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Increase of income inequality in crisis periods applied to Colombian society.

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Dedication and acknowledgements

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Chapter 1

Introduction

In the following investigation the inequality problem will be analyzed specifically the different factors that can improve or worsen inequality indexes. Especially the condition that will be analyzed in more detail is the influence of crisis periods in income inequality. The scope of this thesis will be primarily focused on Colombian society. However additional investigation that includes other countries will be done as well, particularly to prove the significance of the results of the performed experiments when applied to different societies and contexts.

A theoretical analysis will be done to identify the main factors that affect inequality. In the next pages the situation of different countries will be analyzed and compared in order to better understand the behavior of this variable. Also statistical model will be created in order to verify the hypothesis made with theoretical bases. The model will be performed to Colombian situation at first and then it will be translated to a set of other countries in the world to verify the results of the study.

Inequality is one of the most evident repercussions of unsuccessful or evolving economic systems. Particularly in developing countries the inequality most common measures sign the problematic with the higher levels around the world ‚Äì With exception of some successful systems that deal with this inconvenient- In the particular case of Colombian society the problem needs to be addressed ‚Äì been one of the most unequal countries of its region- However, the main goal of this thesis is study the relationship and possible correlation between increase of inequality in crisis periods of the economic cycle.

Particularly analyzing the Colombian society situation supported by the collected official data of that republic and also taking into account the effect that a period of time defined characteristics have had in other countries' economies. This work will follow a logical sequence to analyze the problem. Starting from the basics and going through the more complex parts of the problem.

This study intends to show an overview of the Republic of Colombia in different fields working as a diagnostic, studying the consequences that an economic crisis period can bring -stressing the fact that a crisis period is very likely to worsen the inequality problem- and exalting economic potential and strengths, such as, its geographical position, the increase in the number of people being educated and better disposition on the part of the government to achieve peace, with which it is hoped to improve internal conditions of the country and therefore improve the economic conditions of its inhabitants.

Under this standpoint this work is intended to make a reference on how this problematic could be attacked in a -vulnerable situation (crisis) - for different subgroups present in any society, such as, race minorities, low qualified workers, women, rural populations, among others. Highlighting its weaknesses and great existing opportunity differences in this nation. This is intended to be achieved through initiatives that will allow recovering the countryside, improving the situation in different forgotten economic sectors and working on the disparity that some groups suffer. Making emphasis in education and government investment for developing sectors.

Chapter 2

Inequality

2.1 The concept

To start we have to define the concept in order to make a precise investigation with well-defined boundaries. In the first place we understand an inequality as a miss distribution of any given resource in a determined group of individuals, in other words a specific population. This resource can be any given good or even service according to the necessities of the group.

In economic terms this measurement is done to a set of individuals that belong to a state or government; or even more selected groups when we talk about a region of a country or even a city. We also have to take into consideration that there will always be differences in the amount of a given resource or service that a person has. The important thing is determine whether these differences are normal or not. Consequently it is necessary to clarify which criteria are used to conclude if there are normal differences or not.

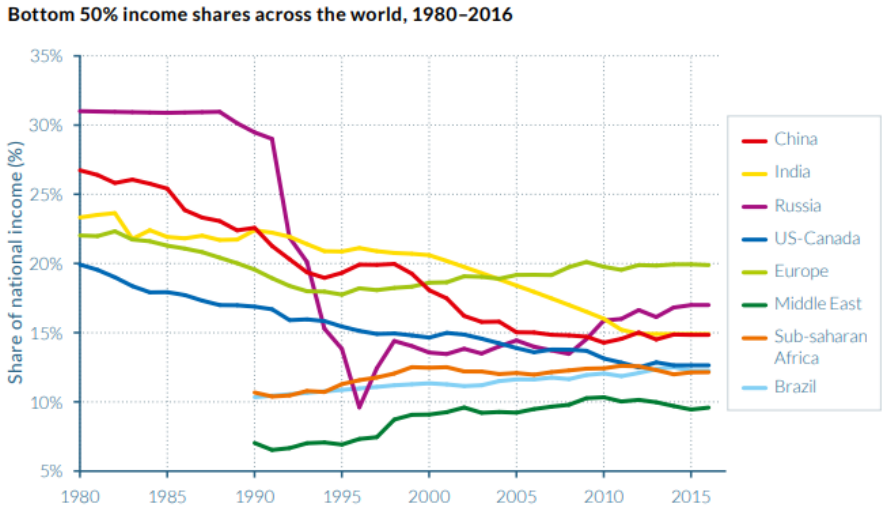


FIGURE 2.1. Bottom 50 percent income shares across the world, 1980- 2016. Figure reproduced from [18]

In the case of this work we will prioritize on income inequality also known as income disparity. We will analyze the different perspectives that governments had taken in time in order to compare the results of the programs and make valid conclusions that could lead to a progress in a given country or state by replicating the whole or a part of a program in the one that is been implemented at the moment.

2.2 Income

In the other hand we have to define what exactly income is. In the first place we have to take into account cash and non-cash components as a part of a whole. So we can define it as any remuneration received by a person in return of a performed activity, this includes salary and all other sources of remuneration like businesses and return of investments. Regarding this subject there are many ways in which income can be accounted. For instance it can be presented as the sum of all the income perceived by each member of a family or the income received by a specific individual and its comparison with other individuals.

The main objective of this work is to make an analysis about the situation that is occurring in Colombia with respect to the income inequality. Taking into account past history, as well as the progress that has been done by the government and the current situation of its citizens and general economy.

Income disparity is a big problem in modern societies. Even the most developed countries in the world have big differences in the income perceived of its citizens, obviously this can be considered as a normal situation since each individual contributes in a different proportion to society and consequently the incentives given back from society in the form of money or any of its equivalents is higher or lower.

This is a pretty valid argument and is the base of the current economic system however this discussion has place only if each and every one of the individuals of a society have a minimum amount of commodities and social services that allows to live a comfortable life with at least the minimum necessary and this is not the case especially in underdeveloped countries where the percentage of people considered poor is way higher than it should be.

2.3 Perfect equality, A reasonable goal?

The purpose of this thesis is not to argue that perfect equality should be the objective of any economy since it is well known that inequalities are good economically speaking. By promoting individual to improve and try to be better in a given activity, society is pushed forward by the development that is generated competing. And clearly the motivation behind all this is the

incentives associated.

This can be exemplified by the economic models implemented in countries such as Venezuela and Cuba. The final goal of those economic systems was absolute equality. The problem is that by implementing these systems people slowly begin to reduce its efforts since they are no incentives for doing it. The other problem with such economic models is that reaching a state of perfect economic equality does not necessarily mean wellbeing for the whole population. Equality can be reached and might be that all individuals of the society life in poor economic conditions.

Substitution towards skilled labor within industries occurred in all ten developed countries that we studied in the 1970-90 period, despite constant or increasing relative wages of skilled labor [4].

Taking into account the arguments exposed previously communism and equality as a final goal can lead to bad results. However when speaking of underdeveloped countries with high poverty percentages the strategies implemented by governments should be radically different from those of developed countries in Europe or North America.

For these specific countries that are in a situation of underdevelopment reducing poverty levels and increasing employment rates should be a priority. In this situation is valid to talk about a government intervention and a redistribution of wealth. It is a situation in which people that is born in a bad economic situation has very low chances of escaping from that poverty. Education must be a priority in government‘s plans and not only accessibility to education but also quality and support.

If we have a society in which the majority of people have a good purchasing power and the necessary mediums to contribute to society it is very likely that economy will grow and labor force of the country can be multiplied and in advantage with other countries if the education levels are higher and members of the same are highly qualified.

Also it is valid to discuss whether a liberal view has more benefits than a Keynesian one. Taking into account the conditions previously explained a liberal view could not be very efficient. In conditions of high percentages of poverty the state should interfere and coordinate closely the distribution of wealth.

The perfect example in this regard is Singapore. It is the exemplification of a liberal economy the results in terms of GDP growth had been amazing however by reducing taxes and letting economy going by itself the most unfortunate individuals are those that do not have a good economic situation. People that have money make more money and those who are poor conditions

become poorer.

Liberal economy definitely works but a research should be done to study if a bigger intervention of government could help reduce the gap. In the last decades the economic gap between rich and poor has become bigger but it seems like this is not a priority for the government since a lot of people is visiting that country to make investments and bring money. The problem is that the other part of the population must also be taken into account and have the exact same rights that any other person has. It is not very logical to think that under the same government there are many persons that can be considered millionaires worldwide and people that cannot bring bread to the table. These kinds of minorities are those that should be protected by governments to try to guarantee well being for everyone.

Since most of these problems are not fixed as fast as we would like to, some members of the group will try to find immediate solutions. One very obvious consequence is migration to other countries where situation could be much better and even the power of a foreigner currency can be significantly stronger than domestic one. The majority of the people that is forced to migrate are people with low education levels and high economic necessities but there is also a small part of individuals that are well prepared and can find better professional opportunities abroad. Causing well prepared individuals to be wasted.

Underdeveloped countries have a great potential to improve their GDP and wealth since there are a lot of fields that can be improved. In the one hand the labor force of the country has not reach its full potential since a big part of the population is not well prepared in terms of education and formation. Meaning there is a lot of room for growing.

On the other hand in many Latin-American countries economy is based in the exploitation of natural resources such as natural gas or petroleum and also mining of carbon or others. However for the construction of a prosper economic program is not necessary to count on natural resources. If a country base its economy purely on the exploitation of mineral resources or other resources there is a risk on depending exclusively from this capacity. In this aspect there is also a lot of room for growing for economy not to depend exclusively from exploitation of natural resources and rely in the capacities and the production made by its own members.

Now it would be interesting to see what happens in a situation of economic crisis. What happens as a result in terms of economic inequality? Does the gap between rich and poor becomes closer or does it gets wider? This is the most significant question to be answered as a result of this work.

When we think of a healthy economy and we analyze equality condition, most of the time inequality indicators a very low. Casually or maybe not the most powerful economies in the world does not have a problem regarding distribution. This validates our previous reasoning that equality is a consequence and is not a main goal.

2.4 Inequality in minority groups

Taking another posture or seeing the problem from a different perspective inequality can lead to social problems. Often times minorities of a particular society are not provided with the same economic resources for different circumstances that are completely valid and even sometimes fare. However this creates a problem, in the sense that, members of the minority are perceived as poor and as a consequence this increases the invisible separation that exist between the groups.

Spatial and social segregation is negatively associated with upward income mobility [1].

In this sense this particular problem happens in societies that are well developed economically and for this reason they receive a significant amount of immigrants or have done it in the past and the next generations have to deal with the same problem. It is true that economic situation of immigrants gets better with time. Being the first generation coming to the foreigner country the one that suffers the problematic the most. And the following generations mitigate this problem with the resources received by its parents and the opportunities that they have learning the language perfectly and having the same benefits as a normal citizen.

In the same line of thinking immigrating people can easily be treated that way as well. Nevertheless, governments can reply saying that this people are not government's responsibility which can also be valid but increases the gap and the problem.

However economic situation such as changes in industrial structure, increased foreign trade, increased immigration, skill-based technical changes, and the decline in institutions that limit the market reduces economic inequality.[8].

2.5 Corruption and inequality

Other societies that are not so well developed economically such as African societies have to focus its efforts to fight corruption since the majority of African countries have a high corruption indexes when comparing them with the rest of the world. In the next chapters real data will be shown regarding this argument to study different states of Africa and the world.

So primarily there are a few factors that determine the level of inequality in a given society been the most important ones unemployment rates and corruption. Corruption on the one hand

can be described as the action taken by a particular individual that guarantees his well being and his close circle, without carrying for the well being of other individuals in society. Without caring of other peoples necessities and struggles.

However this behavior is slowing down the progress of the group that ultimately will be reflected in a better situation not only for other but even one self, knowing that if the economy get better for a state it will have a benefit for all of the members of society. Corruption is a common problematic that presents even in the most developed economies of the world. There is not one state in the whole world that can claim to be a fully corruption free administration but the more underdeveloped in economic terms a country is, the more negative impact is taken for the population and jet the highest corruption rates are presented in places where economy could be significantly different than it is.

A state with a well formed economy and structure that experience a vulnerable action from a member of it will have the necessary tools to mitigate this damage coming from corruption. In the other hand when a country is not as well developed as it should does not have a very efficient way to mitigate damage, moreover resources are much more valuable in this kind of states. So we have a pretty interesting paradox where for underdeveloped countries the damage suffered from corruption is considerably high nevertheless is in this countries where corruption rate are significantly higher.

Another factor that have to be taken into consideration when talking about inequality is unemployment. Despite of been tow totally different concept they are still related in certain ways. Maybe it might be the case in which there exists a state of full employment that is still very diverse in terms of equality. Let us imagine that a government in some part of the planet has reached a very unlikely goal.

They successfully arrived to a situation of full employment however as it is expected no every person in this group counts with the same amount of resources than the others in fact there are pretty obvious differences but even if those differences are there, every person counts with a minimum amount of resources that ensures their survival. In this sense it is also related with poverty but the inequity indexes of a society with these characteristics must decrease. And at the same time it is a fair society that reward people in base of their work as well as guarantee minimum needed conditions for a dignified life.

2.6 Race and Gender income inequality

Another factor that must be taken into consideration when speaking of income inequality is the differences that exist between males and females. It is a valid comparison since in many companies women are significantly less paid than man in the same positions. In recent years the gap between women and men has been reduced however there are many companies in which this problem is still relevant. Furthermore there are countries in which this situation is generalized to the point that almost every company has the same problem. Precise information regarding this subject will be shown in the next chapters of this thesis.

When speaking of this regard there are split opinions since it could be argued that man are more prepared than women or have better abilities for certain jobs. This opinion could be valid up to some point but it is certainly not valid in a situation where a man is getting paid better than a woman for doing the same job. However situation has changed a lot in last decades.

Married women's labor force participation rates, hours, and wages increased substantially in almost all countries during the 1980s. The positive correlation between husbands and wives earnings also in- creased moderately, thus tending to increase income inequality. [8].

Another point that we should take into account is the disparity that exist in the income of people that belong to different races. This is also a very sensible subject but is a problem that should be also considered. On the one hand the differences in education of people of different races is significant. Under this point of view it is fair that income of the the two or more groups is justified according to the logic that we have been exposing in the development of this thesis. Since people that make significant efforts will get significant rewards. On the other hand people can argue that this differences in education are directly related to this inequity problem.

Interracial inequality did fall throughout the eighties and nineties, but inequality within race groups increased . [1].

Under the other point of view people belonging to the referred group may say that the differences in education are a direct consequence of inequity. Clearly in this case the action to be taken is offer the same opportunities in education for every person in society. However this option is not possible in a country where prices of education are high. In this sense to ensure a society where opportunities are the same for everyone, education is a very important point. If a society cannot ensure that opportunities in education are equal the results would be that the returns would not be equal.

To make a practical example we could think of two trees that are feed in different ways. On the one hand we have a tree that is growing with all the resources that it need to grow. On the

other hand we have a tree that does not count with the same opportunities and is growing on only some percentage of the resources that it needs. After both trees have finished their growing period it is not possible to expect that both of them reach the same goals. In the same way we expect that people with reduce possibilities reach their full potential. One of the biggest problems related to inequity is education is a problematic that needs to be addressed as soon as possible in every society.

It is clear that in some cases the comparison between groups of different races does not have any sense since the differences existing between the two of them could be perceived as normal differences that are commonly presented in any society. Because as we have expressed in the past income differences are normal and even necessary for a healthy economy. Some of the biggest economies nowadays present very pronounced differences giving opportunities to its citizens and growing at a slow but constant rate.

Continuing with the same argument we can conclude that a difference in the level of information or education can lead in the future to a difference of economic resources which is reflected in increased inequity. One of the most recent example that we can take in consideration is the restrictions that universities had for years by no allowing women to study or educate. Only after decades of pressure imposed on this institutions educations rights started to balance. However it is important to say that the problematic is still alive nowadays even in the most developed economies.

It should be noted that in some countries women rights is a problematic that should be addressed in the fastest possible way. Up to this days there are countries that does not allow women to educate or study in government institutions or the culture of that society make a women with this characteristics to look bad. This creates a problematic by making women economically dependent of man and making it difficult for next generations to exit from this vicious cycle.

2.7 Legal inequality

Also we can think of another condition that favors an unequal society and it is legal inequality. This problem presents when an exclusive group of people receive special economic treatment that favors them in an unnecessary way. The most common cases in which this problem occurs is with politicians and people with really high economic leverage. Many countries around the world suffer from these problems. Since politicians are the ones that create the rules and impose certain social and even economic order the take advantage of that situation. The most common practices in these cases are setting absurd rules and legislations that favor them in a pretty obvious way. It is not strange to see that a politician can receive a salary of 1 ten times the minimum monthly salary or even more in some specific places. Another way is by creating special

rewards or economic incentives coming out of nowhere and making no sense.

Other cases in which these benefits can be applied are extremely long periods in a given position, create benefits for their families and etcetera. Also reduce the required age for them to go in retirement or modifying legislations so that one person can receive multiple payments at the expense of the government.

We can also highlight the problem of people with a very high economic status that corrupt the system to receive a benefit. Regarding this topic we have to be careful to say that no every state works in the same way and that there are multiple governments that are completely honest and carry out things the way is supposed to be. However in some other places people with high economic status can modify rules according to their benefit. A practical example could be making people that surpass a certain income level stop to pay taxes or reductions are applied to the amount of money that they have to give back to society.

Some people argue that charging a high amount of money to this kind of people is a step back in an economical point of view since by doing this people will be discouraged to be more successful or receive a higher amount of money knowing that that the more they make the more is taken away from them and at the same time this motivates people with powerful amounts of resources to change the rules to their benefit and the people that is helping them. Without thinking of the social impact that their actions generates.

Now many people says that resources in the hands of a government or state is very inefficient and this might be true because people is not consuming their own resources and because it is not easy to press public institutions since the expected results are never too high. Moreover people discuss the way how resources are misused or even stolen from son functionaries.

But as mentioned before we emphasize that not every country or state works in the same way and there are states that organize themselves in a way that every person in society receives the minimum necessary conditions to life well and in a worthy environment. However in general much work needs to be done to improve the corruption in the system and society.

2.8 Economic crisis

Economic crisis is a phase of economic cycle that is characterized by production and economic shortage as well as low levels of commercialization and off course low numbers in goods consumption. As a result of the previous characteristics economic outcome is unfavorable.

Economy does not move in a normal rhythm because people are not as prone to spend as they were when in a good economic period. People do not want to spend money because there is an uncertainty of the future. As a consequence owners of businesses or stores do not receive the same amount of money as they did before. So in a way it becomes a vicious cycle where people does not want to spend, and those that are not been paid will not have the possibility participate in a fluent economy or at least not at the same rate as they did before. A financial crisis generated in a given country usually starts from the mistreatment of the own currency crisis or devaluation.[10]

A crisis period can be caused by multiple factors that could not be going so will and makes the economy to move to a worst situation. A very interesting example is how petroleum price changed as a result of unnecessary competence and how this economic decision affected economy worldwide. Some governments that where not ready for the change were deeply affected and lost a significant amount of their economic value in comparison with other types of currency. Another factor that can cause an economic crisis is the explosion of a bubble, some situation in which everything is going well and economic value is growing but based on not so reliable practices.

One simple example could be giving too much money to people that is not able pay such debt. This is what happens in many states that start to concede loans without making the appropriate studies to be sure that people is going to be able to give back a certain amount of money. The economic force of a bank is certainly able to resist this kind of hits easily. However when the same problem becomes recurrent the system breaks and not even banks are able to support this kind of hits.

... essentially linking income inequality to the unsustainable surge in household indebtedness within the economy, which in turn has been singled out as one of the major predictor of banking crises. [16].

We can think of an economic crisis as one phase presented in the economic cycle that is characterized by a reduced level of productivity when comparing with normal productivity rates or capacity this directly affects economic order as people reduce their consumption. It is the opposite definition of economic growth. One of the direct consequences of an economic crisis is the growth of unemployment rates which becomes even a bigger problem because it accentuates the lack of productivity that is taking place in a given society.

So we can say that in an economic crisis there are a bunch of factors that get affected. In the first place productivity rates decreases. Also it is likely to find an increase in unemployment rates. And lastly but no less important the credit consumption grows as a consequence of the shortage in economic resources.

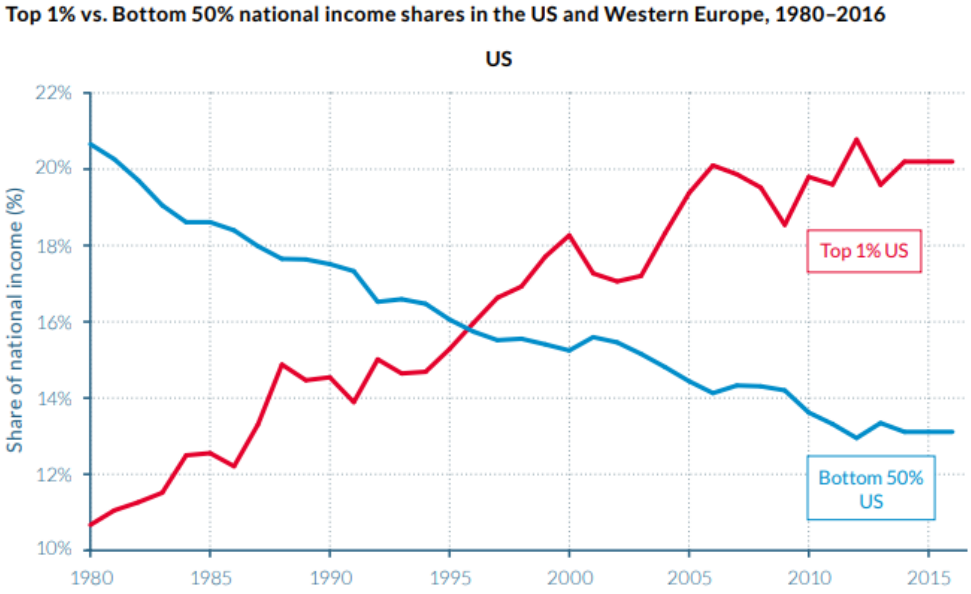


FIGURE 2.2. Top 1 percent vs Bottom 50 percent national income shares in the US and Western Europe, 1980- 2016. Figure reproduced from [18]

It is interesting to analyze how all this different factors affects inequality. Does people starting in a bad economic situation benefit from crisis or the other way around? This is a pretty interesting question because according to the answer governments and economic administration should take specific action in order to help the group of people at which crisis affects the most.

Is it important to have a good economic leverage to face an economic crisis? Does people with good economic situations actually benefit from crisis? We cannot say that any group of people benefits from a bad economic situation at least we were talking about international commerce that involves currency exchanges. In this case it is possible to benefit from the drop or the rise of a certain currency evaluating if it is good to export products or import them. Or even just changing currencies expecting to buy at low prices to be able to sell at high prices. However in normal conditions no specific group of people benefits or expects to be in an economic crisis. The correct notion to be studied would be the differences or changes presented on inequality indicators. Throughout the development of this thesis these problems will be discussed in order to understand this kind of situations better and come out with a series of actions to be taken to mitigate damage to vulnerable populations.

2.9 Health disparity

The well being of every individual of any given population should be a top priority and under this point of view it is interesting to see the relationship that stands between the economic wealth

and health risks or diseases suffered. To try to generate a correlation between these factors it is possible to take different postures that anyhow arrive to a similar result with consistent solutions.

One possible way to do this is to divide population in different groups according to their annual income. Once the division is done and diverse groups are created the next step is to find the percentage of people belonging to a given group that present health problems. This measurement could be done in a qualitative or quantitative way. In former people is asked how they perceive their own health in a given scale that contains options such as very good, good, normal, etcetera. In the later numerical data is studied in order to know for instance of the total group of people that is going to a hospital which percentage belongs to which economic group and according to the collected data give conclusions by analyzing the data.

Another possible way to try to address this problem is studying the life expectancy of the population and dividing it into groups according to annual income. To compare if there exist differences in life expectancy of people with differences in their economic resources. Another factor that plays an important role when talking of this subject is that in the majority of developed countries health is becoming a service that changes its quality according to the money spend by people. In other words people that do not have enough economic resources will never be able to access an excellent health service.

This is a problem that needs to be addressed because everyone should have the opportunity to enjoy a good health service regardless of their economic level. There are diseases that can take somebody's life in a small period of time if not treated and its treatment must be guaranteed for every single member in society.

2.10 Inequality recap

When speaking of economic disparity it is not easy to emit a judgment without analyzing the endless factors that affects this situation. It is necessary to study factors such as equality in opportunities and economics behaviors. The answer to the question is not easy as saying that people that are in a bad economic situations because of the decisions they have made or the lack of effort that they have put. In the same way we cannot fix the problem by giving everyone the same exact amount of resources and compensation regardless of the efforts they make or the different abilities required.

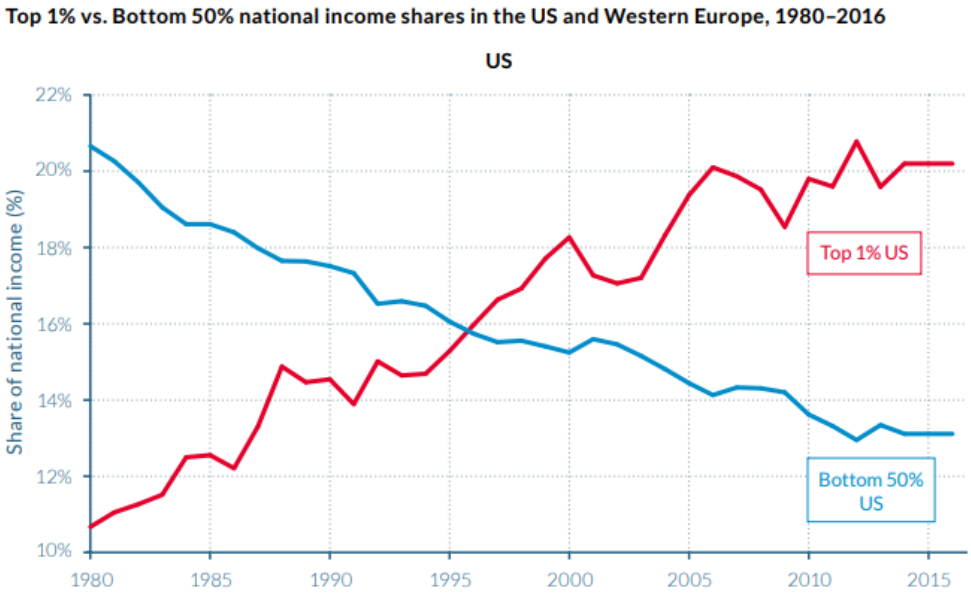


FIGURE 2.3. The Squeezed global wealth middle class, 1980-2050. Figure reproduced from [18]

To arrive to a reasonable answer is necessary to study different points of view and taking into account different perspectives.

However according to the way I see it governments should focus its efforts into helping vulnerable groups since they are running a race with a huge disadvantage when compared to others. Moreover when progress arrives to the majority of the population the economy of the entire group improves and people is able to contribute at their full potential. It is a matter of making a stronger team a stronger society that pushes in the same direction.

Chapter 3

Inequality measures

In this chapter we will expose the different ways in which income inequality can be measured. Throughout history different calculations have been used to measure the distribution in the resources of population. One of the most popular systems to measure this is the Gini coefficient. However this index has some limitations that we will expose later on. As a result of this limitation many other tools have been created in order to successfully measure the distribution of resources of a determined group of people.

All these different tools have been used to measure the dispersion that exists in the distribution of income in a determined population or within the participants of any given economy. These studies are frequently done separating different countries and analyzing how the distribution of resources is done in that special context.

It is not rare to see this indexes applied to even bigger contexts. For instance one can study the income distribution or income inequality presented in a region or even a continent. It is interesting to see that no matter how big the group is it is still a measure that could be applied. In other words we can say that it is also possible to analyze the distribution of resources and the disparities that exist in a group as big as the entire population of the world.

One limitation that any of the different indicators or techniques has is that the result can only be useful to see how resources are distributed and how well those are distributed however we will not be able to identify the reason behind these results. Whether the results are good to try to replicate action or the results are bad it is not possible to conclude that a given result is a consequence of a specific factor. At least not directly. It is possible to create correlation between variables so with a statistical support it would be possible to conclude that a variable ”X” or ”Y” has a high impact in the resulting data of inequality indexes.

By using this methods it is possible to compare the differences that exist between two diverse

populations that excludes one to another in order to identify the places in which the results of the specific index is better or worse. On the other hand it is also useful to use this kind of indicators to compare the situation in which a certain population is in a given period of time to start creating a traceability so that the same indicator created on the same restriction and conditions can be used in the future to learn if the situation in that specific regard is getting better or instead is not working as it should.

A reasonable difficulty that could be presented to create these indexes is the amount of information that is needed to create a significant and relevant study. The reason for this is that some indicator requires very specific information that sometimes is not easy to find as well as the scale in which the studies must be performed to create a precise research. However even with the difficulties that are presented when creating such studies it is especially important to create a record and a measurement system in order to understand better the situation within a specific population to create necessary adjustments with the objective of creating a fair society that guarantees certain conditions for all the participants of that given economy.

3.1 Income Definition

As previously presented there are a number of factors that have to be taken into account to create relevant system to measure income inequality. However the first thing that is needed is the definition of the variable itself. That mentioned variable must remain unmodified when creating other studies and the conditions and restrictions putted in the variable of the method of any kind must be respected in order to conclude in a relevant manner. In other words consistency is fundamental for the relevance of a study. As a practical example it is not correct to measure the variable ”height” without taking into account if the person is using shoes or not.

However it would not be correct to say that this kind of measures can only be used to study income inequality. The different indexes can be used to measure the disparity presented in various resources that have to be distributed.

In the following part of the thesis we will define income as the most common way in which it is represented for various authors yet it is not declared that this is the only way to define income or that the only way for a study to be significant is by following this alignment. Conversely a study that does not follow this definition can be as significant as does who does if and only if the method, restrictions and conditions of the environment in which the study is created, are consistent one to another time.

For that reason it is fundamental to define income properly. One commonly known definition

of Income does not only make reference to the amount of money that an individual receives in a given period of time - Let us say a month what we normally would call a salary- we also have to take into account all the resources that the specific individual receives in an established interval of time. To make a clear example, a person receives one hundred of ”X” currency but that person also receives a meal in its workplace. The salary of the person in the example would be one hundred nonetheless its income would not be one hundred. It would be at least - supposing that those are their only sources of income- its salary and the economic value of the meal that that person receives every work day.

Moreover in a later instance we should also take into account the services that a person receives from any governmental institution such as health, education or even transportation. It is pertinent to have this concept into account because it could be a case in which a person that have a small salary than other happen to have a bigger income.

Also some important variables that take place into income measurement are taxes namely if the income is measured before paying taxes or after paying them as well as the standard to measure the income of every individual by separated or the income per household. It is useful to measure before and after taxes in order to understand better how progressive taxation works and how it could be applied to reduce disparities.

3.2 Income Inequality metrics properties

As it was previously exposed there can be many different ways in to measure the distribution of income in a given society. Using inequality metrics is most common way to analyze the case. It is important to highlight that these metrics or indexes have to satisfy certain properties that are presented in the majority of the metrics.

The first property is anonymity or symmetry this property states that the index will not depend on the identification of individuals. That is to say if individual ”A” has eighty percent of the income of certain society and individual ”B” has the remaining twenty percent the metric cannot be modified if the percentages that each of the have would be exchanged. In this sense income inequality metrics does not take into account what a person deserves according to the situation in which he is but only how income is distributed in a given society. In other words equity is not taken as a part of the index while inequality is the one and only objective that the index desire to study.

The formal definition of a general inequality index in a discrete case rather than a continuous one can be modeled as follows. Let x be a function of ”I” (income) where ”x” is a set of a number of

economic values that are generally the representation of income or in some cases wealth. Each and every one of them associated with an economic agent also known as a member of an economy or a society. In a more explicit way we can express it in the following way:

```
I(P(x)) = I (x)
```

Another important property that any inequality index must satisfy is the scale independence or homogeneity that states that the indicator cannot be influenced by the size of the total of income in a given society. In other words if the income of one society is bigger than another one but the percentages of distribution of it is the same in both societies then the index should remain the same. To make a practical example if we take a given society and reduce by half each individual income the indicator should give the same result whether it is society A or society A/2. Mathematically we can express I(alpha*x) = I (x)

In the same way an equality distribution indicator should not vary whether a certain economy counts with a very large or small population. In other words the amount of people that belongs to certain society should not be a factor that penalizes or reward the result of the metric. Namely the metric should be independent of the amount of people that is part of a certain economy. I(x U x) = I(x) in a more theoretical perspective.

The last of the four most important properties that every inequality metric should have is the transfer principle. This principle states verifies that the indicator is an actual reflection of a situation of inequality. To explain, if there is an income flow from a rich person to a less rich person but the income ranks between individuals remain the same, then the measured level of inequality should be reduced. Since a person that at the beginning of the process had a big gap when comparing its income to the others and at the end of the process this gap was reduced which should imply that the inequality levels in that situation have to decrease.

The previously exposed properties are the most relevant rules in order to evaluate if a metric can be valid or not. Nonetheless there are other properties that should also be satisfied. In other words even if the next properties to be exposed are less relevant that the previous ones they should always be fulfilled for an indicator to be valid. To illustrate an index I(x) should always be greater than zero. This is the non-negativity property.

Also an index I(x) should always have a determined value that expresses the biggest of all inequalities. This is the case in which all individuals have zero income or any given resource and only one individual have the total amount of that given resource. Namely extreme inequality. This value in most of the cases the value tends to a unity the bigger a population is. The name of

this property is bounded above by maximum inequality.

In the contrary case when everyone in a certain population has the same amount of one resource then the result of the indicator should always be zero. Formally describing it there should exist an egalitarian zero when that particular situation occurs.

As mentioned before there is a classification between more important properties and the other existing properties however this does not mean that only the important one should be fulfilled. It is mandatory that all properties are respected for a metric to be taken in consideration.

3.2.1 20:20

The 20:20 ratio compares only a fraction of the total population. Taking as a subject of study only the twenty percent of people that enjoy the highest income and the twenty percent of people that suffer with the lowest rents in the entire society. It can be more instructive in some cases since it takes away the remaining sixty percent of the population often have small differences when comparing income levels. Focusing the analysis in the most problematic groups or the set of individuals in which a specific strategy should be applied.

Under the point of view of some scientist this indicator is more useful that other when studying developed societies with social stability. This indicator shows that the lowest ranked countries are Japan and Sweden where the twenty richest percent receives only four time is the income of the twenty poorest percentage. While other developed countries such as the United States and the United Kingdom presents a relation of seven to one. Which a pretty indicative number and shows that some work is worth to be done. Even if this countries have low inequality qualifications with other indicators.

3.2.2 Palma Ratio

The name of this index comes from its creator and it makes reference to Gabriel Palma which is a social scientist born in the city of Santiago in Chile. His work in this particular index was motivated from the inconsistencies that he found in the Gini index. Specially the extreme sensitivity that is taken into account in the middle of an economic distribution and the lack of sensitivity that exists in the top and the bottom of the studied group. According to the theory that the Chilean scientist proposes the inequality problem is a dispute between the rich and the poor. Leaving the middle class out of debate according to his ideas redistribution must be done in this specific individuals.

Under this point of view his ideas can be compatible with the concept of progressive taxation. However coming back to this index the main idea in which the indicator is founded is that in

the majority of time middle class aggregated income represent fifty percent of the total national aggregated income that leaves us with the other half of total income that is distributed by the ten richest percent and the forty poorest percent of the population. And almost inevitably the richest group is a small fraction of individuals when comparing them with the poorest total individuals.

Having all these thoughts in mind he created an indicator that relates these parts of population throughout a ratio. Dividing the ten richest percent into the forty lowest percent of aggregated income. The lowest this number is the lower it would be its inequality. Ideally this number should be the lowest possible under 1 however it is hard to arrive to a point lower that 0,9. The better qualified countries in the world according to this ratio are Japan, Sweden, Norway, Denmark, Germany, among others all of them with a score of maximum 1 and minimum 0.9. In the other hand the lowest qualified countries according to the measure are Qatar with a awful score of 9.2, Chile 3.5, Uruguay 2.5, among others.

It is pertinent to distinguish that this is not a very popular index and for that reason in many countries this tools has never been applied. Even if it would give important conclusions by comparing one to another. It is expected that the score of Latin American countries as well as African countries would have a high ratio.

3.2.3 Hoover index

The next indicator that would be presented is the Hoover index is it known for been one the easiest indicators to calculate and corresponds to a simple concept how much is the amount of income that would have to be redistributed in order to achieve a state of perfect equality. In this case the best result that can be obtained is a zero answer that would mean that no resource should be redistributed to have a perfect equality.

In the opposite scenario if only one individual receives the total income of a state almost one hundred percent of the resources should be redistributed. The superior limit of this index is 1 that represents a state of perfect inequality and the other inferior limit of the indicator is 0 that represents a state of perfect equality. The results are expressed in a percentage value according the quantity to be redistributed.

3.2.4 Ratios

Another way of measure the income distribution in a given population is by using a ratio. A relationship between two economic variables of interest. Or it could be also present as the comparison between two set of groups generally one referring to a high group and a low group. In a similar way in which for intense the Palma ratio is calculated. By using this type of indicator a relationship that correspond to a one by one ratio means that both groups enjoy the same amount

of resources in certain period of time. While as the difference between the two groups grows higher the ratio also starts to go up or down according to the order in which the relation is made. Ideally the relationship should be as close to the unity as possible as higher dispersion means higher inequality.

In concrete ratio relationships could be very useful to compare the distribution of percentiles. These percentiles can be defined as a value that indicates below what given percentage of a group of percentage observations falls. For instance in the 5th percentile is the value below which 5 percent of observations are found. In this way it is possible to study the relationships that exist when comparing two different percentiles.

These ratios do not represent the total of the population be definition. Since it excludes multiple values according to the interest of the scientist. But it is useful to see how the distribution of resources is changing in a specific part of population. In other words it is possible to identify the micro movements generated in each rank of the population. And making it possible to see in the positive case if inequality reduced because of the flow from high percentiles to mediums or in the negative case if a measure of inequality increased because of the upper earners increasing their income or the losses presented by the lower income earners.

3.2.5 Income Share

The income share relates the percentage of income perceived by a certain percentage of the population. Generally the result of this kind of measurement shows that a very small group of people usually captivates a gross share of total income in a studied economy.

According to data from worldbank.org [9] the highest twenty percent individuals by income held the forty seven percent of the aggregated income in 2016 which means that almost half of the total wealth of the country is in the hands of only one fifth of the population and the other half is distributed among the other eighty percent of the total population of the United States.

FIGURE 3.1. Comparison of income share held by highest 20 percent of Brazil and Finland. Figure reproduced from [9]

But this is not the most concerning part if we study the ten lowest percent of the population receives only one point seven percent of the aggregate income of that nation. This indicator is a perfect example that wealth is concentrated in a small group of people within a population. There are countries in which inequality is very strong and it is very evident to see the miss distribution present in their systems. Even developed countries like the united states and the united kingdom have a bad result in this specific indicator. This shows that the economy that they have implemented is thought to create wealth in a progressive way for those who have a big amount of resources under their control at the expenses of normal people to which arrive to that specific level of wealth would be extremely difficult speaking in percentages terms.

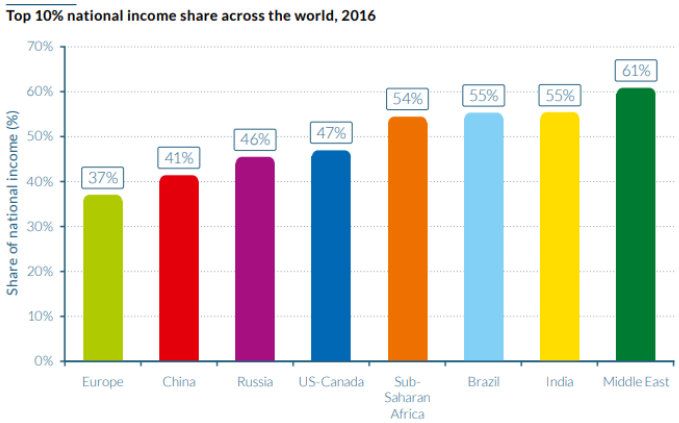


FIGURE 3.2. Top 10 percent national income share across the world, 2016. Figure reproduced from [18]

Only a minimum and almost uncountable part of the population success into becoming a top twenty percent economy member when they are coming from less favored part of the population.

The disadvantages of this approach are that many people live in completely different well-being standards than people in high perceived income. It is also true that if an economy gives every person the opportunity to be successful and guarantees the basic rights of alimentation, education and social wellbeing it is arguable to debate that the group of people that enjoy an excellent level of perceived income are there because of the efforts that they have made to be there. There are also examples of people that came out of nowhere and became millionaires based only on their capabilities and the added value the give to society.

On the other hand we can also think in the opposite situation. This is the case of Nordic countries that when tested, they present excellent results in almost every inequality indicator they are tested on. In that kind of society economy is thought in a very different way. In general it is given that if a person is receiving a big amount of income or resources that person should give more back to society. In some Nordic countries taxes go up to almost fifty percent. In other words of every dime they make they have to give back half.

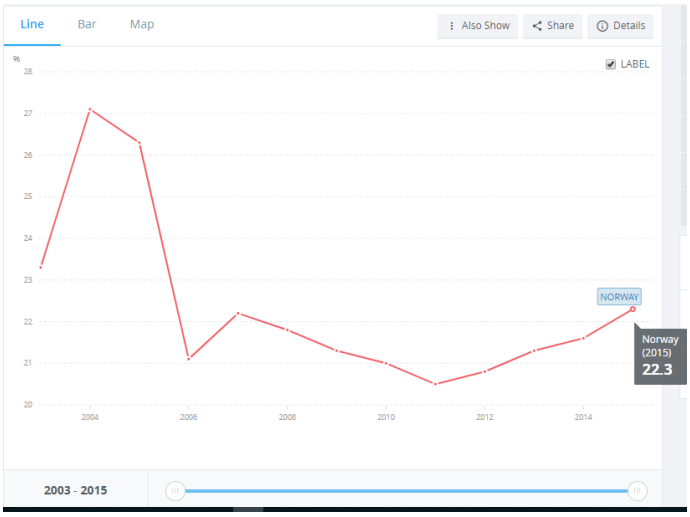


FIGURE 3.3. Norway share held by highest 10 percent. Figure reproduced from [9]

When we analyze the top twenty percent of the people that perceives a big amount of income it is surprisingly found that the aggregated income barely exceeds twenty five percent. In these economies the distribution of the wealth almost follows a uniform nature. These are totally different points of view and also it can be arguable that in Nordic countries people that perceive a big amount of income can be mistreated since they have to get rid of a pretty important amount of resources and the effort that they make to be there may no be well compensated when comparing the effort that any other ‚Äúnormal‚Äù person has to do. In this kind of societies it is arguable that people arrive to a certain point in which they are no longer motivated to make a significant

effort since they will have an excellent lifestyle doing practically any job.

One can say that in certain way an excellent economic situation can slow down human development. Nobody need to make an effort since the way in which they life is an excellent one so for some individuals it is not important to change the way in which they life or to go further to feel fulfilled.

However that is a better scenario in terms of human wellbeing than a situation in which most of the resources are concentrated in a very small part of the population. This can be the case of some states in underdeveloped countries. This kind of inequity problem is happening in some countries of Latin America as well as some Asian or African countries.

To illustrate let us take the case of Brazilian population. This society is the perfect example of income distribution disparity. Using the same indicator we were using before it is possible to see that there is a small group of people that perceives a huge amount of the total income of the country. To be precise the twenty percent of the richest people of that country held fifty six percent of the total income share (2016). While in the same year the ten poorest percent of the population only held one point six percent of the total income share of the country.

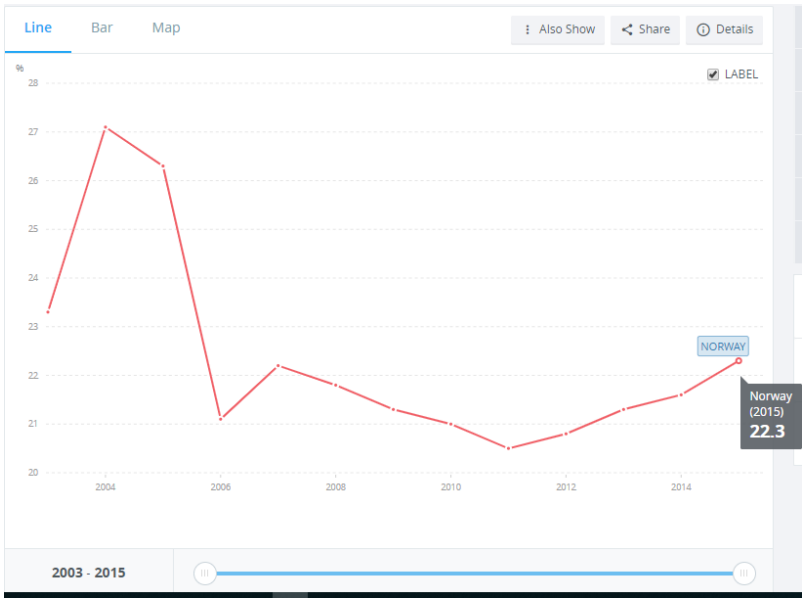


FIGURE 3.4. The case of Brazilian population. Figure reproduced from [9]

It is obvious that especially for the group of people that belongs to this group a change must be done. In such cases a direct intervention from the government is needed providing assistance to the people that needs it such as alimentary bonds, to ensure that people is not starving as well

as immediate action to provide a shelter to those who need it, clothes or every other minimum necessity good that they could need. Moreover the tendency of families with low economic resources and in a precarious situation is to have a high number of persons in charge. It is a paradox in the sense that people that do not have the minimum necessary resources are the ones that result to have more children or persons in charge. So the little resources that they already had have to be spitted in even lower parts for each member of a house.

To create conscious in people education plays a very important role. Often times people in bad economic situations do not even know about pacification methods or have imprecise information of the way in which sexuality works. It can also become a public health problem with the propagation of diseases of sexual nature. That is a problem that is presenting in African societies. With specific problem of overpopulation and propagation of diseases. Also this contributes to a change in the way that households are composed. According to data of mid 80's single household with or without children was 15 percent and in mid-2000's it was 20 percent. A trend to smaller households increases earning and income inequality.[14]

3.3 Gini Coefficient

3.3.1 Calculation

The Gini coefficient is arguably the most used inequality measure in the world and even history. This indicator was created by the Italian scientist Corrado Gini. This indicator was first presented in his theoretical work variability and mutability (variabila e mutabillita) in a project created in the year 1912. This indicator is uses as a fundamental tool the ‚ÄúLorenz curve‚Äù this curve relates two accumulated variables in order to understand how the income or wealth is distributed along a specific population.

As we previously expose in this thesis the share of income is the percentage of wealth perceived by a specific fraction in a given group of people belonging to an economy. The Lorenz curve organizes a population in tiers from the bottom to top putting this variable in the "x" axe. The other variable that is taken into account is the amount of accumulated income. This is the dependent variable responding to a given accumulated number of people in a society. In reality values a measured from 0,2 to 0,3 in countries with a low degree of inequality and from 0,5 to 0,7 for unequaly strong [17]

Each point in the Lorenz curve addresses the relationship of: For this accumulated group of people, how much accumulated percentage of income is perceived. In this way it is possible to relate each and every one of the points in the graphic going through all tiers of population until finally arrive to the hundred percent of income perceived by the hundred percent of people in a

society.

Until this point only the Lorenz curve has been analyzed but the Gini coefficient goes further than this. It uses the Lorenz curve and creates a relationship or a comparison if one wants to say of the actual distribution of income in a society with an utopic case of perfect equality, for all the individuals belonging to an economy. The graphic result of such distribution would be a straight line where for every x percent of population the same x percent of income or wealth belongs to that group. In other terms using a practical example this would mean that the lowest ten percent of population has ten percent of accumulated income. The fifty per cent of the population would perceive the fifty percent of the total income. And similarly with all other points in the distribution from the beginning to the end. The main purpose of that kind of graph is represent an economy in which every individual would have the same amount of resources that the other.

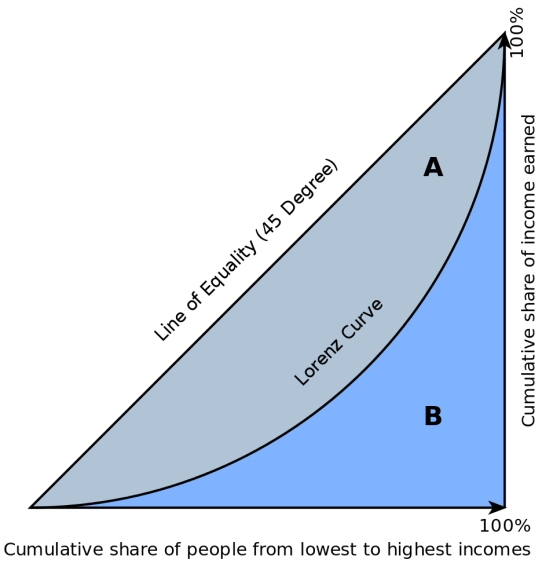


FIGURE 3.5. Lorenz's curve. Figure reproduced from [19]

To resume up to this point two different functions have been studied one the one hand the Lorenz curve and on the other hand the perfect equality function. This to relationships can be represented as follows.

When the two functions are put on paper it is easier to see for what the Gini coefficient stands for. This indicator is not more than the fraction under the perfect equality line and above the particular Lorenz line according to the case. Expressed in the form of a proportion responding the question how big is the described area compared to the total fraction under the perfect equality line. If we call A to the Gini coefficient area the graphical calculation would be *'A'*/ Total area or

'A'/'A+B'. So for this situation the result is expressed by the fraction multiplied for one hundred to show it as a percentage. The possible interval of results that the indicator can have goes from ‚Äú0‚Äù to '1' making a supposition that income or wealth can only take positive values. In reality there are some points in which people that have a big amount of debt represent a negative amount of wealth. So with the necessary condition the Gini coefficient can give a result slightly higher than the unity.

This particular indicator give us the answer to a fundamental question when analyzing any given resource inequality and it is how much the actual resource distribution is deviated from a situation of perfect equality for that given resource.

To better illustrate the functioning of the index we will expose a couple of cases that are useful to better understand the concept. In the first case we will expose a situation in which the Gini index is very high. A high Gini index is represented by an economy in which there is a big area under the perfect equality line and the Lorenz line or in other word a big difference on the distribution of resources compared to the ideal scenario.

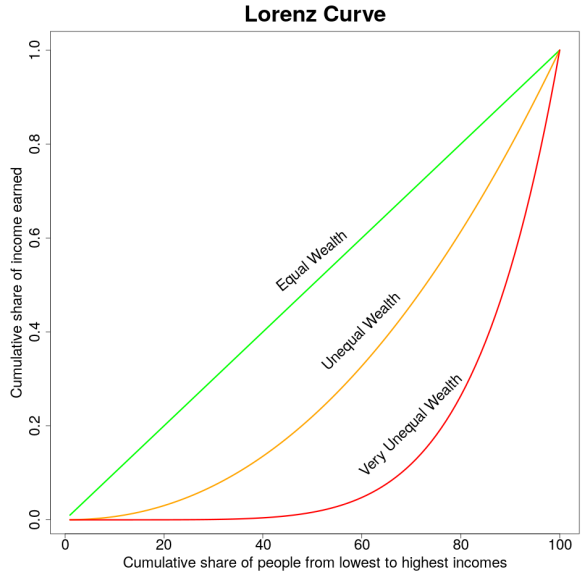


FIGURE 3.6. Levels of Lorenz's curve. Figure reproduced from [11]

On the hand we have the scenario in which the actual distribution is very similar to the ideal distribution of resources in this kind of economies inequality is at low point but obviously still exists. Most of the country that has this kind of curves is developed countries in northern Europe. In this point practically the whole population counts with the minimum needed resources in terms of goods, education, and health system, among others. It is a good point for the development

of the economy since it keeps the foundations of meritocracy and keeps motivation as a factor for the development of an individual.

At this point is useful to know the extreme cases that can present but that in reality are very unlikely to happen. The first one is a situation in which all of the resources of a society are concentrated in only one individual. In other words, virtually everybody has no resources except for a single person. In this case the graph would be represented in the following way. With a Gini coefficient of one that is obtained by a vertical line at the end of the accumulated population axes that goes up until the total amount of resources of the population. This would be the case of an economy with perfect inequality.

FIGURE 3.7. Total Inequality Lorenz's curve.

In the same way the opposite case is also a possibility however as it was mentioned before in practice it is very unlikely to happen. This is the case of a society that enjoys perfect equality. In this kind of economy everyone has the same quantity of income or wealth. In the graph it is represented as a one on one correspondence between the accumulated percentage of population and the accumulated percentage of income or wealth.

If a situation of this characteristics would take place it could have a negative impact in the economy as a whole since people would no longer be condition by motivation or effort to arrive to a certain level of wealth. Even there could be the case that people no longer have desire to work or to do a productive activity or the majority of people would want to have the less effort required jobs. In the present time there is no government that follows this particular distribution and it

have never been successfully implemented since the creation of money.

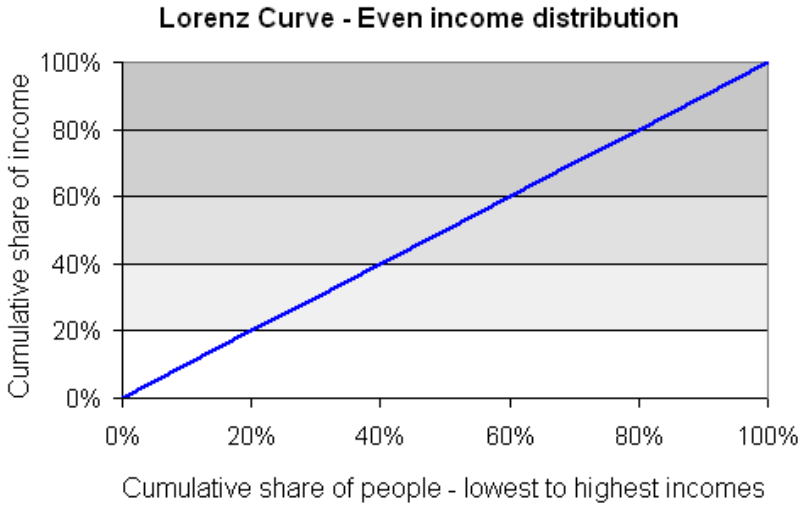


FIGURE 3.8. Perfect equality Lorenz's curve. Figure reproduced from [11]

3.3.2 Indicator weaknesses

As it was mentioned before this is one of the most used indicators globally speaking for the measurement of inequality however it is far to be a perfect indicator. Some of the flaws that the indicator has will be shown. In the first place it is a very generic value it is a scale that goes from zero to one (in the case of all positive numbers) but does not show detailed information about the distribution at that given population.

The main problem with this is that many different repartitions can lead to the same result and only by looking at the final number is not possible to address the different situations that may be presented in certain scenario. To successfully do this it is necessary to break down the indicator be analyzing the income share of a fraction of the individuals. Or even changing the indicator used by another one that complements the information of the Gini coefficient and reflects detailed information about some aspects that will not be seen otherwise..

It is also a relative measure so the analysis done throughout this indicator can change from one social scientist to another one. Similarly it is possible to have a particular case in which a Gini coefficient rise - which would be a bad economic sign - but the actual poverty level of that economy falls. So if the conclusion is not made with caution it can lead to wrong answers.

... Measures such as the Gini coefficient are not purely 'statistical' and they embody implicit judgements about the weight to be attached to inequality at different points on the income scale. [2].

Also if the Gini coefficient of one country is lower than the other does not automatically means that that is a better economy. In fact there are cases in which Gini coefficients are the same but the quality of life, opportunities and average income are completely different since they can greatly differ in wealth or income.

The use of traditional measures hide the fact that ranking of distributions cannot be reached without fully specifying the form of the social welfare function [3].

Another weak point that this indicator has is that it is downwardly bias. The coefficient tends to show low results for small and therefore less diverse populations. While in a big society with a much more diverse economy is likely to receive a high Gini coefficient. In fact some small countries with low economic development have a low Gini coefficient but this result does not show the real situation that the population is living.

Finally another point that needs to be taken into account is the difficulty that exists into valuing the social benefits that individuals enjoy. This is evident especially in the cases of countries that provide health benefits, subsidized housing, education among other resources that are difficult to measure objectively therefore the precision of the Gini coefficient depends on the single assumptions that a given person emits in a subjective way. Moreover in emerging countries around the world informal economy a big part of people's livelihood in some countries the percentage of informality arrives up to fifty percent. Obviously these capital movements are not accounted and consequently the information taken from the starting point is not completely accurate and in fact has a lot of impreciseness for the lack of information and traceability.

It is also to be mention that the standards in which the Gini coefficient is calculated can vary in a big way. Specifically this index generally is used for income and wealth analysis. However the way in which income is defined can be by individual or by household. Another important point is if the indicator is calculated before or after taxation. In the case of economies with aggressive progressive taxation results change completely and show diverse results. And finally the indicator can take into account or not government benefits given to people in poor conditions.

Gini coefficient is very useful to understand the economic situation in terms of inequality and distribution of a given country. However there are several fields in which the indicator have flaws and does not show specific information. Consequently often time a second indicator is needed to better understand a given scenario. Finally the conditions of the collection of data are a fundamental factor. And it should foresee the differences that can be presented when calculating it before or after taxes as well as if it takes into account or not social benefits. Respecting all the previous guidelines the indicator can provide much more accurate information to support powerful conclusions.

Chapter 4

Inequality in the world

4.1 LATIN AMERICA AND THE CARIBBEAN

Taking into account the ECLAC document of 2016, in which Mrs. Lais Abramo shows a panorama of inequality in Latin America, where it is analyzed that there are multiple social gaps that make it necessary to turn our eyes to this situation, since this inequality generates greater poverty for the different countries of Latin America and the Caribbean, this is why within the topics to be studied to close these gaps we should pay attention in the first place:

1. Socio-economic inequality:

   Latin America together with Africa are the most unequal continents in the world, so governments must make great efforts to reduce these gaps, it cannot be denied that great progress has been made to reduce inequality, which we witness in the period between 2002 and 2015 where inequality decreased by 0.09% and in the period from 2008 to 2012, decreased by 1.2%, while in the period from 2012 to 2015 it decreased by 0.6%, these numbers show that great efforts are being made to reduce poverty in these countries.

   However, this is what ECLAC states, since the income of households with fewer resources increased more than that of households with greater labor resources. Added to this is the fact that governments have been transferring resources to the poorest households through subsidies, government policies have also been implemented which have helped formalize employment and have also helped to stimulate employment in different sectors.

   This political process is the most important role that countries must play, in terms of public policies, to seek the transformation of the state, taking into account the functional distribution of income, which is the way to measure GDP. For the period 2002-2014, the Gini coefficient was not related to an improvement in the functional distribution.

In the period 2006-2014, this relationship varies, and most of the increase in distribution is due to the strengthening of wages, the increase in the insertion of people into the labour market and the formalization of employment in many Latin American and Caribbean countries.

2. Poverty Eradication: ECLAC, in its projections for 2030, seeks to eradicate poverty, as well as to diminish financial and non-financial ownership, since these are the source of the concentration of current income in the world. The policies to support this reform and for it to be possible to implement it by 2030, is that governments are aware that they must carry out a tax reform of great magnitudes, in which a tax on large fortunes is put in place, in order not only to distribute government income among the poor, but also that the income of the richest will help to reduce the existing gap between them.

   Perhaps this is the greatest challenge the world is facing at the moment, if it wants to achieve greater equality and a reduction in poverty, in rates higher than those that have currently been presented, it is up to governments to enhance policies that will allow them to reduce the unemployment rates that currently exist in different countries.

3. Gender Inequality: At this point it is important to emphasize that there is inequality with women, since women dedicate about 30% of their weekly time to household activities, while men dedicate about 10% of their weekly time to these activities, which translates into fewer opportunities for women to access formal jobs, as they face a double working day and the latter is not remunerated, and even more the possibility of getting a job decreases to the extent that among the population is poorer there is a greater number of children that makes it almost impossible for women to get a stable and well paid job or pay for this service, which is not within their reach. This is why people talk about time poverty, since it makes it difficult for people to gain income in their homes, due to the lack of opportunity to take care of their children and take care of their work. This ends up with women dedicated to the upbringing of children, without any payment and without opportunities for immersion in the labor market, much less having a chance to educate themselves better in order to try to get involved in the productive sector in a better way.

   There is also racial ethnic inequality, since in Latin America and the Caribbean there are approximately 46 million indigenous people and 130 million Afro-descendants, meaning that one in four people is indigenous or Afro-descendant.

   Of the Afro-descendant populations, 20% are concentrated in Brazil and Cuba, mainly but have a strong presence in five countries of this continent.

There are about 800 million illiterates in the world, of which 530 million are women, distributed mainly in countries of Latin America, India and Africa.

4. Territorial Inequality: This leads us to analyze the gap that exists between those who are of African descent and those who are not. Because infant mortality and the quality of life of children of African descent are much lower than those who are not, largely because their geographical location does not allow them access to health services because of distance or because they are located in regions very far from the capital cities where this service is provided. The fact that these communities are located in places far from the capitals of the countries makes it less likely that these people have access to education, health services and to be able to insert themselves into the economic and productive force of the countries.

   The same situation happens with the issue of education, since the distance that many times one has to travel to attend school and the journeys that have to be made to attend it, discourage children and adolescents that day by day have to go through this situation and that is a sacrifice that many times they do not see retribution in the improvement of their economic and social situation. What finally makes that the rates of desertion in the rural regions and with afrodescendant and indigenous population is every time greater.

5. Life Cycle: All this leads us to have a large number of young people who, at the age when they have to be in school, find themselves carrying out other types of activities that prevent them from attending it, inasmuch as they prefer to carry out activities that generate some immediate income for them.

   This situation is increased in childhood, adolescence and adulthood or old age, because although the risks are different, these deficiencies will be reflected at the end of life, where the accumulated deficiencies will generate greater inequality, less household income, less education, less health services which will be reflected in a population that has greater poverty and a very difficult inclusion in the economic and social system of the country, allowing it to overcome these inequalities.

4.1.1 COUNTRIES OF LATIN AMERICA WITH GREATER INEQUALITY

For the purposes of this study, the five countries in Latin America and the Caribbean with the highest levels of inequality will be analyzed.

The first thing to bear in mind is that there is an average income of a society, which allows to determine the poverty level of society, and inequality is the way this income is distributed in society, so it is not a linear relationship between income and inequality, but has different possibilities, so analyzing different countries we find countries that have a high average income

in their economy, but that this distribution is not the same for the inhabitants of that country, this is where the deep inequalities are born and where governments try to make huge efforts to reduce them, since there are poor countries with low incomes, and middle and high income countries such as Brazil and the United States with high levels of inequality. In this sense, we are going to analyze the countries with the greatest inequalities in the distribution of these incomes within the population.

According to the World Bank, the first five countries with the greatest inequalities are the African countries, followed by five Latin American countries:

- Honduras

  According to data from the World Bank, this country has 64.5% of the population in a situation of poverty and 42.6% in a situation of extreme poverty (whose income is less than 2.5 dollars a day), in terms of the Gini index the inequality is 53.7, which compared to Norway which has the Gini index of 25.9 which is the most egalitarian country on the planet and the most unequal is South Africa with an index of 63.4. The WB compared the income of the five countries of South America and the Caribbean, with greater inequalities:

  - 53.7 Honduras
  - 53.5 Colombia
  - 52.9 Brazil
  - 52.4 Guatemala
  - 51.7 Panama
  - 50.5 Chile

  The greatest inequalities are perceived in education and health, which is reflected in the poorest children because they have access to an average of 4 years of education, while in the highest strata children have access to education for at least 10 more years. This situation increases even more in rural areas.

- COLOMBIA

  In Colombia the income is moderately high in the middle classes, but there is a small group of people who concentrate a large amount of the wealth of the country, however there is also a large group living in poverty, which is why it is in the top of the levels of inequality, below Honduras by a few small points. But in the GDP Colombia is 74 places above Honduras.

Inequality in Colombia is present in the low coverage of education and access to health services, in addition to the fact that the population is located in rural areas that hinders access to these services. A similar situation arises with unemployment, because the population has difficulty formally entering the productive force in the country.

Another point that is important to highlight is that according to recent research carried out by important universities of this country, in Colombia land ownership is close to 78% in the hands of 13.7%, giving a Gini index of 0.86, one of the highest in the world.

- BRAZIL

It is the largest economy in Latin America, however its large income belongs to 5% of the population that gets about 44% of the country's income, thus concentrating wealth in a few and increasing poverty and inequality in this country.

Added to this, the greatest scourge that attacks this country is the great evasion of taxes being about 13% of people who do not make the declarations of their goods and / or have their money and property in other countries or tax havens. For this reason, it is increasingly difficult to track the property and wealth of the most powerful and therefore do not pay taxes in the country with the levels and transparency, it is also required that come to light the underground economies that allow increased tax revenues in this country, which are required to be narrowing the gap between rich and poor.

Corrective policies on the part of the Government greatly affect the poorest, making the situation more difficult for the poor who do pay taxes, which leads to an increase in poverty and inequality in a country with the highest income level in Latin America.

- GUATEMALA

In this country income average are low, in which 8 out of 10 people live in poverty, despite the fact that GDP increased in 2016-2017 by 2.8, a situation that has been presented from 2010 onwards with a growth in GDP. But the biggest problem is the low tax collection rate "the lowest percentage of public income in the world in relation to the size of its economy.

In Guatemala there is a vicious circle of poverty, because income levels are very low, tax collection is low, so foreign investors do not consider it very viable to make investments in this country, which generates a low foreign investment and therefore a rising unemployment rate because there is no reactivation of the economy through foreign production.

- PANAMA

  The economic growth of this country is one of the highest in this region, with a GDP growth of 5.4% by 2017, however, there is a big difference between the city of Panama and the slums. Where the income of the big skyscrapers is much higher than in the slums or the interior of the country, where true inequality is observed, in terms of Gini the coefficient for this country is 51.7.

  Accompanying this situation of inequality, the fact that there is no aqueduct, sewerage, drinking water, education, health, high levels of malnutrition and housing conditions, unlike the big skyscrapers is, on dirt floor, in whose conditions the majority of the population lives.

- CHILE

  Chile is the country with the greatest inequality when it comes to income, education, welfare and wage income, since the income of the richest 10% of the population earns 27 times as much as 10% of the total population from labor income.

  In addition, the government makes very little intervention to the population on transfer issues. Two reforms have been carried out, one of which included the older population that did not have the requirements to access the pension and the government considered them to carry out a transfer of monthly income that would improve the quality of life of this population. The other reform seeks to include the school-age population in education in such a way as to reach the entire population free of charge. The aim is to reduce the gaps between rich and poor.

  However, Chile's greatest problem is the fact that its tax reforms are in favor of the rich, making it unlikely that the economic and social situation for the less favored classes will be possible and they will rather see the possibility of entering this select group increasingly distant, where incomes are higher and poverty and inequality indices are reduced, since the reforms impose higher taxes on the poor than on the rich. This situation makes social differences even greater.

4.2 The Rest of the World

According to the International Confederation - OXFAM which integrates 17 non-governmental organizations that carry out humanitarian actions in 90 countries of the world, in its report called ”an economy for 99%”. informs that : The wealth of 8 people in the world is equal to the

wealth of 50% of the world's population. 1810 millionaires appearing in the magazine Forbes have 6500 million dollars, equivalent to the wealth of 70% of the world's poorest population.

10 companies worldwide obtained a revenue greater than the public revenues of 180 countries together 767 million people lived on less than $1.90 a day in 2013, of which the half of this population was in Sub-Saharan Africa according to World Bank data. Between 2008 and 2013, the income of 66% of the richest increased, more than 40% of the poor.
Hunger in 2016 affected 815 million people, equivalent to 11% of the world's population according to FAO data. 155 million children under the age of 5 suffer from stunting due to malnutrition and hunger in their first years of life, according to the UN report in 2017. According to the UN agency 520 million people have suffered from hunger in the world, of which are located in Asia (7%) of the continent's population, 243 million in Africa equivalent to (20%) and 42 million are located in Latin America and the Caribbean (6.6%).

The 10,000 workers in the Bangladesh textile factories earn in one year the same as the General Manager of any company. According to FTSE 100 stock market index. Women earn between 31% and 75% less than men, due to wage gaps and other inequalities, which is reflected in the fact that within the most powerful people on the planet does not reveal the name of any woman.

- Africa: It is geographically separated from the European continent by the Mediterranean Sea and the Atlantic Ocean through the Strait of Gibraltar, and geopolitically from Asia by the Suez Canal, where the Red Sea is located. However, Africa is actually linked to Asia by the Suez isthmus, and the Sinai Peninsula of Egypt is considered to belong to Asia despite the fact that Egypt is part of Africa.

  The continent rests on the African Plate. It has a total area of approximately 30.2 million square kilometers, thus covering approximately 20.4 percent of the surface of emerged lands. To the east lies the Indian Ocean, the Atlantic to the west and the Mediterranean Sea to the north. It is composed of almost all of the mainland and few islands. The largest of these is Madagascar, the fourth largest island in the world.

  The equator crosses the continent, which extends similarly to both sides of this line. For this reason, much of its territory is circumscribed within the tropics; the climate of Africa encompasses several types, but the tropical predominates. At its highest points it reaches the subarctic climate. Usually, north of the equator the conditions are arid or desert although in the coastal region is a Mediterranean climate, while in the lower region dominate hot and humid climates and even temperate in the southeastern region.

Africa's landscape includes 3 large deserts: the Sahara (the largest in the world), the Namib and the Kalahari. In the east is the Abyssinian plateau and in the northwest is the Atlas Mountains, a long mountain range. The highest peak on the continent is Kilimanjaro, in Tanzania.

It has about 26,000 kilometers of coastline, but the rivers are relatively small and unnavigable. The most prominent are the Nile, the Zambezi, the Congo and the Niger. The Nile is probably the most important; it is the largest in the continent and one of the longest in the world. The great lakes are represented by the Victoria, Tanganyika, Malawi, Albert, Edward and Kyoga, among others along the Great Rift Valley.

In Africa, about 2000 different dialects or languages are spoken, its main activities are agriculture and livestock. In Africa are located the poorest countries in the world, in Africa is the population without the coverage of basic conditions covered, such as water, electricity, sewerage, water, food, roof, so it is said that the people of Africa live in conditions of indigence which is the extreme condition of poverty.

The African continent is the most impoverished continent on the planet, due in great measure to the large number of people living on this continent and the large number of children born every day, increasing the needs of all people on this continent. According to the IMF - about 34 million children between the ages of 6 and 11 and at least half of African youth between the ages of 15 and 17 do not attend school. Girls are the most disadvantaged, especially in West Africa. Children under five are 14 times more likely to die than in other regions, and 7 of the 10 most unequal countries in the world are in Africa.

As far as drinking water is concerned, hand washing awareness is carried out with the little water we have in Africa, as the sources of unhealthy conditions have led to ever higher infant mortality rates. Added to this issue is the lack of vaccination of children and where malaria has claimed the lives of six million African children a year. [12].

Hunger in Africa is another problem faced by the population, since the large amount of population, the kind of land available (not very productive), the lack of water, make food constantly scarce, generating malnutrition in the majority of the population of the continent.

This situation is increasing every day due to the high levels of corruption that these countries live, because of their governors. The lack of fiscal policies that allow the collection of income from the richest people in these countries has plunged the population into these

precarious social situations.[15]

Additionally, there has been a discouragement regarding the issue of donations made to different African countries, since most of the income ends up in the coffers of the rulers. Situation that became evident with the paper panama, where the greatest income comes from African leaders, among which are kings, zakahs, ministers and presidents, who have their fortunes in tax havens to evade the taxation they have in their countries.

This is why many analysts do not understand how Africa, being a continent that receives so many international transfers, does not progress in the same way that it receives these funds.[7].

South Africa It is the country at the top of the World Bank's Gini list, with an index of 0.63, the country is located in southern Africa and has a dimension of 1,219,090 km2, and is considered a large country. It is a country in which its population is mostly black (67%) and White South Africans reach (19%) of its population, its capital is Cape Town and the currency is the Rands, is the largest economy of Africa and hosts 75% of the country's businesses, its economy is mainly mining, agriculture and finance, until 1994, blacks had no right to vote, only until 1994, this situation changed and blacks are the new voters in the country.

As you can appreciate, until that time South Africa had not had a black president, but had been led by white minorities. Until 1990, South African leader Nelson Mandela was released by President Willen de Klear, who later received the Nobel Peace Prize for ending apartheid in 1993.by 1994, after the release of Nelson Mandela, the country sees for the first time in its history how its black population reaching 67% of the population has the right to vote, and as a result of this situation Nelson Mandela was elected president. With Mandela's arrival in power, several reforms were made in the country, including the devolution of some land to blacks, with a view to improving the levels of poverty and inequality in the country. However, this has not reduced inequality, but rather, has seen the birth of a new social class equally unequal as are the new "rich blacks", which has increased inequality in a country where their unemployment levels are the highest in the world 27.2%, which means that of every four people of working age, one is out of work, which makes the gaps in this country are more notorious.

- RWANDA: It is located in eastern Africa with an area of 26,340 km2 and is one of the smallest countries, has a population of approximately 12,208407 people, its capital is Kigali and its currency are the Rwandan Francs and according to the United Nations, the standard of living of the inhabitants is among the "worst quality of life in the world" with a Gini

index of 0.50, ranked number eight.

Its economy is devoted to subsistence agriculture and according to the report Elaborated by the Economic and Commercial Office of Spain in Nairobi Updated to July 2017, "Rwanda is a mostly rural and agrarian country, with 35% of its population engaged in subsistence agriculture. The population density is high but not concentrated in the large metropolises - 13 million people spread over a small tract of land.

Tourism, minerals, coffee and tea are Rwanda's main sources of foreign exchange. Despite Rwanda's fertile ecosystem, food production does not always meet demand, so imports are necessary. Energy shortages, instability in neighbouring countries and lack of transport links with other countries continue to be the main obstacles to private sector growth. However, Rwanda has had very high rates of economic growth in recent years.

In 1959, three years before independence, the majority ethnic group (Hutu) overthrew the Tutsi king in power. Over the next few years, thousands of Tutsis were killed, and some 150,000 forced into exile in neighbouring countries. The children raised in that exile later formed a rebel group, the Rwandan Patriotic Front (RPF) and started a civil war in 1990. The war, along with several political and economic upheavals, exacerbated ethnic tensions, culminating in April 1994 with the state-orchestrated genocide, in which Rwandans killed one million of their fellow citizens, including three quarters of the Tutsi population. The genocide ended later that year with the RPF operating from Uganda and northern Rwanda, defeating the national army and Hutu militias, and establishing the pro-RPF national unity government. Approximately 2 million Hutu refugees - many fearing Tutsi repression - traveled to neighboring countries such as Burundi, Tanzania, Uganda and former Zaire.

Since then, many of the refugees have returned to Rwanda, although several thousand have remained in the DRC and formed an extremist insurgency group. Rwanda held its first local elections in 1999 and its first post-genocide legislative and government elections in 2003. In 2009 it developed a joint military action with the Congolese army in the DRC to eliminate the Hutu insurgent group present in that country, and thus Kigali and Kinshasa re-established diplomatic relations. Rwanda also joined the Commonwealth in 2009 and assumed a non-permanent seat on the United Nations Security Council for the years 2013-2014.

With regard to unemployment rates, official statistics show that for every seven persons employed there is one unemployed person. The female unemployment rate (13.6%) is higher

than the male unemployment rate (12.9%), and in urban areas (15.9%) it is higher than in rural areas (12.6%).

For all these reasons, the Rwandan government has been making enormous efforts to close the existing gaps of inequality and poverty, strengthening different sectors, including construction, export and consumer agriculture, mining and making great contributions to education and health in a country where fiscal policy has not been the best and where the government wants to bet on a better country by 2020. In which it is expected that the indicators of both the GDP and the Gini index will ostensibly improve and remove them from this place of inequality before the world.

Chapter 5

Inequality in Colombia

This chapter intends to show an overview of the Republic of Colombia in different field working as a diagnostic, exalting economic potential and strengths such as its geographical position, the increase in the number of people being educated and better disposition on the part of the government to achieve PEACE, with which it is hoped to improve internal conditions of the country and therefore improve the economic conditions of its inhabitants. Under this standpoint the Government is going to have to attack its weaknesses and its great existing inequities within the national territory, through government policies that will allow to recover the countryside, improve the situation in different forgotten economic sectors, that will allow the Colombian population to improve their living conditions making emphasis in education and government investment for developing sectors.

5.1 Conformation

From the year 1810, Colombia declares its independence and recognition as a new republic. In the course of the history of this country it have had a total of 10 Constitutions (1811, 1812, 1819, 1821, 1832, 1843, 1853, 1863, 1886, 1991) that were adapting to the characteristics of the government, the country and of its inhabitants.

Since then, the country has been governed by norms and laws registered in a constitution, and it has been organized geographically and politically in 32 departments. Colombia's government power is distributed in three powers: Executive Power, Legislative Power and Judicial Power.

Colombia is a republic where the executive power is exercised by a president elected by popular suffrage for a period of four years, there is the possibility of re-election. The President of the Republic has an interdisciplinary team for the fulfillment of his duties composed by: the ministers of: Government, Justice, Defense, Agriculture, Education, Health, Finance, Labor, Public Works,

Mines and Energy, Development, External Relations , Communications and Foreign Trade.

In Colombia the Legislative Power corresponds to two chambers: 1. Senate and 2. The House of Representatives, both constitute the National Congress and its members are also elected by popular vote for a period of four years.

The Judicial Power is formed by the Supreme Court of Justice, composed by magistrates and judges, divided into five branches: Constitutional, Civil, Criminal, Labor and General Business.

The Supreme Court is in charge of the courts of the district and the municipal courts. The Council of State and the Electoral Court are also part of the judicial branch. The country is divided administratively into a Capital District and 32 departments with their respective capitals:

Capital District: Santa Fe de Bogota

Departments: Amazonas, Antioquia, Arauca, Atlantico, Bolavar, Boyaca, Caldas, Caqueta, Casanare, Cauca, Cesar, Choco, Cordoba, Cundinamarca, Guainia, Guaviare, Huila, La Guajira, Magdalena, Meta, Narino, Norte de Santander, Putumayo , Quindio, Risaralda, San Andres y Providencia, Santander, Sucre, Tolima, Valle del Cauca, Vaupes, Vichada.

Water bodies: It is surrounded to the north by the Atlantic Ocean and to the West by the Pacific Ocean.

Geographical neighbors: Eleven countries, in the following way : To the east with Venezuela (2,219 km) and Brazil (1,645 km); to the south with Peru (1,626 km) and Ecuador (586 km) and to the northwest with Panama (266 km); to the north, it borders the Caribbean Sea, in whose waters it borders six countries: Costa Rica, Nicaragua, Honduras, Jamaica, the Dominican Republic and Haiti; to the west it borders the Pacific Ocean.

Extension the total length of the coasts is 3,208 km. The total extension of Colombia is 1'141,748 km2 and is the third country in size in Latin America, after Brazil and Argentina. The currency that is used in Colombia since 1810, is the Colombian peso. (COL peso), which was born as a result of the Independence of Colombia, replacing the 'real'. The currency is issued and controlled by the Bank of the Republic of Colombia, which was a entity founded, to issue, manage and control the monetary movements of Colombia, as well as to issue the currency that legally circulates in the country.

The population of Colombia is formed as follows, according to DANE's figures and census conducted in 2005, updated information for all economic issues in the country. At the time of this thesis is the country conducting the new census in Colombia which is expected to end in October 2018, this new census will reveal the new official figures for the country, meanwhile the census conducted in 2005 and its figures are the official ones for all the studies and investigations to be carried out.

5.2 Colombian Population

In this context, in Colombia, five main ethnic groups are recognized, according to the National Administrative Department of Statistics DANE and according to the results of the 2005 census.

GROUP	POPULATION	PERCENTAGE
NATIVE AMERICAN	1.392.623	3.4
GITANO	4.858	0.01
RAIZAL OF THE ARCHIPIELAGO OF SAN ANDRES, PROVIDENCIA AND SANTA CATALINA	30.565	0.08
AFRICANCOLOMBIAN	4.273.722	10.52
PALENQUEROS DE SAN BASILIO	7.470	0.02
NOT BELONGING TO ANY OF THE PREAVIOUS GROUPS	34.898.170	85.9

FIGURE 5.1. Colombian ethnic groups. Figure reproduced from [13]

The statistical information, collected in the 2005 General Census -with a differential focus-, allowed a demographic characterization of the ethnic groups that acted as a basis for the differentiation in order to monitor and evaluate public policies for the construction of defined changing plans for villages and rural population.

The distribution of Colombian population according to the ongoing data of the new census shows:

Total amoun of people	40.422.827
Male population	19.688.398
Female population	20.699.877

FIGURE 5.2. Colombian distribution population. Figure reproduced from [13]

The current relationship shows that there are 95 men for every 100 women. It is evident that the level of aging in the country has increased, compared to the previous census, since it has tripled the category of 54 years old or more (40.61 percent). In contrast the category of children under 15 years of age is the one that has decreased the most.

The category of men over 54 is 35.4 percent higher than the category of men under 15 years. Similarly the category of women over 65 years is 46.2 percent higher than the category of children under 15 years of age.

The population in Colombia is bordering 50 million people, according to figures from the National Administrative Department of Statistics, -DANE, on October 21, 2018, the country will reach these huge numbers, which only other 27 countries on the planet have achieved or surpassed, which are:

ITEM	COUNTRY	POPULATION
1	CHINA	1371220000,00
2	INDIA	1311050527,00
3	UNITED STATES	321418820,00
4	INDONESIA	257563815,00
5	BRAZIL	207847528,00
6	PAKISTAN	188924874,00
7	NIGERIA	182201962,00
8	BANGLADES	160995642,00
9	RUSIA	144096812,00
10	MEXICO	127017224,00
11	JAPAN	126958472,00
12	PHILIPPINES	100699395,00
13	ETHIOPIA	99390750,00
14	VIETNAM	91703800,00
15	EGYPT	91508084,00
16	GERMANI	81413145,00
17	IRAN	79109272,00
18	TURKEY	78665830,00
19	DEMOCRATIC LICA	77266814,00
20	THAILAND	67959359,00
21	FRANCE	66808385,00
22	UNITED KINDOM	65138232,00
23	ITALY	60802085,00
24	SOUTH AFRICA	54956920,00
25	BIRMANIA	53897154,00
26	TANZANIA	53470420,00
27	SOUTH COREA	50617045,00
28	COLOMBIA	48228704,00

FIGURE 5.3. Population distribution. Figure reproduced from [13]

For Colombia this figure is a challenge, even more so when there is a migration of more than one million people from the neighboring country of Venezuela, who are in conditions of vulnerability and have not been able to establish themselves within the productive formality of the country. Most of the people that enter in an illegal way go directly to a poverty situation and contribute to economic informality of the country, making it even more difficult to achieve a state of full employment.

5.3 Colombian Territory

Colombia is a country that is formed geographically by rural regions, urban populated and urban not so populated, this distribution allows an analysis of socioeconomic variables surrounding the situation of people living in these regions.

In the world, Colombia is in third place among the countries with the greatest amount of

water, with Brazil in first place and Colombia in third place. According to GWP data, only 3 percent of the world's water is fresh and in South America 20 percent of the water resource is found. Colombia stands out for having the largest rivers in the world such as the Amazon, the Orinoco and the Magdalena in Colombia, and the Rio de la Plata in Brazil, with which Latin America plays an important role in the amount of fresh water that the planet possesses and that it can contribute to the world.

5.4 Education

Based on the geographic conformation, it can be determined according to the studies carried out by DANE, that the access of people living in rural regions to education is not privileged, since there are difficulties for the displacement of children and adolescents of educational age, because the roads and different accesses are difficult and often times are hours away from the place where they should receive their classes.

Students are known to need to travel for two or three hours on a mule's back to get to schools, or to cross rivers using suspension bridges that make it too risky for both parents and children to travel in these conditions.

In addition, the children and young people who live in these rural areas, their families live from the activities of agriculture and livestock, making the training of these boys generate within the family nucleus a deficit in the labor force that must work in the field and/or crops. This often means that parents are not interested in taking their children to school, especially when the conditions for the transfer are not the best and do not guarantee the protection of their lives. In addition, the conditions of the structure of these schools are generally very precarious.

A slightly different situation occurs with the youth population living in urban places (cities), where access to education is easier near (35.9 percent) of young people and in rural areas about 35.9 percent study, so the government has generated different strategies for schooling children and young people, starting from free education, aid for books and having transportation for students, has made a change in the perception of parents to send their children to school. In addition, the government maintains projects that seek to root children and adolescents in school, such as the school snack or school lunch, which makes it possible for students to have their basic needs met when they go to school.

In addition, the government has built a large number of schools in the different cities of the country, generating with this an increase in the coverage of students in the different regions of the country, where the conditions of the schools are constructed or improved and that allows

to receive a greater number of students, in the different levels of schooling in which they are. According the studies made by Mauricio Cardenas and Raquel Bernal in its work changes in the distribution of income and the new economic model in Colombia, education explain a significant proportion of the changes in the income distribution of this society [6].

5.5 Health

Colombia has a health network to attend the inhabitants of the national territory through SISBE, which is the medical service provided to people belonging to strata 0, 1 and 2. This service is subsidized by the government through an extensive network of hospitals and medical centers that attend to the various health situations required by the population.

The other regime that exists is the contributory one, in which all those people who are in the productive force of the country and who pay their contributions directly to the system for the attention of the health needs they require are found.

Despite these situations, people's care is not the best, since this sector has been one of the most affected by the country's corruption, since millions of resources have been invested to care for the inhabitants of the less favored strata, but not always these services are provided with high quality and with the benefit that the government expects to do to these people.

On the other hand, opportunities for health services are better in cities than in rural areas, because the hospital network of towns and villages has not been modernized, nor does it attend in the vast majority of cases, serious health situations. Therefore, people in rural areas must travel to the nearest cities to obtain better health care.

5.6 Commerce

Colombia is a country traditionally dedicated to agriculture and livestock, however due to the different conditions of geographical location and violence in the country, has caused these rates of productivity of the land, have decreased noticeably, as the peasants have migrated to large cities, leaving the countryside and their land.

For this reason, the government has undertaken projects to return the peasants to the countryside, with strong incentives for the peasants to return to cattle ranching and to cultivate and use the land.

Traditionally, the peasant has cultivated coffee, being Colombia the third world producer of coffee, cotton, cocoa and floriculture and other products that have allowed the country to

increase its GDP and make an adjustment in its balance of payments, livestock is another sector that is being promoted because the production of meat and milk also make their contribution to consumption and exports of these products, and therefore helps to improve the balance of payments in a positive way in the country.

Other sectors such as mining, for the exploitation of some metals such as copper, gold and iron precious stones such as emeralds and diamonds, coal and oil, gas, also contribute greatly to the balance and for the exports that the country makes and improves the balance of payments of the country.

Trade, seen from the point of view of services, has also increased, especially tourism in different parts of the country for its geographical location the coastal area-such as Cartagena, Santa Martha and the Guajira are the most popular destinations for domestic and foreign tourists, the jungle in particular the Amazon is the favorite destination for foreigners because its beauty and its unexplored nature, make this destination the most desired by all tourists, generating large foreign exchange for the country in this sector. Another sector that generates large foreign exchange are the handicrafts, which are made by the inhabitants in Colombian territory.

Hence, it is important that Colombia turns its eyes to this sector since it is the one that most promises to contribute to the GDP.

5.7 Violence

A further point to analyze is the fact that violence through different armed groups makes the non-voluntary desertion of young students is every day greater, however, many times parents prefer to make the displacements to the big cities, in order to keep their children away from the scourge of violence, which is one of the factors that most affects the desertion of the rural population to the city.

This brings a new variable to the situation, such as the displacement of peasants to the city, generating a greater number of people in cities where opportunities are fewer and fewer and the conditions for these displaced people are not the best and they come to form part of the informality in employment, they come to swell the number of people without housing, without health and without the attention of basic services.

The Colombian government has bet on education as a tool to allow the population to reach a higher cultural level that allows them to incorporate into the productive life of the country, all those who have accessed these opportunities and have taken advantage of them, both for their

own benefit and for the benefit of the country, which allows a higher level of knowledge that leads to greater competitiveness as a direct result, leads to higher productivity and makes it possible to increase the income of people trained in Colombia, in different productive sectors.

In such a way, that this allows the country to position itself at an international level as a country with greater productivity, a greater generator of employment, a country that exports its products to other parts of the world, generating a greater opportunity for those less favored people and taking advantage of all the comparative advantages that the country has and that have not yet been fully exploited as they are (its natural resources both fauna and flora), the water resources and its competitive advantage with its geographical position in the torrid zone since it has diverse climates that make possible the cultivation of a great variety of agricultural products and the development of the cattle ranch, that in the future can become its greater economic strength for the country.

5.8 Peace

Another point on which the government of Colombia has worked is the issue of Peace, since within the country, due to its geographical makeup, different groups have been formed, hands in arms, which have put the sovereignty of the country in check, since in Colombia the ELN (National Liberation Army) is in conflict; Another subversive group is the paramilitaries and a third group is the FARC (Revolutionary Armed Forces of Colombia), which have been exercising for more than 50 years, the destabilization of the government. This is the reason why the ELN (National Liberation Army), the National Liberation Army, has been in conflict in Colombia. For this reason, the government has had to invest large sums of money in the defense of the sovereignty of the country, because the subversive groups have been profiting from the scourge of drug trafficking, which has permeated different levels of corruption of both individuals and the government itself, generating an internal war of power that has not allowed the country to move forward in this struggle.

As a strategy, the government has carried out a successful negotiation with the FARC, who signed Peace on September 26, 2016, and the Colombian people, agreed by popular vote, to endorse the negotiations that took place for nearly three years, in the country of Cuba and where the Colombian people by a vote of 50.2 percent of the voters said NO to the Cuban agreements, so the Congress through its extraordinary faculties endorsed the agreement for the country, in order to try to achieve PEACE, with at least one of the subversive groups existing in the country and that have affected the economy and its security so much.

5.9 Public Services

In Colombia 44 percent of the territory has abundant water, according to the Ministry of Environment, are precisely these regions that have less water for human consumption and are dedicated to irrigation of crops and livestock.

In Colombia there are millions of people who still do not have the service of aqueduct and sewerage and the government has managed to give drinking water for the first time to more than 6.5 million inhabitants of different regions of Colombia, because although it seems strange despite Colombia is the country and another 6 million already have the sewerage service, which has improved the health situation of millions of Colombians, improving their living conditions and their health conditions that will directly affect the health of children, youth and adults.

5.10 Roads

Due to its geographical location, the country requires the development of roads and investment in Colombian ports, since it is through the ports that the greatest number of merchandise arrives to be distributed in the Colombian territory.

It is for this reason that the government has been making investments in the sector of national roads and some departmental roads, because it is through the transport and distribution of products to different sectors of the country and the delivery of the same, where the production process begins.

Therefore, it is important to have a number of very good roads for the transport of products that improve the reduction of delivery times, ensure road safety on the roads, which is expected to decrease the value of indirect costs in products, reducing their price and reaching a greater number of consumers.

According to Portfolio in its recent edition 52 percent of the land belongs to 1.5 percent of the population, in the report delivered by OXFAM, 1 percent of owners have 80 percent of rural land. 46 percent of the land in rural areas is used for activities that are not suitable for their exploitation, of the remaining 54 percent, 5 percent of a total of 114 million hectares, is used for exploitation of agriculture and livestock. Of the total of the existing hectares, nearly 18 million -says the Geographic Institute of Agriculture-, is used for activities that do not correspond to its normal activities and 16 million of these hectares are underutilized or are exploited below their potential.

5.11 Gini Index

As previously mentioned Gini index or Gini coefficient is an economic measure that serves to calculate the income inequality that exists between citizens of a territory, usually a country. The Coefficient is between 0 and 1. Being zero : Maximum equality (all citizens have the same income) and 1 : The maximum inequality (all income is held by a single citizen.

Applying the formula for rural land was determined that the coefficient for Colombia is 89.7 percent for 2016, which reaffirms that Colombia has much rural land but owned by a few people, this indicates that inequality in Colombia is very large according to the place in which an individual lives.

This same concept of inequality can be understood graphically through the Lorenz curve. Applying the Gini coefficient to land distribution, this proportion gives one of the highest rates of inequality: 0.86. Colombia maintains an inequality both in the distribution of land and in the income of the inhabitants, so that the concentration of wealth is in the hands of a few, and thus the gap between rich and poor continues to grow. According to studies realized by Bernal and Cardenas, wage inequality dispersion between 1976 and 1990 went higher. Manly by the rise in inequality between groups with different education as well as the growth of the dispersion between white collar workers with respect to blue collar workers.[5]

Colombia is the second most unequal country in Latin America after Honduras (according to the World Bank in 2014), and former President Santos declared that 1 percent of the population concentrates 40 percent of the wealth. Despite all the above, the country shows great signs of economic recovery since by 2017, according to official figures from DANE, GDP grew 1.8 percent. The sectors that contributed most to this growth were agriculture, mining, the financial sector, social services and manufacturing. With all of the above, the government aims to achieve single-digit inflation as is currently the case, since by 2017 inflation was 3.8 percent.

FIGURE 5.4. Income share held by the lowest 10 percent in Colombia. Figure reproduced from [9]

FIGURE 5.5. Income share held by the highest 10 percent in Colombia. Figure reproduced from [9]

5.12 Strategies

As a strategy to reduce poverty, the government must urgently advance a tax reform that allows the country to receive greater resources to meet the needs of the Colombian people, such as health, housing, education and pensions that the government subsidizes for thousands of elderly people who rely on pension income to subsist in minimum conditions of dignity. However, carrying out this reform is not easy, since these reforms affect the country's most powerful class, which

is not willing to be deprived of the privileges they have obtained and that with this reform the existing gap between the country's rich and poor could be narrowed.

It is hoped to close the gaps in rural and urban areas, so the government should think about making a greater presence in all corners of the country to ensure the security and presence of the army and police in Colombian territory, to ensure that demobilized groups and subversives do not corner the Colombian people again, neither in the cities nor in the countryside.

Although the task is not an easy one, the country is heading towards the recovery of the economic and security circumstances, which will allow Colombians to reduce the rates of inequality in their territory, through the recovery of the countryside, to take advantage of it in cattle raising and agriculture, as well as in education, an important pillar for the Colombian people to have access to better working conditions and purchasing power, and in general in all fields such as health, investment in improving roads and security in the Colombian territory, will make the country gain greater credibility abroad and will make foreign investment possible throughout the territory, in different productive sectors.

Chapter 6

Statistical Model

In the next session of the work, a statistical model with which we will try to explain the inequity situation of Colombian society according to relevant variables will be shown.

This problem will be modeled taking into account all the previous analysis of the most relevant problems in Colombia throughout the years. The model will try to give statistical evidence of different factors that influences inequity situations.

The final goal of the model is identify statistical evidence of correlations between inequity and selected indicators that will take the role of regressors or explanatory variables. As previously discussed inequality is not easy to measure. It takes great effort to have a useful indicator of this variable. First of all the collection of all necessary information takes a lot of effort and needs to be done with a significant group that correctly represents the situation of the society. Also the calculation of such indexes has not been done for longs periods of time so the current data is not very rich.

For these reasons we will use as a measure of income inequality the Gini coefficient that is one of the most popular indicators in this aspect. Even if the series of data are not as good as it would be expected, is one of the most explored ways to measure income inequality.

As for the regressors we will take into consideration variables that theoretically should affect positively or negatively the income inequality in a society, specifically in the Colombian one.

In the design phase of the model a lot of variables were taken into consideration, to be precise a total of eight variables were taken as regressors for the model. Each of these variables was selected according to the theory that was previously mentioned in the present investigation.

Other factor that was taken into account was the years for which the data was available. Since some of the selected variables could have problems in terms of thickness and availability.

The most important variables of the model were Gini coefficient and a variable that could tell if a determined period was considered an economic crisis. The latter variable was not a problem in terms of data collection, since this conclusion can be obtained by analyzing the GDP of the country which is a variable that have been calculated since early stages of past century even for Colombia. While the former is more difficult to find. Specifically there are only seventeen calculations of Gini index for Colombia since 1996 until 2016, as it is shown in the next table.

Gini Cohefficient Years	
1996	2009
1999	2010
2000	2011
2001	2012
2002	2013
2003	2014
2004	2015
2005	2016
2008	-

FIGURE 6.1. Gini Cohefficient Years. Figure reproduced with STATA

Taking this into consideration and for practical reasons for the design and development of the model, all the other variables were selected only in the years that were mentioned. Otherwise the design of the model would have had to be done in a much complicated way taking into consideration the periods for which each variable was available.

According to economic data of Colombia, there have been two economic crisis periods since 1996 the first one occurred in 1999 and lasted until the end of 2002. This crisis was the result of multiple factors that affected economic situation. In that period the armed conflict between army and FARC was at its peak level, also drugs and cartels were still present in the panorama with a lot of strength and finally bad decisions from the government led to an abrupt decrease in the GDP and an increase of unemployment rates. The second and final crisis since 1996 was the global crisis that took place in 2008 and in Colombian case lasted until the end of 2010. This crisis had more to do with external factors that impacted national economy.

Next variable that we took into consideration was GDP per capita. This is a measure that gives an idea of the current situation of a country specially when comparing it with other countries or with other periods of time. The problem of this indicator is its lack of detail since it gives

a similar approach of an average but unsuccessfully explain further information. Interpretation of such variables can lead to errors since it give an idea of the gross domestic product by person. One would expect that the GDP per capita have an inverse relation with the Gini coefficient. This due to the fact that Gini coefficient tends to be low for developed countries, while the Gini index has greater values in developing countries. Similarly the GDP per capita should follow the same patron. This can lead us to conclude that possible this variable will have a negative impact in Gini coefficient, creating an inverse relationship between the two of them and having an expected negative coefficient in the regression.

Other factor that could play a negative effect on the Gini coefficient is the level of corruption that is present is a given society. As we know those societies with very low level of corruptions are the one with the better conditions for its citizens and usually things work very well in these societies. To make an example we can take the case of all the northern countries. In this places collective wellbeing is more important that individual.

These countries pay a significant percentage of its income in taxes sometimes with tax rates over fifty percent. However the money that is paid through this method is well used by state. Especially all this money does not finish in the pockets of a few but in the hand of everyone.

For the purposes of our study a reasonable supposition would be an direct correlation between corruption rate and Gini coefficient. That means that for a country with a high level of corruption it is expected a high level of income inequality as well. This is the opposite case of the one of northern countries. We can take as an example African or Latin-American countries where corruption levels are significantly high even if a good fraction of the population still lives in poverty conditions.

Continuing with the selection of possible factor that could impact on inequality we must consider the total amount of people living in extreme poverty conditions. For countries with a higher level of this variable it would be expected a high level of inequality as well. The interesting thing about this is that we are looking just a small fraction of the population that could have a big impact in inequality lines. This small fraction of people could have a big impact into this problem. If that is the case governments could focus its efforts specifically into reducing this number to bring wellbeing to the majority of population.

In Colombia there are a lot of opportunities coming of the rural side. Colombian coffee has been praised throughout the years by the most sophisticated customers. Unfortunately Colombia,Äôs high potential for agriculture and rural development is not been supported. Or even worse this potential is been used for the cultivation of illegal plants, particularly cocaine. This is

a problem that is still present in this country and has to be addressed as soon as possible.

For these and many other reasons people living out of agricultural activities does not have good conditions and their products are underestimated. A high percentage of people living of this field receive a very low income when compared to urban activities. Taking this into consideration it is a factor that from one way or another is affecting inequality.

Up to this point there are a lot of factors that are been considered to model the income inequality in Colombia, besides the crisis periods, that is one of the most important features of this thesis. However we will add a couple more these factors trying to come up with a model that represent in the better way the current situation of the country.

The next factor to be analyzed will be the life expectancy at birth in Colombian society. This is a pretty good indicator to establish whether a country offers good living conditions to its population or not. We will try to establish a relation between life expectancy and income inequality. The development of this indicator in Colombia and worldwide is following the same patron since the beginning of its measure and it is a growing tendency with time. This is in big part thanks to the increasing economic conditions of societies.

It would be expected for the purposes of the study that an inverse relationship between this indicator and income inequality is presented. This means the more people is expected to live is because of good health conditions that are also related to good economic conditions that at the same time would reduce inequity problems for a better society.

Finally the last factor that will take into account to try to model inequality in Colombian society is education. In an intuitive way it would be expected that the higher the number of people is getting educated is the lower the Gini coefficient must be. In other words there should be an inverse relationship between the two variables. This is a condition that is also satisfied in developed countries where basic education completion rates tend to be high specially at basic level, meaning primary and secondary.

6.1 Explanatory Variables

Selected explanatory variables:

- Crisis period: Dummy variable. This variable takes the value of ”0” if the year is not considered a crisis period. Otherwise it will take the value of ”1” this means that the given year is considered a crisis period.

- Poverty head count (%) (International standard ($1,9)): Continuous variable. This variable reflects the percentage of Colombian society that is living in poverty according to the international standard of 1.9 $ US Dollars received per day.
- GDP per capita ($US): Continuous variable. This variable estimates the Gross Domestic Product generated by one person.
- Percentage of rural population: Continuous variable. This variable measures the percentage of people living outside the urban population.
- Corruption perception index (0 to 100): Continuous variable. This variable reflects the situation of a given country in terms of corruption. The score is given from ”0” to ”100” being zero the lowest score and a very high corruption level and being one hundred the best possible score with low levels of corruption.
- Life expectancy at birth: Continuous variable. This variable estimates the average age that a person will live in the year that person was born. Higher values suggest better economic and social conditions.
- Primary education pupils (millions of people): Continuous variable. This variable counts the number of active primary school student in a given territory at a certain year.

6.2 Program Used

The software in which the experiment was done was STATA. This is a statistical program that can be used for multiple types of regressions or statistical models such as ANOVA or MANOVA among others. It is also useful to verify assumptions and predict values when the model is established. Also it offers graphical features to better understand underlying results. In the figure (6.2) the interface of the program is shown.

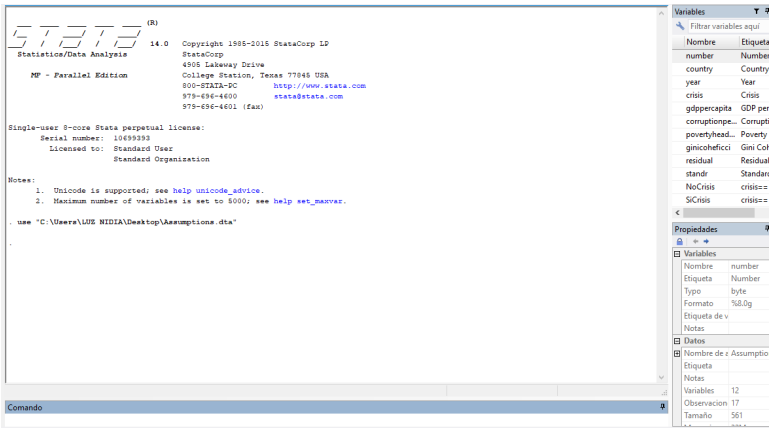


FIGURE 6.2. Program Interface. Figure reproduced with STATA

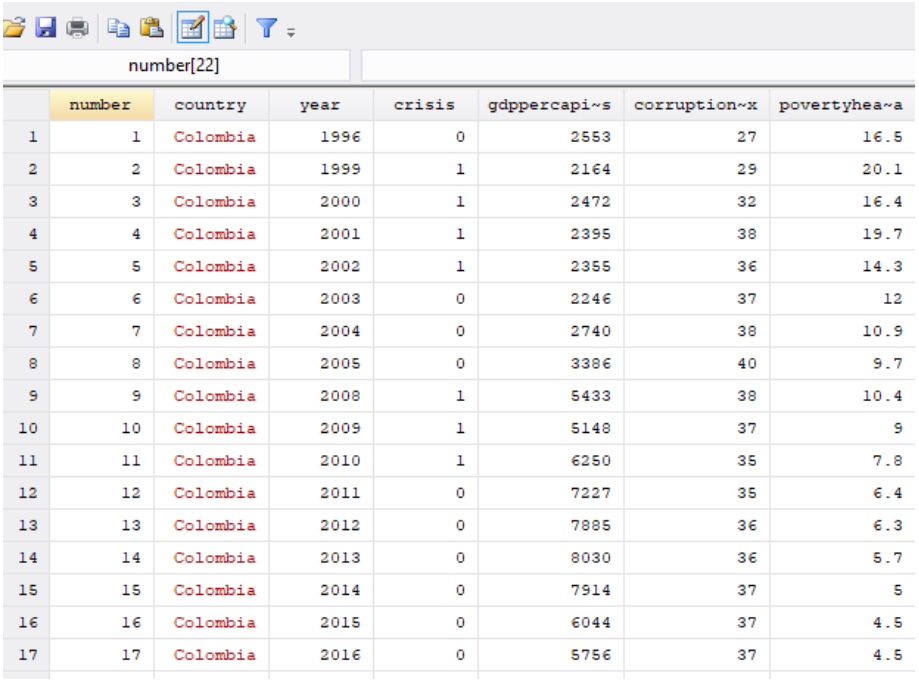
6.3 Data Collection

All data was taken from public domain websites. Specifically the data was taken from the World Bank website for the majority of the variables. The only variable that was taken from a different organization was the corruption perception index that was taken from Transparency International.

In the figures (6.3)(6.4) the collected data is shown for all the variables.

The data was divided in to separate images for a better understanding of the same but both images correspond to the same database model.

Detailed data of: crisis period, GDP per capita, corruption perception index and poverty headcount radio for the periods of interest.Figure (6.3)

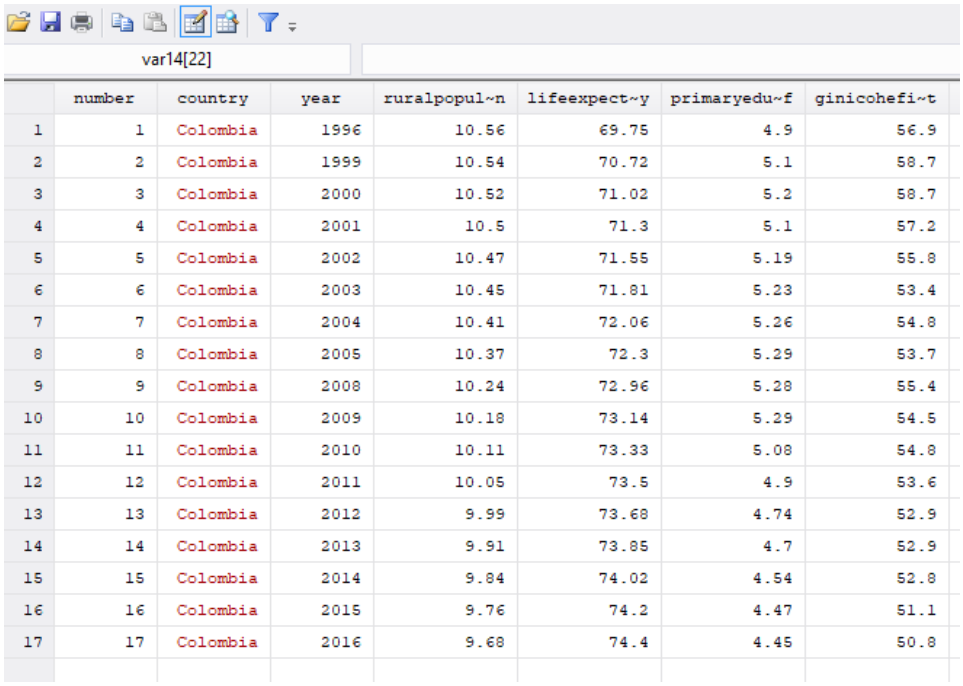


number[22]

	number	country	year	crisis	gdppercapi~s	corruption~x	povertyhea~a
1	1	Colombia	1996	0	2553	27	16.5
2	2	Colombia	1999	1	2164	29	20.1
3	3	Colombia	2000	1	2472	32	16.4
4	4	Colombia	2001	1	2395	38	19.7
5	5	Colombia	2002	1	2355	36	14.3
6	6	Colombia	2003	0	2246	37	12
7	7	Colombia	2004	0	2740	38	10.9
8	8	Colombia	2005	0	3386	40	9.7
9	9	Colombia	2008	1	5433	38	10.4
10	10	Colombia	2009	1	5148	37	9
11	11	Colombia	2010	1	6250	35	7.8
12	12	Colombia	2011	0	7227	35	6.4
13	13	Colombia	2012	0	7885	36	6.3
14	14	Colombia	2013	0	8030	36	5.7
15	15	Colombia	2014	0	7914	37	5
16	16	Colombia	2015	0	6044	37	4.5
17	17	Colombia	2016	0	5756	37	4.5

FIGURE 6.3. Detailed Data crisis period... Figure reproduced with STATA

Detailed data of: percentage of rural population, life expectancy, primary education pupils and Gini coefficient for the periods of interest.Figure (6.4)



var14[22]

	number	country	year	ruralpopul~n	lifeexpect~y	primaryedu~f	ginicohefi~t
1	1	Colombia	1996	10.56	69.75	4.9	56.9
2	2	Colombia	1999	10.54	70.72	5.1	58.7
3	3	Colombia	2000	10.52	71.02	5.2	58.7
4	4	Colombia	2001	10.5	71.3	5.1	57.2
5	5	Colombia	2002	10.47	71.55	5.19	55.8
6	6	Colombia	2003	10.45	71.81	5.23	53.4
7	7	Colombia	2004	10.41	72.06	5.26	54.8
8	8	Colombia	2005	10.37	72.3	5.29	53.7
9	9	Colombia	2008	10.24	72.96	5.28	55.4
10	10	Colombia	2009	10.18	73.14	5.29	54.5
11	11	Colombia	2010	10.11	73.33	5.08	54.8
12	12	Colombia	2011	10.05	73.5	4.9	53.6
13	13	Colombia	2012	9.99	73.68	4.74	52.9
14	14	Colombia	2013	9.91	73.85	4.7	52.9
15	15	Colombia	2014	9.84	74.02	4.54	52.8
16	16	Colombia	2015	9.76	74.2	4.47	51.1
17	17	Colombia	2016	9.68	74.4	4.45	50.8

FIGURE 6.4. Detailed Data % rural population... Figure reproduced with STATA

6.4 Variables Description

Description of the variables in the STATA program: In the figure (6.5) we can see a basic description of the data. The image shows the number of variables involved in the experiment as well as the number of observations and the size of the matrix. Also in the lower part of the image it is displayed the label of each variable and the storage type of each of them.

```
Contains data
  obs:            17
 vars:            11
 size:           595
-------------------------------------------------------------------------------
              storage   display    value
variable name   type    format     label      variable label
-------------------------------------------------------------------------------
number          byte    %8.0g                 Number
country         str8    %9s                   Country
year            int     %8.0g                 Year
crisis          byte    %8.0g                 Crisis
gdppercapitaus  int     %8.0g                 GDP per capita (US$)
corruptionper~x byte    %8.0g                 Corruption perception index
povertyheadco~a float   %8.0g                 Poverty head count International standard ($1,9)
ruralpopulation float   %8.0g
lifeexpectancy  float   %8.0g                 Life expectancy
primaryeducat~f float   %8.0g                 Primary education pupils (millions of people)
ginicoheficci~t float   %8.0g                 Gini Coheficcient
-------------------------------------------------------------------------------
```

FIGURE 6.5. Data basic description. Figure reproduced with STATA

Next, in figure (6.6) we will see a general description of the variables involved in statistical terms: For each of the variables it is possible to see the number of observations with its respective mean and standard deviation. Also we can see the intervals for each of the variables. Or in other words the minimum and maximum value that the variable take in the experiment.

Variable	Obs	Mean	Std. Dev.	Min	Max
number	17	9	5.049752	1	17
country	0				
year	17	2006.941	6.169183	1996	2016
crisis	17	.4117647	.5072997	0	1
gdppercapi~s	17	4705.765	2269.599	2164	8030
corruption~x	17	35.58824	3.336518	27	40
povertyhea~a	17	10.54118	5.210333	4.5	20.1
ruralpopul~n	17	10.21059	.2956449	9.68	10.56
lifeexpect~y	17	72.56412	1.37475	69.75	74.4
primaryedu~f	17	4.983529	.2997487	4.45	5.29
ginicohefi~t	17	54.58824	2.329132	50.8	58.7

FIGURE 6.6. Variables General Description. Figure reproduced with STATA

More detailed information about all variables are shown in the figures (6.7,6.8,6.21,6.10,**??**,6.12, 6.13). The variance of the variable and the Kurtosis of the same are exposed. Moreover there is a quartile breakdown for each of the variables, showing the minimum and maximum value of each of the quartiles.

Crisis

Percentiles		Smallest		
1%	0	0		
5%	0	0		
10%	0	0	Obs	17
25%	0	0	Sum of Wgt.	17
50%	0		Mean	.4117647
		Largest	Std. Dev.	.5072997
75%	1	1		
90%	1	1	Variance	.2573529
95%	1	1	Skewness	.3585686
99%	1	1	Kurtosis	1.128571

FIGURE 6.7. Variables detailed information crisis. Figure reproduced with STATA

The crisis variable can only take values of zero and one that is why up to the 75% mark all value are zero. This tells us that the majority of the values that this variable take are zero.

Specifically only six values out of seventeen take the value of one.

GDP per capita (US$)

	Percentiles	Smallest		
1%	2164	2164		
5%	2164	2246		
10%	2246	2355	Obs	17
25%	2472	2395	Sum of Wgt.	17
50%	5148		Mean	4705.765
		Largest	Std. Dev.	2269.599
75%	6250	7227		
90%	7914	7885	Variance	5151081
95%	8030	7914	Skewness	.2092643
99%	8030	8030	Kurtosis	1.45856

FIGURE 6.8. Variables detailed information GDP per capita. Figure reproduced with STATA

In this chart is shown that the minimum value that this variable takes is 2164 US dollars of GDP per capita in the lowest year. While the maximum value that the variable takes is 8030 US dollars. This is a value of almost four times the minimum value. So it can be intuited that the standard deviation must be high. On the other hand the average value is 4705 US dollars.

Corruption perception index

	Percentiles	Smallest		
1%	27	27		
5%	27	29		
10%	29	32	Obs	17
25%	35	35	Sum of Wgt.	17
50%	37		Mean	35.58824
		Largest	Std. Dev.	3.336518
75%	37	38		
90%	38	38	Variance	11.13235
95%	40	38	Skewness	-1.428822
99%	40	40	Kurtosis	4.281623

FIGURE 6.9. Variables detailed information corruption perception index. Figure reproduced with STATA

The corruption perception index is a variable that takes high values when corruption is low, on the other hand it takes low values for evident corruption situations. The minimum value is 27 and the maximum value is 40. In this case the standard deviation of the variable is low. While the mean value is 35.58.

Poverty head count International standard ($1,9)

	Percentiles	Smallest		
1%	4.5	4.5		
5%	4.5	4.5		
10%	4.5	5	Obs	17
25%	6.3	5.7	Sum of Wgt.	17
50%	9.7		Mean	10.54118
		Largest	Std. Dev.	5.210333
75%	14.3	16.4		
90%	19.7	16.5	Variance	27.14757
95%	20.1	19.7	Skewness	.5528844
99%	20.1	20.1	Kurtosis	2.060209

FIGURE 6.10. Variables detailed information poverty head count. Figure reproduced with STATA

Poverty headcount radio (%) the minimum value that the variable takes is 4.5% while the higher value is over 20%. This variable present a downward slope tendency when plotted in time. This is a good indicator that shows that poverty percentages are getting low with time.

ruralpopulation

	Percentiles	Smallest		
1%	9.68	9.68		
5%	9.68	9.76		
10%	9.76	9.84	Obs	17
25%	9.99	9.91	Sum of Wgt.	17
50%	10.24		Mean	10.21059
		Largest	Std. Dev.	.2956449
75%	10.47	10.5		
90%	10.54	10.52	Variance	.0874059
95%	10.56	10.54	Skewness	-.3973408
99%	10.56	10.56	Kurtosis	1.769207

FIGURE 6.11. Variables detailed rural population. Figure reproduced with STATA

The rural population variable has the lowest standard deviation of all variables. Many of the observation present similar values. However the tendency of this variable is to diminish with time. The minimum percentage of rural population is 9.68% while the higher is 10.56%.

Life expectancy

	Percentiles	Smallest		
1%	69.75	69.75		
5%	69.75	70.72		
10%	70.72	71.02	Obs	17
25%	71.55	71.3	Sum of Wgt.	17
50%	72.96		Mean	72.56412
		Largest	Std. Dev.	1.37475
75%	73.68	73.85		
90%	74.2	74.02	Variance	1.889937
95%	74.4	74.2	Skewness	-.4261871
99%	74.4	74.4	Kurtosis	2.091792

FIGURE 6.12. Variables detailed life expectancy. Figure reproduced with STATA

Life expectancy variable contrary to the behavior of the other analyzed variables have an upward tendency whit time. This is also a good economic indicator that reflects the wellbeing of population. The lowest value of this variable is 69.75 while the higher is 74.4 expected years lived.

Gini Coheficcient

	Percentiles	Smallest		
1%	50.8	50.8		
5%	50.8	51.1		
10%	51.1	52.8	Obs	17
25%	52.9	52.9	Sum of Wgt.	17
50%	54.5		Mean	54.58824
		Largest	Std. Dev.	2.329132
75%	55.8	56.9		
90%	58.7	57.2	Variance	5.424855
95%	58.7	58.7	Skewness	.2857405
99%	58.7	58.7	Kurtosis	2.33184

FIGURE 6.13. Variables detailed Gini Coefficient. Figure reproduced with STATA

The Gini coefficient variable presents a diminishing behavior with time. The higher value is 58.7 and it is presented in the first years in which the indicator was measured. On the other hand the lower value of 50.8 corresponds to one of the last years in which the indicator was measured. Hopefully this tendency continuous in this way for many years to come.

In the next sections the linear relation between the regressors and the dependent variable will be shown. This is done to have an idea of the kind of relation between variable, whether it is direct or inverse. It is also useful to see how good the point of the variables fit into the line.

1. Two way graph Gini Index VS. Crisis Period

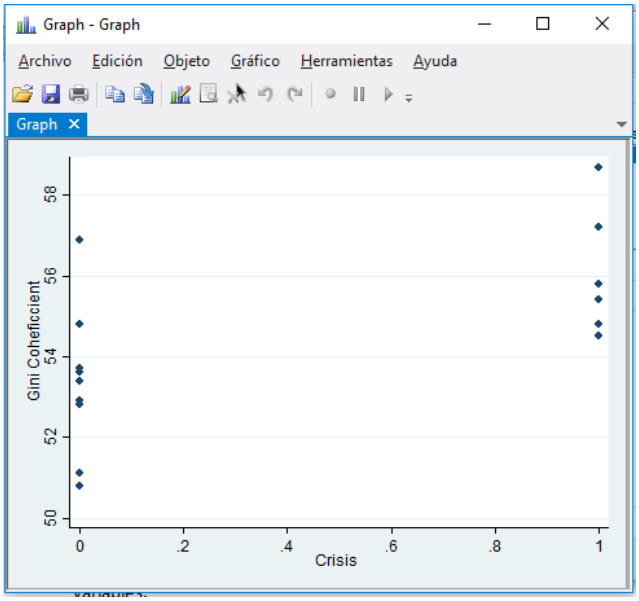


FIGURE 6.14. Two way graph Gini Index VS. Crisis Period. Figure reproduced with STATA

In this graph it can be seen a tendency in which higher Gini coefficients tend to be associated with crisis. Even if there are some values that present a high Gini when there is not crisis.

2. Two way graph Gini Index VS. GDP per Capita

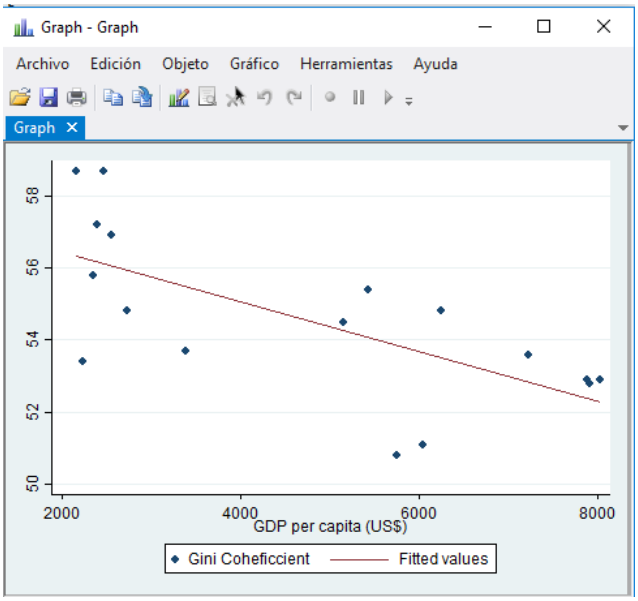


FIGURE 6.15. Two way graph Gini Index VS. GDP per Capita. Figure reproduced with STATA

In this graph it is appreciated that Gini coefficient tends to reduce with the increase of GDP per capita. The bigger the GDP, the better the economic situation for the country and also for the inequality conditions.

3. Two way graph Gini Index VS. Corruption perception index

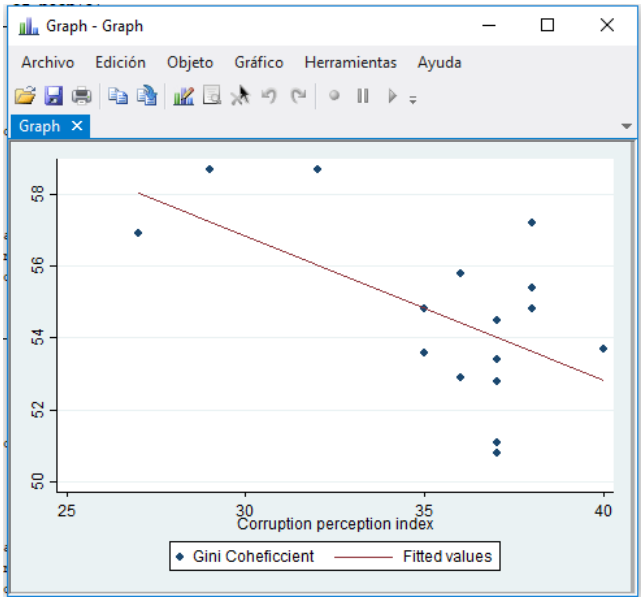


FIGURE 6.16. Two way graph Gini Index VS. Corruption perception index. Figure reproduced with STATA

This variable seems to take the contrary behavior that would be expected but is not like that. In fact it is a very useful variable. It present a inverse relationship with Gini coefficient this is because the higher the corruption coefficient, the better for the corruption situation. The less corrupt countries of the world present high indicators while the low values reflect a bad situation in terms of corruption. This explains why the tendency is that way.

4. Two way graph Gini Index VS. Poverty head count radio

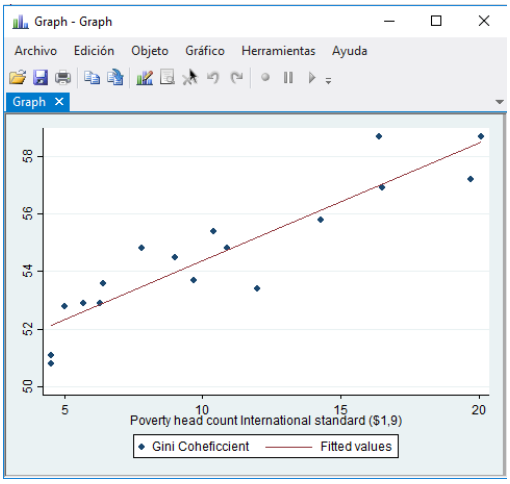


FIGURE 6.17. Two way graph Gini Index VS. Poverty head count radio. Figure reproduced with STATA

In this graph the points are very close to the tendency line. There is a direct relationship between the percentage of people living in conditions of poverty and the Gini coefficient. High values of poverty correspond to high values of income inequality.

5. Two way graph Gini Index VS. Percentage of Rural Population

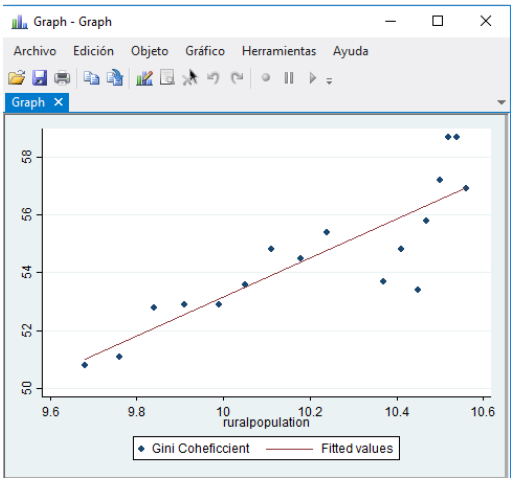


FIGURE 6.18. Two way graph Gini Index VS. Percentage of Rural Population. Figure reproduced with STATA

Rural population also shows a direct relationship between the two of them. This means that the more people living in rural areas the higher the Gini coefficient is. This conduct can be explain for the poor economic condition of this population and the disinterest of the government.

6. Two way graph Gini Index VS. Life Expectancy

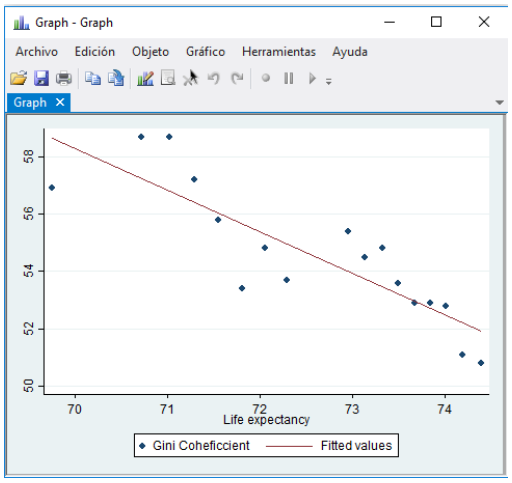


FIGURE 6.19. Two way graph Gini Index VS. Life Expectancy. Figure reproduced with STATA

His graph shows a surprising result that has nothing to do with theory. It shows a direct relationship between the two of them while in reality it should be the other way around. The more people in a country is educated the lower the inequality should be. This is not the case in this situation. This can lead to wrong conclusions and experiments related with this variable should be looked closer.

7. Two way graph Gini Index VS. Primary Education Pupils

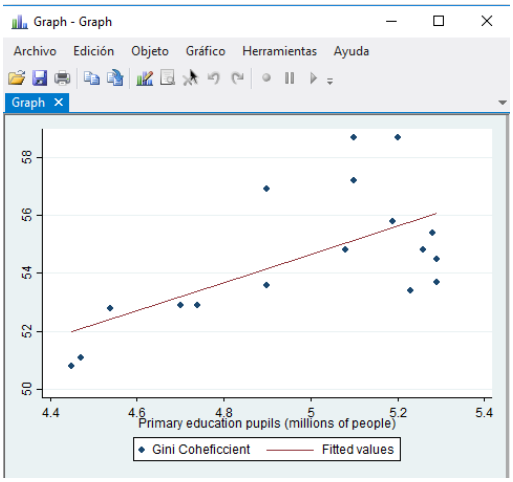


FIGURE 6.20. Two way graph Gini Index VS. Primary Education Pupils. Figure reproduced with STATA

Life expectancy and Gini coefficient present an inverse relationship. In other words the higher the life expectancy is the lower the Gini coefficient for that specific period of time. This makes sense since this indicator shows the welfare state of society.

Assumptions for the lineal model: Next it will be shown all the assumptions that a model should satisfy in order to be considered valid and make conclusions of its results. The different assumptions are listed as follows:

- ”The sample is representative of the population for the inference prediction”.
  In the case of this investigation this is the case since all available data of the independent variable (Gini coefficient) was taken into consideration. So the sample can be as good as it can be.

- ”The error is a random variable with a mean of zero conditional on the explanatory variables”.
  To prove this assumption two different approaches will be followed the first one is a graphical test to try to identify the shape that the residuals take versus their density. The second approach is a statistical test that will conclude if the variable is normally distributed or not. Specifically the Shapiro-Wilk test will be done.

  The goal is to NOT attain statistical significance since in that case the variable will differ greatly from a normal distribution. we do not want evidence to refuse the null hypothesis, which is that the variable is normally distributed.

- ”The independent variables are measured with no error”.
  All the variables that were selected are public domain information that is owned and calculated by serious agencies such as the world bank or the Bank of the republic of Colombia. There are no incoherencies in the way the variable is measured in time.

- ”The independent variables (predictors) are linearly independent, i.e. it is not possible to express any predictor as a linear combination of the others”.
  To test this assumption the variance inflation factor of the variables of the model will be calculated to find statistical evidence of independence or dependence between regressors.

- ”The errors are uncorrelated, that is, the variance,Äìcovariance matrix of the errors is diagonal and each non-zero element is the variance of the error”.
  This assumption will be tested when the model and coefficients are ready to be used and calculate residual errors. The way in which it would be done is through a graphic of residual versus fitted values in order to see the behavior of the variable and make conclusions.

- ”The variance of the error is constant across observations (homoscedasticity)”.
  For this assumption two different statistical tests will be performed. Similarly to the

previous explained statistical test we do not want evidence to refuse the null hypothesis, which is that the variable (residual errors) follows a homoscedasticity pattern. The names of the tests are Cameron & Trivedi's decomposition of IM-test and Breusch-Pagan / Cook-Weisberg test for heteroskedasticity.

The statistical test will be applied pertinently in the following steps.

The figure (6.21) shows the correlation index for each pair of variables for the experiment: Positive numbers will show a direct correlation between the two variables while negative numbers will show an inverse relationship of the same.

	ginico~t	crisis	gdpper~s	corrup~x	povert~a	ruralp~n	lifeex~y	primar~f
ginicohefi~t	1.0000							
crisis	0.6867	1.0000						
gdppercapi~s	-0.6715	-0.3650	1.0000					
corruption~x	-0.5781	-0.1520	0.2743	1.0000				
povertyhea~a	0.9140	0.5654	-0.8490	-0.5012	1.0000			
ruralpopul~n	0.8540	0.4525	-0.8711	-0.3736	0.9053	1.0000		
lifeexpect~y	-0.8541	-0.3521	0.8691	0.5949	-0.9320	-0.9438	1.0000	
primaryedu~f	0.6298	0.5570	-0.6437	0.0453	0.5876	0.8091	-0.5898	1.0000

FIGURE 6.21. Correlation Index. Figure reproduced with STATA

6.5 Regression model

For the design of the regression model a big set of variables were selected to explain in a precise way the behavior of the dependent variable that in our case is the Gini coefficient. This is a first step that had the goal of approach the problem and see if the selected variables could be helpful for the development of the model. However when the regression was done for all the variables, turned out that some of the variables did not showed statistical significance. This could be considered as normal, since for the model eight different variables were selected.

In order to make the model statistically more effective, the stepwise regression was performed with all the variables. In this kind of regression variables are added or taken away according to an established rule that allows to make structured decisions. The approach that was done for the model was a backward elimination model. Under this point of view one rule is established to

decide what variable should be eliminated (if any) and when to stop the elimination process.

One of the conditions for making this process is to have a higher amount of observation that number of variables. In our case this is not a problem since we count with seventeen observations and seven regressors.

In the case of this experiment the rule that was set is that the variable that shows the less statistical significance is eliminated and the regression is done one more time to check if the model fulfills the expectations of the researcher.

The first iteration of the process was done with seven regressors and one dependent variable. Results of the regression are shown next in the figure (6.22).

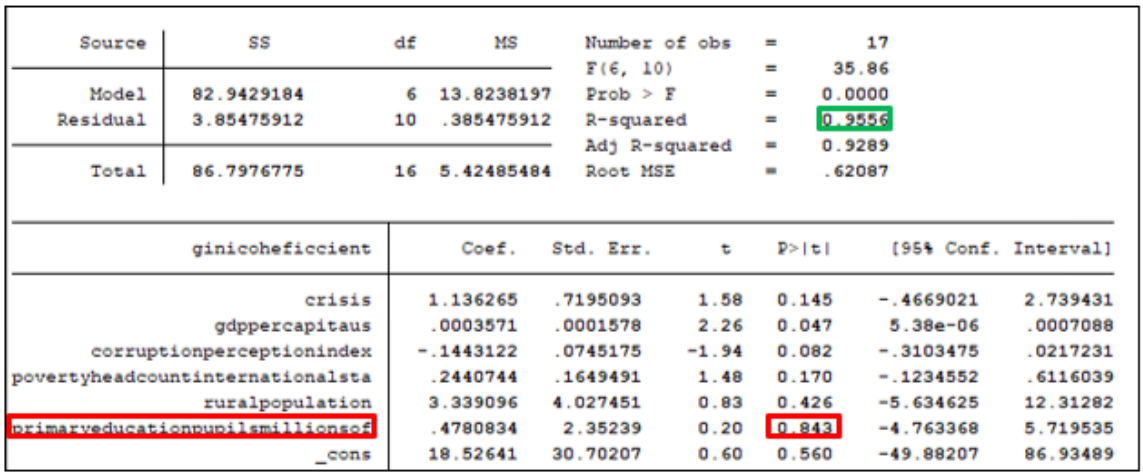
Source	SS	df	MS	Number of obs	=	17
				F(7, 9)	=	27.78
Model	82.9584092	7	11.8512013	Prob > F	=	0.0000
Residual	3.83926836	9	.426585373	R-squared	=	0.9558
				Adj R-squared	=	0.9214
Total	86.7976775	16	5.42485484	Root MSE	=	.65314

ginicoheficcient	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
crisis	1.142972	.7577219	1.51	0.166	-.5711141	2.857058
gdppercapitaus	.0003807	.0002073	1.84	0.099	-.0000882	.0008496
corruptionperceptionindex	-.1267023	.1211811	-1.05	0.323	-.4008329	.1474284
povertyheadcountinternationalsta	.2448011	.1735638	1.41	0.192	-.1478275	.6374298
ruralpopulation	2.163961	7.481889	0.29	0.779	-14.76125	19.08917
lifeexpectancy	-.2514069	1.319301	-0.19	0.853	-3.235872	2.733058
primaryeducationpupilsmillionsof	.8284446	3.082899	0.27	0.794	-6.145558	7.802447
_cons	46.2739	149.1487	0.31	0.763	-291.1238	383.6716

FIGURE 6.22. First Iteration process. Figure reproduced with STATA

In the first iteration of the process we got an excellent R-squared of almost 96%. However a lot of the variables in the model do not show statistical significance. For this reason we eliminate the variable that shows the less amount of significance and it would be Life Expectancy.

We do the regression again with six regressors now (Crisis, GDP per capita, Corruption Perception Index, Poverty Headcount Radio, Rural population and Primary Education Pupils). Results of the second regression are shown next in the figure (6.23).



Source	SS	df	MS	Number of obs	=	17
				F(6, 10)	=	35.86
Model	82.9429184	6	13.8238197	Prob > F	=	0.0000
Residual	3.85475912	10	.385475912	R-squared	=	0.9556
				Adj R-squared	=	0.9289
Total	86.7976775	16	5.42485484	Root MSE	=	.62087

ginicoheficcient	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
crisis	1.136265	.7195093	1.58	0.145	-.4669021	2.739431
gdppercapitaus	.0003571	.0001578	2.26	0.047	5.38e-06	.0007088
corruptionperceptionindex	-.1443122	.0745175	-1.94	0.082	-.3103475	.0217231
povertyheadcountinternationalsta	.2440744	.1649491	1.48	0.170	-.1234552	.6116039
ruralpopulation	3.339096	4.027451	0.83	0.426	-5.634625	12.31282
primaryeducationpupilsmillionsof	.4780834	2.35239	0.20	0.843	-4.763368	5.719535
_cons	18.52641	30.70207	0.60	0.560	-49.88207	86.93489

FIGURE 6.23. Second Iteration process. Figure reproduced with STATA

In the second iteration of the process we also got an excellent R-squared of almost 96%. However a lot of the variables in the model do not show statistical significance. For this reason we eliminate the next variable that shows the less amount of significance and it would be Primary Education Pupils.

We do the regression again with five regressors now (Crisis, GDP per capita, Corruption Perception Index, rural population and Poverty Headcount Radio).

Results of the third regression are shown next in the figure (6.24).

Source	SS	df	MS	Number of obs	=	17
				F(5, 11)	=	47.13
Model	82.9269968	5	16.5853994	Prob > F	=	0.0000
Residual	3.87068069	11	.351880063	R-squared	=	0.9554
				Adj R-squared	=	0.9351
Total	86.7976775	16	5.42485484	Root MSE	=	.59319

ginicoheficcient	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
crisis	1.257215	.3863451	3.25	0.008	.4068747	2.107555
gdppercapitaus	.0003571	.0001508	2.37	0.037	.0000251	.000689
corruptionperceptionindex	-.1353278	.0573144	-2.36	0.038	-.261476	-.0091796
povertyheadcountinternationalsta	.2170347	.0931561	2.33	0.040	.0119995	.4220699
ruralpopulation	4.10666	1.33637	3.07	0.011	1.165329	7.047991
_cons	12.98715	13.5032	0.96	0.357	-16.73319	42.7075

FIGURE 6.24. Third Iteration process. Figure reproduced with STATA

In the third iteration of the process we also got an excellent R-squared of almost 96%. This time all of the variables in the model show statistical significance. However if we analyze the constant of the model is not significant moreover the p-value of it is very high. However this can be considered as normal and a model can adjust well to a given situation even if the constant Beta zero is not significant. So the next step will be to check that all the assumptions of the model are satisfied.
The first thing will be to check that the residuals are not correlated. To this end will test with a graphic of Residual Errors Versus Fitted Values (Figure 6.25). In this test what we are looking for is that the errors should follow a random distribution. There cannot be long sequences of points that increases or decreases for three or more periods. Also there should not be points outside the two and minus two lines. In this case none of those things happens we can say that the errors are nor correlated due to the fairly evidence shown in the graph.

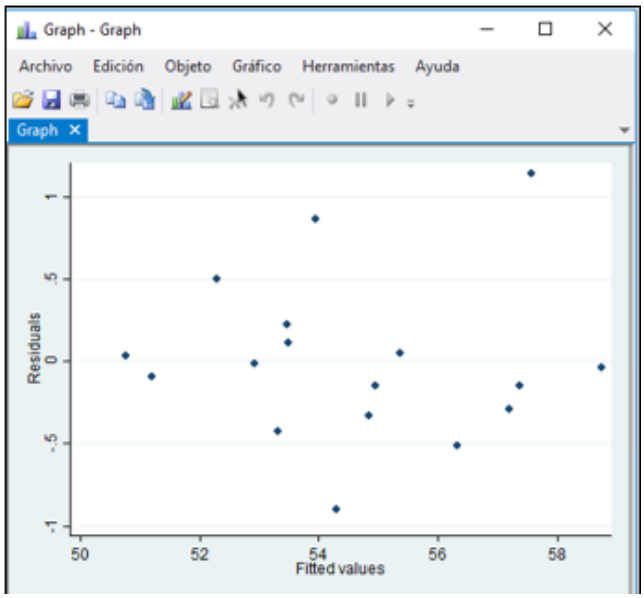


FIGURE 6.25. graphic of Residual Errors Versus Fitted Values. Figure reproduced with STATA

The next assumption that we will test is the constant variance of the errors (homoscedasticity). To this end we will apply a heteroskedasticity test that should not give statistical evidence that the errors follow that distribution.
First we apply IM-Test that returns a p-value of 0.3856. This means that there is no statistical evidence of heteroskedasticity.

Cameron & Trivedi's decomposition of IM-test

Source	chi2	df	p
Heteroskedasticity	17.00	16	0.3856
Skewness	7.50	5	0.1859
Kurtosis	0.51	1	0.4732
Total	25.02	22	0.2963

FIGURE 6.26. IM-Test. Figure reproduced with STATA

In a second test we should verify that this is correct so we perform a Breusch-Pagan / Cook-Weisberg test for heteroskedasticity. Similarly to the first time the test should not fount statistical evidence of heteroskedasticity.

The returned value of the test is 0.2996 so we do not find statistical evidence of heteroskedasticity. So we can conclude that there is homoscedasticity.

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of ginicoheficcient

         chi2(1)      =     1.08
         Prob > chi2  =   0.2996
```

FIGURE 6.27. Breusch-Pagan / Cook-Weisberg test for heteroskedasticity. Figure reproduced with STATA

Now the normality assumption of the errors must be proven. To make this a graphical display of the errors will be presented. The distribution of it must follow a similar distribution of the standard normal. Next image shows a display of errors versus their corresponded density.

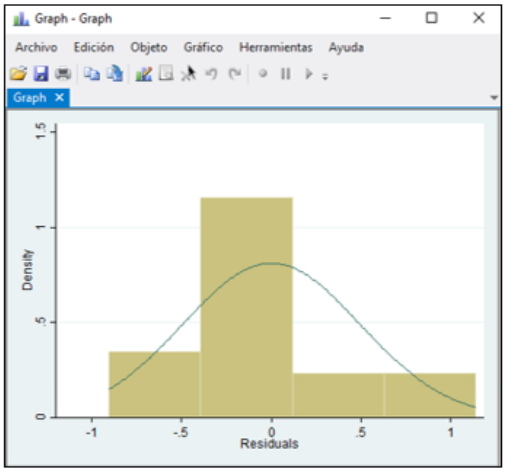


FIGURE 6.28. Graphical display of the errors. Figure reproduced with STATA

According to the graphic that we see above it is coherent to say that the errors follow a normal distribution when plotted against its density. However as this is an ambiguous reference and could be subject to interpretation we will confirm the assumption with an statistical test.

A Shapiro-Wilk W test for normal data will be performed. In this test again we do not want to see statistical significance because otherwise it would show that our data is departing significantly of what it is expected from a normal distribution.

Shapiro-Wilk W test for normal data

Variable	Obs	W	V	z	Prob>z
resd	17	0.94285	1.207	0.376	0.35356

FIGURE 6.29. Shapiro-Wilk W test for normal data. Figure reproduced with STATA

The test does not show statistical significance so we can determine that the errors follow a normal distribution. And we fulfill this assumption.

Finally it should be proved that the independent variables are not linearly correlated. To do so the variance inflation factor of the variables will be calculated. The expected results should be values under five or maximum ten.

Variable	VIF	1/VIF
povertyhea~a	10.71	0.093351
ruralpopul~n	7.10	0.140890
gdppercapi~s	5.33	0.187737
crisis	1.75	0.572525
corruption~x	1.66	0.601395
Mean VIF	5.31	

FIGURE 6.30. Variance inflation factor of the variables. Figure reproduced with STATA

The variance inflation factor of poverty head count radio is above ten and also the one of rural population is higher than seven. Taking these values into consideration, it is not possible to say that the model satisfies the condition of non-lineal correlation between independent variables.

For this reason we conclude that the model could be better and the decision is to eliminate the next variable that shows the less amount of significance and it would be Poverty Headcount Radio as we can see from the regression.

We do the regression again with four regressors now (Crisis, GDP per capita, Corruption Perception Index and Rural Population).

Results of the fourth regression are shown next in the figure (6.31).

Source	SS	df	MS	Number of obs	=	17
				F(4, 12)	=	42.05
Model	81.0170094	4	20.2542523	Prob > F	=	0.0000
Residual	5.78066814	12	.481722345	R-squared	=	0.9334
				Adj R-squared	=	0.9112
Total	86.7976775	16	5.42485484	Root MSE	=	.69406

ginicoheficcient	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
crisis	1.730308	.3845652	4.50	0.001	.8924122	2.568203
gdppercapitaus	.000197	.0001571	1.25	0.234	-.0001452	.0005392
corruptionperceptionindex	-.2074338	.0564425	-3.68	0.003	-.3304114	-.0844563
ruralpopulation	5.827346	1.303123	4.47	0.001	2.988084	8.666607
_cons	.83037	14.57203	0.06	0.955	-30.91935	32.58009

FIGURE 6.31. Fourth Iteration process. Figure reproduced with STATA

In the fourth iteration of the process we also got an excellent R-squared of 93%. This time one variable in the model does not show statistical significance. For this reason we eliminate this variable that is showing the less amount of significance and it is GDP per capita.

We do the regression again with three regressors now (Crisis, Corruption Perception Index and Rural Population).

Results of the fifth regression are shown next in the figure(6.32).

Source	SS	df	MS	Number of obs	=	17
				F(3, 13)	=	53.19
Model	80.2593303	3	26.7531101	Prob > F	=	0.0000
Residual	6.53834724	13	.502949788	R-squared	=	0.9247
				Adj R-squared	=	0.9073
Total	86.7976775	16	5.42485484	Root MSE	=	.70919

ginicoheficcient	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
crisis	1.76384	.3919961	4.50	0.001	.9169838	2.610696
corruptionperceptionindex	-.2154916	.0572978	-3.76	0.002	-.3392759	-.0917073
ruralpopulation	4.449989	.716695	6.21	0.000	2.901664	5.998315
_cons	16.0939	8.18848	1.97	0.071	-1.596231	33.78404

FIGURE 6.32. Fifth Iteration process. Figure reproduced with STATA

In this case all of the variables show statistical significance, the R-squared is also very high with more of 92% of explained variance. The only detail that could not be very good is that the constant is not significant with a confidence level of 5%. However with a confidence level a little higher that 7% the constant can also be taken into consideration.

Taking into account that this is a very good model and all of the variables are significant we can stop the process and keep this as the final version of the model. Now the test should be done to guarantee that this model is valid and satisfy assumptions.

The first thing that will be show is a graph of standard errors versus fitted values (6.33) to test if the errors are uncorrelated. In this test what we are looking for is that the errors should follow a random distribution. There cannot be long sequences of points that increases or decreases for three or more periods. Also there should not be points outside the two and minus two lines. In this case none of those things happens so we can say that the errors are nor correlated due to the fairly evidence shown in the graph.

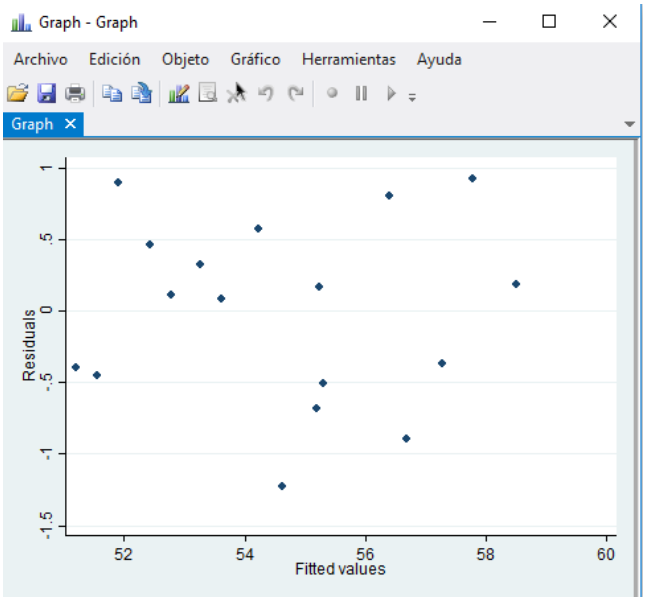


FIGURE 6.33. graph of standard errors versus fitted values . Figure reproduced with STATA

The next assumption that we will test is the constant variance of the errors (homoscedasticity). To this end we will apply a heteroskedasticity test that should not give statistical evidence that the errors follow that distribution.

First we apply IM-Test that returns a p-value of 0.1613. This means that there is no statistical evidence of heteroskedasticity.

Cameron & Trivedi's decomposition of IM-test

Source	chi2	df	p
Heteroskedasticity	11.78	8	0.1613
Skewness	4.17	3	0.2441
Kurtosis	1.49	1	0.2219
Total	17.44	12	0.1339

FIGURE 6.34. IM- Test . Figure reproduced with STATA

In a second test we should verify that this is correct so we perform a Breusch-Pagan / Cook-

Weisberg test (figure 6.35)for heteroskedasticity. Similarly to the first time the test should not fount statistical evidence of heteroskedasticity.

The returned value of the test is 0.5981 so we do not find statistical evidence of heteroskedasticity. So we can conclude that there is homoscedasticity.

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of ginicoheficcient

         chi2(1)      =     0.28
         Prob > chi2  =   0.5981
```

FIGURE 6.35. Breusch-Pagan / Cook-Weisberg test . Figure reproduced with STATA

Next we will have to prove that the errors are normally distributed. To this end a graphical display of the errors will be presented in the figure (6.36). The distribution of it must follow a similar distribution of the standard normal. Next image shows a display of errors versus density.

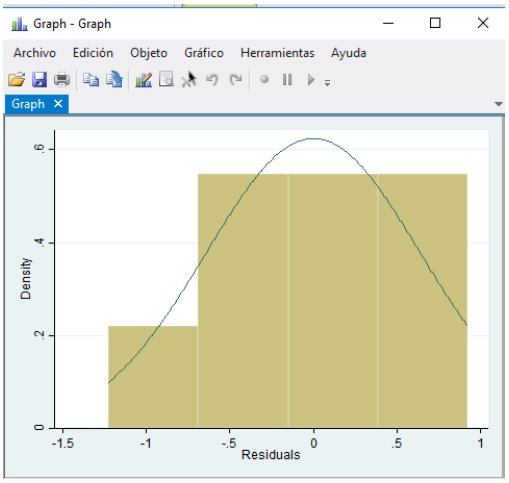
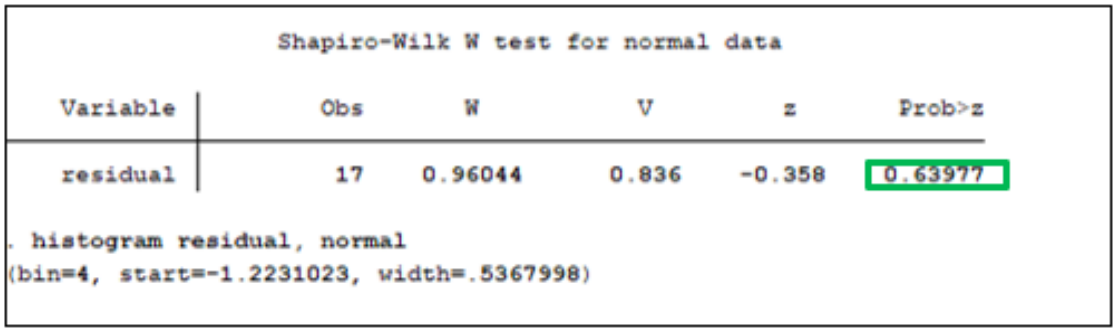


FIGURE 6.36. Graphical display of the errors. Figure reproduced with STATA

In the graphical analysis it is not very clear that the data follows a normal distribution even if we can see fair evidence but not irrefutable. For this reason a Shapiro-Wilk W test for normal data will be performed (6.37). In this test again we do not want to see statistical significance

because otherwise it would show that our data is departing significantly of what it is expected from a normal distribution.



Shapiro-Wilk W test for normal data

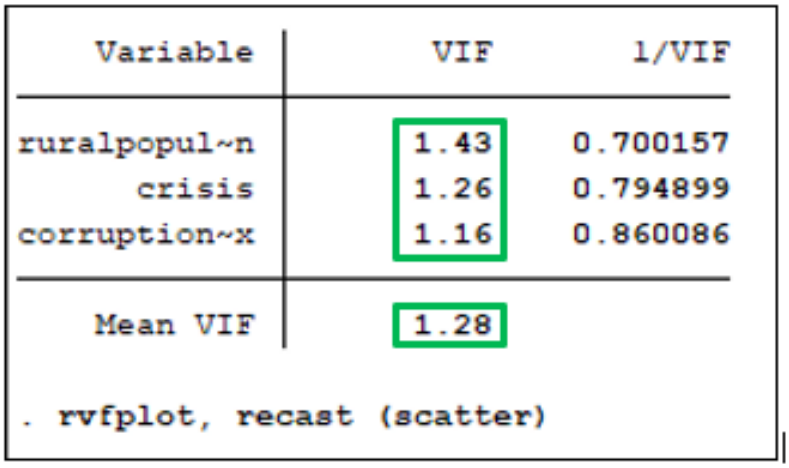
Variable	Obs	W	V	z	Prob>z
residual	17	0.96044	0.836	-0.358	0.63977

. histogram residual, normal
(bin=4, start=-1.2231023, width=.5367998)

FIGURE 6.37. Shapiro-Wilk W test. Figure reproduced with STATA

The test does not show statistical significance so we can determine that the errors follow a normal distribution. And we fulfill this assumption.

Finally it should be proved that the independent variables are not linearly correlated. To do so the variance inflation factor of the three variables will be calculated. The expected results should be values under five or maximum ten. In our case the VIF values are very low so it is possible to say that the independent variables are not linearly correlated.



Variable	VIF	1/VIF
ruralpopul~n	1.43	0.700157
crisis	1.26	0.794899
corruption~x	1.16	0.860086
Mean VIF	1.28	

. rvfplot, recast (scatter)

FIGURE 6.38. Variance Inflation Factor. Figure reproduced with STATA

Also it is reasonable to check again the graph of residual errors versus predicted values. Checking that the observations are randomly distributed and do not follow a pattern and there are not atypical values above or below two.

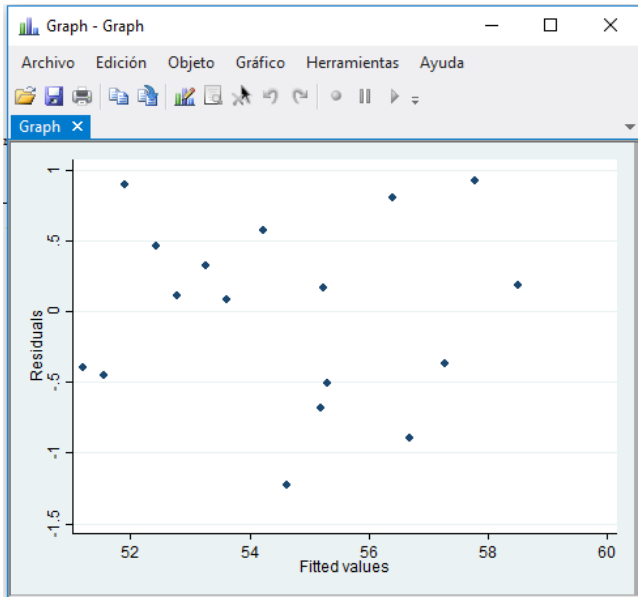


FIGURE 6.39. Graph of residual errors versus predicted values. Figure reproduced with STATA

After applying all tests to the selected model and proving the most relevant assumptions we can affirm that the model is significant. The model can be used to identify correlations between the independent variables and the dependent one. However it will not be so useful for predicting values in the future.

In order to better support the experiment a further analysis will be performed not only for Colombia, but also other countries that have also experienced periods of crisis. Specifically the selected countries are Colombia, Argentina, Thailand, Spain, Mexico, Italy and Greece. However the information for all the countries was not complete. Since for some countries the beginning of the measurement of the Gini coefficient began in the first years of two thousand.

Taking this into consideration and for the purposes of the experiment it will be treated as an unbalanced panel. This means that the values are not found for all periods of time for all the different groups, which in our case would be the countries for which we will perform the study. In the following image the statistical data is shown.

Number	Country	Year	Crisis	GDP per capita (US)	Corruption perseption index	Poverty	Gini
1	Colombia	1996	0	2553	27	16.5	56.9
2	Colombia	1999	1	2164	29	20.1	58.7
3	Colombia	2000	1	2472	32	16.4	58.7
4	Colombia	2001	1	2395	38	19.7	57.2
5	Colombia	2002	1	2355	36	14.3	55.8
6	Colombia	2003	0	2246	37	12	53.4
7	Colombia	2004	0	2740	38	10.9	54.8
8	Colombia	2005	0	3386	40	9.7	53.7
9	Colombia	2008	1	5433	38	10.4	55.4
10	Colombia	2009	1	5148	37	9	54.5
11	Colombia	2010	1	6250	35	7.8	54.8
12	Colombia	2011	0	7227	35	6.4	53.6
13	Colombia	2012	0	7885	36	6.3	52.9
14	Colombia	2013	0	8030	36	5.7	52.9
15	Colombia	2014	0	7914	37	5	52.8
16	Colombia	2015	0	6044	37	4.5	51.1
17	Colombia	2016	0	5756	37	4.5	50.8

FIGURE 6.40. Statistical Data I .

Number	Country	Year	Crisis	GDP per capita (US)	Corruption perseption index	Poverty	Gini
18	Argentina	1993	0	6940	34	2.4	44.9
19	Argentina	1994	0	7450	34	2.3	45.9
20	Argentina	1995	0	7373	34	4.1	48.9
21	Argentina	1996	0	7683	34	4.6	49.5
22	Argentina	1997	0	8172	34	4.1	49.1
23	Argentina	1998	1	8248	30	4.6	50.7
24	Argentina	1999	1	7736	30	4.8	49.8
25	Argentina	2000	1	7670	35	5.7	51.1
26	Argentina	2001	1	7170	35	9.4	53.3
27	Argentina	2002	1	2579	28	14	53.8
28	Argentina	2003	0	3330	25	7	50.7
29	Argentina	2004	0	4250	25	5.4	48.3
30	Argentina	2005	0	5075	28	3.9	47.7
31	Argentina	2006	0	5878	29	3.3	46.6
32	Argentina	2007	0	7193	29	2.9	46.3
33	Argentina	2008	0	8953	29	2.6	44.5
34	Argentina	2009	0	8161	29	2.6	43.9
35	Argentina	2010	0	10276	29	1.1	43
36	Argentina	2011	0	12726	30	0.9	42.3
37	Argentina	2012	0	12969	35	0.8	41.2
38	Argentina	2013	0	12976	34	0.8	41
39	Argentina	2014	0	12245	34	0.7	41.4
40	Argentina	2016	0	12654	36	0.6	42.4

FIGURE 6.41. Statistical Data II.

Number	Country	Year	Crisis	GDP per capita (US)	Corruption perseption index	Poverty	Gini
41	Thailand	1994	1	2490	30	3.2	43.5
42	Thailand	1996	1	3042	30	2.2	42.9
43	Thailand	1998	1	1845	30	1.5	41.5
44	Thailand	1999	1	2032	32	2.5	43.1
45	Thailand	2000	0	2007	32	2.5	42.8
46	Thailand	2002	0	2096	32	1.1	41.9
47	Thailand	2004	0	2660	36	0.8	42.5
48	Thailand	2006	0	3370	36	0.7	41.8
49	Thailand	2007	0	3972	33	0.3	39.8
50	Thailand	2008	0	4378	35	0.1	40.3
51	Thailand	2009	0	4212	34	0.2	39.6
52	Thailand	2010	0	5075	35	0.1	39.4
53	Thailand	2011	0	540	34	0	37.5
54	Thailand	2012	0	5860	37	0.1	39.3
55	Thailand	2013	0	6168	35	0	37.8
56	Thailand	2014	0	5953	38	0	37
57	Thailand	2015	0	5846	38	0	36

FIGURE 6.42. Statistical Data III.

Number	Country	Year	Crisis	GDP per capita (US)	Corruption perseption index	Poverty	Gini
58	Spain	2003	0	21495	69	0.7	31.8
59	Spain	2004	0	24918	71	0.7	33.3
60	Spain	2005	0	26510	70	0.7	32.4
61	Spain	2006	0	28482	68	0.7	33.5
62	Spain	2007	0	32709	67	0.4	34.1
63	Spain	2008	1	35579	65	0.5	34.2
64	Spain	2009	1	32334	61	0.7	34.9
65	Spain	2010	1	30736	61	0.7	35.2
66	Spain	2011	1	31835	62	1.2	35.7
67	Spain	2012	1	28563	65	1	35.4
68	Spain	2013	1	29211	59	1.2	36.2
69	Spain	2014	1	29623	60	0.7	36.1
70	Spain	2015	0	25789	58	1	36.2

FIGURE 6.43. Statistical Data IV.

Number	Country	Year	Crisis	GDP per capita (US)	Corruption perseption index	Poverty	Gini
71	Mexico	1994	1	5715	33	6.6	50.3
72	Mexico	1996	0	4295	33	11.2	48.2
73	Mexico	1998	0	5327	33	11.2	48.7
74	Mexico	2000	1	6960	33	8.9	51.4
75	Mexico	2002	0	7400	36	6.6	49
76	Mexico	2004	0	7310	36	5.2	48.3
77	Mexico	2005	0	8090	35	6.2	48.9
78	Mexico	2006	0	8860	33	3.4	47.7
79	Mexico	2008	0	9765	36	4.1	44.6
80	Mexico	2010	1	9016	31	4.2	45.3
81	Mexico	2012	0	9940	34	3.4	45.4
82	Mexico	2014	0	10580	35	4.1	45.8
83	Mexico	2016	0	8444	30	2.5	43.4

FIGURE 6.44. Statistical Data V.

Number	Country	Year	Crisis	GDP per capita (US)	Corruption perseption index	Poverty	Gini
84	Italia	2003	0	27387	53	0.7	34.9
85	Italia	2004	0	31174	48	0.7	34.3
86	Italia	2005	0	31960	50	0.7	33.8
87	Italia	2006	0	33400	49	0.7	33.7
88	Italia	2007	0	37700	52	0.7	32.9
89	Italia	2008	1	40640	48	0.7	33.8
90	Italia	2009	1	36900	43	1	33.8
91	Italia	2010	1	35850	39	1.2	34.7
92	Italia	2011	1	38335	39	1.2	35.1
93	Italia	2012	1	34814	42	1.2	35.2
94	Italia	2013	1	35370	43	1.4	34.9
95	Italia	2014	1	35396	43	1.2	34.7
96	Italia	2015	0	30180	44	2	35.4

FIGURE 6.45. Statistical Data VI.

Number	Country	Year	Crisis	GDP per capita (US)	Corruption perseption index	Poverty	Gini
97	Greece	2003	0	18477	43	0.5	32.8
98	Greece	2004	0	21955	43	0.7	33.6
99	Greece	2005	0	22551	43	0.2	34.6
100	Greece	2006	0	24801	44	0.5	35.1
101	Greece	2007	0	28827	46	0.5	34
102	Greece	2008	0	31200	47	0.5	33.6
103	Greece	2009	1	29710	38	0.5	33.6
104	Greece	2010	1	26920	35	1	34.1
105	Greece	2011	1	25915	34	1.2	34.8
106	Greece	2012	1	22242	36	1.5	36.2
107	Greece	2013	1	21874	40	1	36.1
108	Greece	2014	1	21760	43	1.5	35.8
109	Greece	2015	1	18070	46	1.5	36

FIGURE 6.46. Statistical Data VII.

As it can be seen from the data, there are some countries that have more data than others. Also the years for which the data are available are not the same for every country. That is the reason why the panel is considered as unbalanced.

From STATA we will create a panel divided into groups according to a determined variable. For the case of this experiment it will be the country. Consequently we will have a total of seven groups. This step is shown in the next figure.

```
      panel variable:  num_cou (unbalanced)
       time variable:  year, 1993 to 2016, but with gaps
               delta:  1 unit
```

FIGURE 6.47. Data time spam. Figure reproduced with STATA

As it can be seen from the image the time spam of the data begins in 1993 and and at 2016. However as previously mentioned the panel presents gaps and is unbalanced. The next figure shows that there are seven different groups referring to ”n” present in twentyfour different periods in which the delta is one since the data is taken year by year.

In the lower part of the image it is possible to see the distribution of the different groups (countries) . Three of the groups have almost none of the first half of data. The other four groups

present more frequent data been organized from less to more dense group. The groups as a whole present a good overall density.

```
num_cou:  1, 2, ..., 7                                  n =          7
   year:  1993, 1994, ..., 2016                         T =         24
          Delta(year) = 1 unit
          Span(year)  = 24 periods
          (num_cou*year uniquely identifies each observation)

Distribution of T_i:   min      5%     25%       50%       75%     95%     max
                        13      13      13        13        17      23      23

     Freq.  Percent     Cum.  Pattern
------------------------------------------------------------------------------
         3    42.86    42.86  ..........1111111111111.
         1    14.29    57.14  ...1..1111111..111111111
         1    14.29    71.43  .1.1.1.1.1.111.1.1.1.1.1
         1    14.29    85.71  .1.1.111.1.1.1111111111.
         1    14.29   100.00  11111111111111111111111.1
------------------------------------------------------------------------------
         7   100.00           xxxxxxxxxxxxxxxxxxxxxxxxx
```

FIGURE 6.48. Groups Presented. Figure reproduced with STATA

Next it will be shown the linear relationship that exists between the Gini coefficient and the independent variables. The first image corresponds Gini coefficient VS GDP per capita.

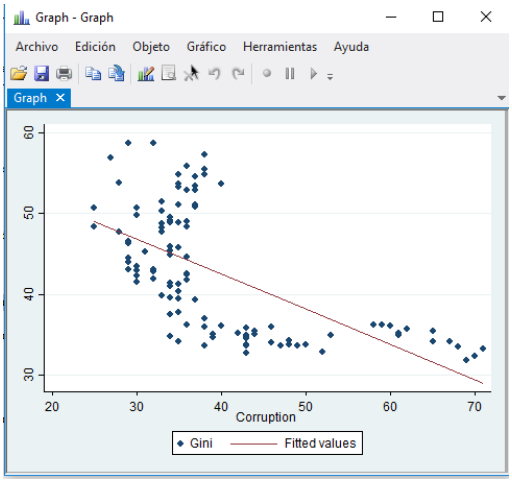


FIGURE 6.49. Linear Relationship. Figure reproduced with STATA

Meaning that the Gini coefficient is inversely related to GDP per capita. The second image correspond Gini coefficient VS poverty headcount radio.

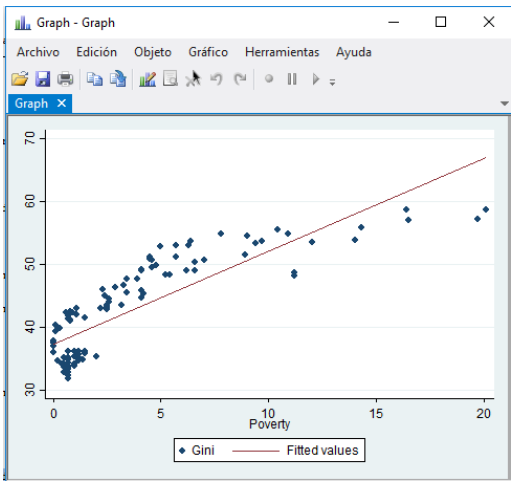


FIGURE 6.50. Gini coefficient VS poverty headcount radio. Figure reproduced with STATA

Meaning that the Gini coefficient is directly related to poverty headcount ratio.

First of all a simple regression will be applied with put taking the groups into consideration. In other words a similar experiment as the one performed with Colombia will be applied. This experiment would be the equivalent to take the whole one hundred and nine data as it would be just one country. Results are the following.

```
. reg gini crisis gdp_per_cap corruption poverty

      Source |       SS       df       MS              Number of obs =     109
-------------+------------------------------           F(4, 104)     =  174.92
       Model |  5576.47846     4  1394.11962            Prob > F      =  0.0000
    Residual |  828.901385   104  7.97020562            R-squared     =  0.8706
-------------+------------------------------           Adj R-squared =  0.8656
       Total |  6405.37985   108  59.3090726            Root MSE      =  2.8232

------------------------------------------------------------------------------
        gini |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      crisis |   -.1035354   .6327189    -0.16   0.870    -1.358241    1.15117
  gdp_per_cap |   -.0002476   .0000388    -6.39   0.000    -.0003244   -.0001707
  corruption |   -.0812216   .0365898    -2.22   0.029    -.1537805   -.0086627
     poverty |    1.060605   .0775031    13.68   0.000     .9069138    1.214297
       _cons |    45.67237   1.26252     36.18   0.000     43.16875    48.176
------------------------------------------------------------------------------
```

FIGURE 6.51. Result from the model. Figure reproduced with STATA

In this model crisis factor and corruption perception index are not significant. In fact there p-value for crisis is 0.87 suggesting that the variable should not be taken into consideration. Also according to the coefficients it shows that the Gini index decreases with a crisis periods which is

completely opposite to the expected behavior.

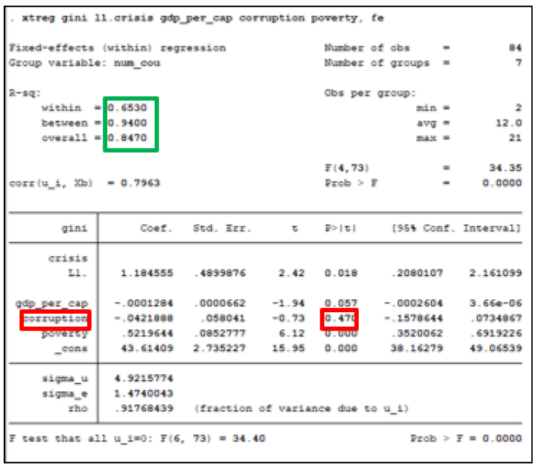
Nevertheless this analysis is biased since it is not taking into consideration a significant condition which is the division of the groups. The next step to be followed would be to perform the same analysis but taking the division into consideration and see if the results change or not. When the regresssion is performed as a panel with unbalanced data it is obtained:

```
. xtreg gini crisis gdp_per_cap corruption poverty, fe

Fixed-effects (within) regression               Number of obs      =       109
Group variable: num_cou                         Number of groups   =         7

R-sq:                                           Obs per group:
     within  = 0.6459                                         min =        13
     between = 0.9288                                         avg =      15.6
     overall = 0.8377                                         max =        23

                                                F(4,98)            =     44.69
corr(u_i, Xb)  = 0.7591                         Prob > F           =    0.0000

------------------------------------------------------------------------------
        gini |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      crisis |   1.646493   .3863426     4.26   0.000     .8798083    2.413177
gdp_per_cap |  -.0001841   .0000597    -3.08   0.003    -.0003026   -.0000655
  corruption |  -.0289854   .0467817    -0.62   0.537    -.1218222    .0638513
     poverty |   .4446393    .070861     6.27   0.000      .304018    .5852606
       _cons |   44.28515   2.152821    20.57   0.000     40.01295    48.55735
-------------+----------------------------------------------------------------
     sigma_u |   4.535791
     sigma_e |    1.50335
         rho |   .90101977   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0: F(6, 98) = 44.79                     Prob > F = 0.0000
```

FIGURE 6.52. Regression performed and unbalanced data. Figure reproduced with STATA

In this case most of the independent variables of the model are significant and more importantly the crisis variable have a p-value of almost zero which means that is a significant variable. This experiment shows a completely different result compared to the previous one. The coefficients are coherent showing that increases in GDP diminish inequality as well as the perceived corruption index which is the expected outcome. On the other hand crisis and poverty headcount radio increases Gini coefficient. Both of them are coherent results supported by facts and theory.

The next step to make the model more coherent with reality will be to correlate the Gini coefficient of year ”x” with the crisis value of the year ”x + 1” since a crisis period has an impact in the future not necessarily in the exact same period.



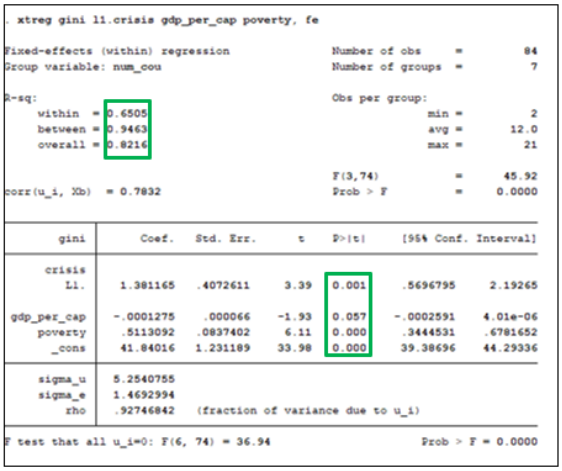
```
. xtreg gini l1.crisis gdp_per_cap corruption poverty, fe

Fixed-effects (within) regression               Number of obs      =        84
Group variable: num_cou                         Number of groups   =         7

R-sq:                                           Obs per group:
     within  = 0.6530                                         min =         2
     between = 0.9400                                         avg =      12.0
     overall = 0.8470                                         max =        21

                                                F(4,73)            =     34.35
corr(u_i, Xb)  = 0.7963                         Prob > F           =    0.0000

------------------------------------------------------------------------------
        gini |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      crisis |
         L1. |   1.184555   .4899876     2.42   0.018     .2080107    2.161099
             |
  gdp_per_cap |  -.0001284   .0000662    -1.94   0.057    -.0002604    3.66e-06
  corruption |  -.0421888    .058041    -0.73   0.470    -.1578644    .0734867
     poverty |   .5219644   .0852777     6.12   0.000     .3520062    .6919226
       _cons |   43.61409   2.735227    15.95   0.000     38.16279    49.06539
-------------+----------------------------------------------------------------
     sigma_u |  4.9215774
     sigma_e |  1.4740043
         rho |   .91768439   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0: F(6, 73) = 34.40                     Prob > F = 0.0000
```

FIGURE 6.53. Gini coefficient of year correlated with the crisis value of the year. Figure reproduced with STATA

Results are similar to the previous model even the variables that were significant and the one that were not significant remain the same. However the values do change as well as the p-value of each of them, in most of the cases increasing.

Similarly on what we did in the Colombian case the least significant variable will be taken out of consideration on the experiment. In the case of the preceding regression, the least significant variable was corruption perception index. So this variable is taken out of the model.

Results will be shown in the next figure as follows.



```
. xtreg gini l1.crisis gdp_per_cap poverty, fe

Fixed-effects (within) regression               Number of obs      =        84
Group variable: num_cou                         Number of groups   =         7

R-sq:                                           Obs per group:
     within  = 0.6505                                         min =         2
     between = 0.9463                                         avg =      12.0
     overall = 0.8216                                         max =        21

                                                F(3,74)            =     45.92
corr(u_i, Xb)  = 0.7832                         Prob > F           =    0.0000

------------------------------------------------------------------------------
        gini |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      crisis |
         L1. |   1.381165   .4072611     3.39   0.001     .5696795    2.19265
             |
  gdp_per_cap |  -.0001275   .000066    -1.93   0.057    -.0002591    4.01e-06
     poverty |   .5113092   .0837402     6.11   0.000     .3444531    .6781652
       _cons |   41.84016   1.231189    33.98   0.000     39.38696    44.29336
-------------+----------------------------------------------------------------
     sigma_u |  5.2540755
     sigma_e |  1.4692994
         rho |   .92746842   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0: F(6, 74) = 36.94                     Prob > F = 0.0000
```

FIGURE 6.54. Corruption perception index taken out. Figure reproduced with STATA

In this case all the regressors have a very low p-value and the expected behavior of each

variable is the expected one. Crisis period, with a lag of one year, increments the Gini coefficient by 1.38 points. This result is similar to the one obtained with Colombia's experiment that was 1.76 points. Also, increases in the GDP per-capita, reduces the Gini coefficient similarly to the results of the other situations. Last but no least poverty headcount radio increases inequality. All results show statistical evidence and are coherent either with intuitive concepts as well as previously analyzed theory.

Chapter 7

Conclusions and Recommendations

According to the investigation made in the previous section we can affirm that there exists statistical evidence that proves the effect that some variables have of Gini Index as a measure of inequality. In the first place the correlation between economic crisis and increase of inequality was proven. In the majority of the models created in the thesis this variable always showed a direct correlation to Gini coefficient. Specifically according to the results of the investigation, a crisis period can increase this coefficient between 1.38 and 1.76 points. This result was confirmed when the analysis was made for Colombian society as well as when it was performed to the data panel of seven different countries in the world.

This variable always showed statistical evidence in the impact on the independent variable (Gini coefficient). In the same way other variables were analyzed, to list some of the variables that did not showed statistical evidence it was founded: The number of pupils on primary level showed no significance and was one of the first variables to be taken out of consideration. However this definitely does not means that education does not play a role on inequality. In fact all of the variables that were selected for the model have a relative importance and impact on inequality.

Education is one of the most important factors in the reduction of inequality however the selected variable did not show a strong correlation with the independent variable. An important conclusion of this analysis is that the results should be interpreted with attention. The fact that a variable does not show statistical significance does not mean that a bigger factor that includes that variable should also be non-significant.

To make another example the life expectancy did not show a strong bond or influence on the predicted variable, but from theory we know that highly developed countries have a significantly higher life expectancy levels than others and also very low Gini coefficients.

The variables that counted the most in the development of the analysis, besides from economic

crisis, were poverty headcount radio, corruption perception index and percentage of people living in rural areas.

Starting from the first one, extreme poverty levels certainly influence levels of inequality, especially from the way that the Gini index is calculated. The higher the portion of people living in extremely poor conditions the higher the inequality will be. The same results occur the other way around. If there is a small group that owns a great amount of wealth this will cause a distortion in the distribution of resources.

One of the most interesting facts that came out of this investigation is the impact that rural population has on the inequality of the country. There was a clear tendency that was also statistically proven, that showed that the lower the proportion of people living in rural areas the lower the Gini coefficient would be. This is surprisingly truth since in Colombia there is an internal conflict that affects greatly the people living in the country side. Moreover government policies do not favor at all these kinds of jobs and the national product is sold as such low prices that they can only cover its basic needs.

Finally, other variable that showed statistical evidence was the corruption perception index. As it could be imagined the less corrupt a country is the less inequality there will be. However this measure was not so clear due to the ambiguous way in which it is calculated and it could change from one point of view to another.

The variable crisis showed a negative impact in the majority of the scenarios. Governments should take this into consideration when a situation like that happens.

The performed model had limitations since the data that was analyzed was not complete and it was very recent. Also the used methodology does not completely satisfy all required conditions for a model to be significant. The selected data did not have any random display.

All of the countries and years were selected due to the availability of the data and never was based in a random manner. Also eliminating variables according to convenience can lead to inconsistencies and can make the model adapt to a specific set of data.

According to the results of the study a crisis period worsen inequality levels and most of the time the income mobility that occurs affect the lower classes. In other words in a crisis periods the ones that have the less are the one that can be affected more severely.

Taking this into consideration governments and especially in the Colombian case where the

study was done, should take action that compensates this situation. In a crisis period unemployment rates arrive to very high levels and the most affected people are the one with low formation that most of the times correspond to people with limited resources.

A crisis period should make government to turn their eyes not only in the reactivation of the economy but also to the compensation of people with low economic power.

On the other hand and specifically in the Colombian case, government should take actions to support people living of the earth. For many people that have live all of their lives in a village the only way to seek for a better future, is to go to the big cities of the country. This profession should be taken more into consideration since the play a fundamental role in our society. Investment from part of the governments in rural areas is necessary for the development of the agricultural industry and its related fields.

Reducing inequality is an effective way to make a country grow. If all people can offer society the best of their capacities it would create an important impact in the development of the country. This is not the case if opportunities are denied for people without a good starting point. In this sense it is not only about economic inequality but also inequality of education or inequality of opportunities. A government should guarantee a system in which meritocracy is the base of progress.

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