<1 year	1-3 years	4-7 years	8-10 years	11-14 years	15< years	Total
black/mixed	4%	3%	7%	5%	9%	5%	34%
White	3%	4%	10%	7%	19%	22%	65%
Yellow	0.02%	0.02%	0.16%	0.08%	0.28%	0.63%	1.19%
Total	7%	7%	17%	12%	29%	28%	100%

Source: Authors calculations based on PNAD

The above gives some information about inequality between the groups, but how about inequality within these groups? Before calculating the actual inequality within the groups there are already some expectations about these inequalities. The lowest inequality is expected to establish itself in a group that has a low average income. For when everyone is poor, there is not much inequality. Most likely the most equal group has had less than one year of schooling.

Predicting the group with the highest inequality is a little harder, for it depends how far along the Kuznet's curve you expect to be. Most likely the most unequal group will have had a relatively good amount of schooling but not the highest. With some education but not all, the group is expected to be relatively heterogeneous and unequal.

Tables 5.10 and 5.11 show the within group inequalities E(0) and E(1) respectively. As expected the lowest inequality exists in the groups with one year of schooling, with the yellow race ending in first place. The highest inequality manifests itself in the 8-10 years of schooling group, with

again the yellow race at the top end. So the yellow race is both the most equal and the most unequal group when the education is also accounted for. This would not have been clear by just looking at the inequality within the yellow race group.

Again it is true that having a higher than average E(0) inequality does not necessarily mean having a higher than average E(1) inequality. This goes for the white race in total. But the difference in measurement of E(0) and E(1) also very apparent in the some of the other groups. Yellow race 1-3 years of study schooling for example. The inequality is much larger when looking at E(0) than E(1) suggesting that there is a relatively large group of people with almost no income such that they would not contribute much to inequality in E(1).

Table 5.10: Inequality within groups of same race and educational attainment E(0)

Race \ Education	<1 year	1-3 years	4-7 years	8-10 years	11-14 years	15< years	Total
black/mixed	0.303	0.340	0.350	0.369	0.365	0.458	0.447
White	0.290	0.322	0.360	0.395	0.403	0.388	0.538
Yellow	0.284	0.407	0.321	0.476	0.343	0.413	0.574
Total	0.309	0.352	0.380	0.402	0.409	0.416	0.551

Source: Authors calculations based on PNAD

Table 5.11: Inequality within groups of same race and educational attainment E(1)

Race \ Education	<1 year	1-3 years	4-7 years	8-10 years	11-14 years	15< years	Total
black/mixed	0.267	0.314	0.344	0.391	0.366	0.438	0.481
White	0.283	0.314	0.397	0.478	0.476	0.391	0.609
Yellow	0.211	0.302	0.313	0.535	0.302	0.420	0.580
Total	0.282	0.334	0.400	0.462	0.461	0.411	0.621

Source: Authors calculations based on PNAD

As with the seven variables discussed in the previous sections a calculation can be made of the contribution to total inequality. The combination of race and education has the following contribution to inequality in Brazil:

$$R_B E(0) = \frac{I_B}{I_{Tot}} = \frac{0.191}{0.551} = 35\% \qquad R_B E(1) = \frac{I_B}{I_{Tot}} = \frac{0.224}{0.621} = 36\ \%$$

The combined contribution of education and race is lower than the sum of the contributions of education and race when calculated separately. This is as expected since now the correlation between race and education is accounted for. Simply adding up the contributions of education and race would lead to an overestimation of their contribution to inequality by seven percentage points for E(0) and six percentage points for E(1).

5.5 Summing up

Section 5.3 showed the within and between group inequality for seven variables that could affect inequality in Brazil. Table 5.12 gives a summary of all the between group inequality that is accounted for by these variables.

Table 5.12: Decomposing Brazil's Income inequality

	E(0)	E(1)
Education	31%	33%
Family type	14%	12%
Race	11%	9%
Region	7%	6%
Urban/Rural	6%	4%
Age	4%	3%
Gender	0%	0%

Source: Authors calculations based on PNAD

It is clear from this table that education is by far the biggest determinant in income inequality in Brazil. Family type and race come in second and third at a distance. Regional disparities and urban/rural differences seem to have a contribution too while gender does not seem to play a role at all. The percentages cannot be added up to find the total inequality explained since the variables are correlated and the decomposition does not control for these interactions. The percentages do however shed some light on the relevance of the different determinants of inequality.

Section six contains some further analysis on the outcomes and gives a comparison of the decomposition of Brazil's income inequality over time.

6. Trends in Inequality

Section five statically decomposed Brazil's income inequality for 2008. This section looks at the development of the determinants of inequality trough time. Ferreira et al. (2006) computed and analyzed these data for 1981, 1993 and 2004. The 2008 data are added to theirs in order to see how the trends develop. It is important to note again that the percentages represent correlation between a variable and inequality between groups. The outcomes do not state the direction of a causal relationship nor do they exclude any correlation between the analyzed variables. The percentages should therefore not be added up. The outcomes do however show a development of the correlation of several variables with inequality. Suggesting what influences inequality more or less through time.

Table 6.1 : Decomposing Brazil's income inequality over time

	1981		1993		2004		2008	
	E(0)	E(1)	E(0)	E(1)	E(0)	E(1)	E(0)	E(1)
Education	38%	42%	34%	36%	35%	38%	31%	33%
Family type	6%	7%	6%	7%	10%	11%	14%	12%
Race	n.a.	n.a.	13%	11%	12%	11%	11%	9%
Region	13%	11%	9%	7%	10%	8%	7%	6%
Urban/Rural	17%	13%	9%	6%	7%	5%	6%	4%
Age	1%	1%	1%	1%	3%	2%	4%	3%
Gender	0%	0%	0%	0%	0%	0%	0%	0%

Source: Authors calculations based on PNAD

The variable of education seems to be losing importance in Brazil's income inequality. Even though the calculations for 2008 overestimate the influence of education compared to the calculations of Ferreira et al. in earlier years (see section 5.3.2). Educational attainment of the family head is still by far the most relevant variable in the equation, but since 1981 it has lost some explanatory value. Part of the reason for this is probably the fact that more and more people have a higher education in Brazil and the return on (basic) education is lower than before.

Family type is gaining ground when it comes to explanatory power in income inequality in Brazil. Ferreira et al. already saw a considerable increase and towards 2008 it increases further. This trend is likely to continue in the coming years. In developed countries family type is a common correlated variable with income. Single parent families tend to have lower income, while single person households have a higher income.

Race is becoming less important in explaining inequality. Ferreira et al. concluded in their paper that racial differences appear stable between 1993 and 2004. Combined with the 2008 data however, race seems to be losing importance when it comes to inequality in Brazil.

Both the spatial variables are losing importance when it comes to explaining Brazil's inequality. Whether the family home is located in an urban or a rural area and in which region is becoming less and less important to the average income of a family. Ferreira et al. indicated the development of these two variables as most remarkable as it suggest a process of income convergence between the regions and rural and urban areas in Brazil. The decline in explanatory power continues towards 2008, confirming the suggestion of Ferreira et al.

The age of the household head is not a big determinant in inequality in Brazil, but is becoming more important. Ferreira et al. find small indicators that lifecycle effects may be gaining importance in Brazil's labor market. The development from 2004 to 2008 confirms the increasing correlation between age and income that was somewhat visible before.

Gender was not of significant importance before and is not now, according to the data. As mentioned earlier this does not mean that the average income of a male and female worker are the same. The definition of family head to people is likely to be dependent on the person that brings in the biggest income. The gender inequality index is 0.449 and ranks 80th (HDR 2011).

Bourguignon et al. (2007) analyzed five observed circumstance variables (father's and mother's schooling, father's occupation, race and region of birth). They find that this group of variables account for ten to thirty-seven percent of the total earnings inequality in Brazil. Parental schooling is by far the most important variable with sixty-five to seventy percent of total effect of observed circumstance. This adds to the finding in Ferreira et al. (2006) and this thesis' that educational attainment is the most influential variable in inequality in Brazil. Both in inequality of opportunity and in overall income inequality.

7. Conclusions and Further Questions

Not everyone in Brazil has a second house near the beach even though some Brazilians like to believe so. Brazil is one of the most unequal countries in the world. This thesis investigated the development of trends in determinants of inequality between 2004 and 2008.

Some countries are more unequal then others, underlying reasons can be found in many directions. Ethnic fractionalization, the distribution of education and skill levels as well as politics have proven to be correlated to inequality. Kuznets' curve shows that the level of development of a country is of importance as well. Rural-urban migration and industrialization have a significant influence on the development of inequality as countries develop. A more equal society is not always to be preferred over a more unequal one.

Brazil combines a large skill and educational gap in the labor force with a relatively large wage-skill premium, causing big differences in labor income. Public pensions in Brazil have been highly regressive in the past compared to those in the United States. Segmentation and discrimination play a relatively large role in inequality in Brazil as well.

Since inequality measures the dispersion within a certain distribution, the determinants of that distribution are also the determinants of inequality. In general shortcuts are used by researchers in order to find the determinants, rather than building a full general equilibrium model. Even though it has obvious limitations a single number decomposition can shed some light on the relevance of variables and the development of this relevance through time. Many different variables are used in investigating the determinants of inequality. This thesis uses seven commonly used characteristics in a decomposition analysis.

There are various types of inequality measures, like the Gini-coefficient, income shares, entropy class measures and Atkinson's measures. Out of the examined measures only the entropy class measures satisfy all the desired axioms for inequality measures since they are the only ones that comply with the additive decomposability axiom. Additive decomposability is required for the decomposition analysis in this thesis.

Income inequality is very high in Brazil, especially for a country as developed as Brazil. The Gini- and Theil-coefficients as well as Pen's Parade and the differences between medium and

mean income show the same picture; high inequality, may it be in a different manner and development.

Brazil's inequality was at a high (or low!) point in 1989; ranking 2nd in the list of most unequal countries in the world. In 2009 it ranked 8th with a Gini coefficient of 0.54. Latin America has a history of high inequality compared to the rest of the world. Brazil places in the 98th percentile when the countries of the world are ranked from most equal to least equal. Over time the level of inequality has fluctuated, but since 1993 it started to decline and from 2001 on a steady decline is visible.

This thesis decomposed the inequality in Brazil. Out of the seven examined characteristics the educational attainment of the family head turned out to have the largest correlation with differences in income between families. Family type, the race of the family head and the location of the family home are also important determinants of income inequality in Brazil. The gender of the family head has no explanatory power, most likely due to endogenous choices that determine headship status. Age of the family head does not have much influence but the relevance has grown in the past ten years, suggesting that lifecycle effects may be gaining importance in the labor market. Family type has also shown increasing importance as a determinant of income inequality. The location of the family home and the race of the family head seem to have become less important in the past thirty years.

The decompositions shed some light on the relevance of the seven variables for inequality. The outcomes cannot be added up to show a total percentage of inequality explained, since the correlation between the variables is not accounted for in the decomposition. When accounting for correlation between the variables education and race, their combined contribution to inequality in Brazil decreases to 35%. Separately, race and education account for 11% and 31% respectively when looking at E(1).

When looking at inequality within groups the most equal group tends to be the group with the lowest income. These groups have a low average income but the total income of the group is relatively evenly spread among the members of the group. This is congruent with the theory behind Kuznets' curve.

This descriptive thesis has mainly shown the development of Brazil's inequality and has particularly added to the insight in the development of determinants of inequality in Brazil in the past years. It shows that most trends, suggested in earlier research, continued on in the past

years. Especially the increasing correlation between family income and age of the family head, which was somewhat unclear before, has been confirmed.

Questions for future research regard to whether the developments will continue in the coming years or that trends will be breached: Will Brazil continue this path of decreasing income inequality? Will family type and age of family head become even stronger as determinants in inequality? Will geographic factors continue to decrease in importance? In other words will the convergence between locations push through?

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