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Growth, Polarization and Poverty Reduction in Africa in the Past Two Decades

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Contents

Abstract

The present thesis observes the situation of growth, of inequality, from the point of view of polarization and poverty on the African continent in the past two decades.

The first part, starting from the evidence of low growth-to-poverty elasticity characterizing Africa, purports to identify the distributional changes that limited the pro-poor impact of the growth of the last two decades. Distributional changes that went undetected by standard inequality measures were not showing a clear pattern of inequality on the continent. A new decomposition technique is applied based on a non-parametric method—the "relative distribution"—and a clear distributional pattern affecting almost all analyzed countries is found. Nineteen of 24 countries experienced a significant increase in polarization, particularly in the lower tail of the distribution, and this distributional change lowered the pro-poor impact of growth substantially. Without this unfavorable redistribution, poverty could have decreased in these countries by an additional five percentage points.

The second part uses a set of national household surveys to provide the first estimates of the level of polarization and inequality for Sub-Saharan Africa as a whole over the period from 1997 to 2012. Save for a slight decline between 1997 and 2002, regional polarization steadily increased throughout the 2000s with greater polarization in the lower tail of the distribution than in the upper tail. This rise in regional polarization was mainly driven by increasing polarization between countries, meaning Sub-Saharan Africa tended to polarize spatially with the Southern cone countries performing above the average and Central African countries lagging behind.

The last part observes the polarization situation in three countries of North Africa, Tunisia, Morocco and Egypt, in the period between what is defined as the Arab spring using the methodologies seen above. The three countries experienced a significant increase in polarization, specifically in the lower part of the distribution.

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List of Table

List of Figures

Chapter 1

Introduction

1.1 Preface

The questions of inequality and the distribution of income have an increasing interest in economic literature in recent years. From the introduction of the concept of the "Kuznets Curve", the inverse-U shaped pattern of inequality introduced by Kuznets (1955), the trend in inequality linked to the economic growth of the post-war years in Western countries was very interesting. Kuznets theorized that, as a result of the economic growth of a country, the inequality first grew until it reached the peak and then fell.

The empirical validity of the "Kuznets Curve" has been investigated extensively, but the empirical results are different and contrasting. Atkinson (1999) shows that for different developed countries, the Gini index has different trends and increases in many cases. Piketty (2000, 2006) and Alvaredo (2009) argued that the Kuznets curve does not exist. The decline of inequality observed by Kuznets in the United States is not linear and depends on the Great Depression or by the two World Wars, for example.

From the economic crisis, the argument again started to be the center of the academic debate. Stiglitz (2012), in his book *The price of inequality*, emphasizes that inequality is rooted in the current market economy, which has led to increased distances between individuals. Thomas Piketty, in recent years, through different works such as *The capital of XX century* (2013), draws attention to the issues of inequality and highlights its problem in the last decades.

The question of polarization of income is of interest to observe inequality from a different point of view. Over the last two decades, the issue of polarization has gained importance in the analysis of income distribution. Notwithstanding the pains the polarization literature has suffered to distinguish itself from pure inequality measurement—see e.g. Foster and Wolfson (1992, 2010), Levy and Murnane (1992), Esteban and Ray (1994), and Wolfson

(1994, 1997)—it has become widely accepted that polarization is a distinct concept from inequality.

Broadly speaking, the notion of polarization is concerned with the disappearance of the middle class, which occurs when there is a tendency to concentrate in the tails—rather than the middle—of the income distribution. One of the main reasons for looking at income polarization this way, which is usually referred to as "bi-polarization", is that a well-off middle class is important to every society because it contributes significantly to economic growth as well as to social and political stability (e.g. Easterly, 2001; Pressman, 2007; Birdsall, 2010). In contrast, a society with a high degree of income polarization may give rise to social conflicts and tensions. Therefore, in order for such risks to be minimized, it is necessary to monitor the economic evolution of the society using indexes that look at the dispersion of the income distribution from the middle toward either or both of the two tails.[1] Measures of income polarization that correspond to this case have been proposed in the literature by Foster and Wolfson (1992, 2010), Wolfson (1994, 1997), Wang and Tsui (2000), Chakravarty and Majumder (2001), Rodríguez and Salas (2003), Chakravarty et al. (2007), Silber et al. (2007), Chakravarty (2009), Chakravarty and D'Ambrosio (2010), Lasso de la Vega et al. (2010), and others.

A more general notion of income polarization (Esteban and Ray, 1994) regards the latter as the "clustering" of a population around two or more poles of the distribution, irrespective of where they are located along the income scale. The notion of income polarization in a multi-group context is an attempt at capturing the degree of potential conflict inherent in a given distribution (see Esteban and Ray, 1999, 2008, 2011). The idea is to consider society as an amalgamation of groups, where the individuals in a group share similar attributes with fellow members (i.e. have a mutual sense of "identification"), but in terms of the same attributes, they

[1] More precisely, there are two characteristics that are considered as being intrinsic to the notion of bi-polarization. The first one, "increased spread", implies that moving from the central value (median) to the extreme points of the income distribution makes the distribution more polarized than before. In other words, increments (reductions) in incomes above (below) the median will widen the distribution: Extend the distance between the groups below and above the median and hence increase the degree of bi-polarization. On the other hand, "increased bi-polarity" refers to the case where incomes on the same side of the median get closer to each other. Since the distance between the incomes below or above the median has been reduced, this is assumed to increase bi-polarization. Thus, bi-polarization involves both an inequality-like component, the "increased spread" principle, which increases both inequality and polarization, and an equality-like component, the "increased bi-polarity" criterion, which increases polarization but lowers any inequality measure that fulfills the Pigou-Dalton transfer principle—the requirement under which inequality decreases when a transfer is made from a richer to a poorer individual without reversing their pairwise ranking. This shows that although there is complementarity between polarization and inequality, there are differences as well. See the references cited in the main text for a thorough discussion.

are different from the members of the other groups (i.e. have a feeling of "alienation"). Political or social conflict is, therefore, more likely, the more homogeneous and separate the groups are, that is when the within-group income distribution is more clustered around its local mean, and the between-group income distance is longer. In addition to Esteban and Ray (1994), indexes regarding the concept of income polarization as conflict among groups have been investigated, among others, by Gradín (2000), Milanovic (2000), D'Ambrosio (2001), Zhang and Kanbur (2001), Reynal-Querol (2002), Duclos et al. (2004), Lasso de la Vega and Urrutia (2006), Esteban et al. (2007), Gigliarano and Mosler (2009), and Poggi and Silber (2010).

Much of the literature so far considered has analyzed summary measures of income polarization. Another strand uses kernel density estimation and mixture models in order to describe changes in polarization patterns over time, not just of personal incomes (as in Jenkins, 1995, 1996; Pittau and Zelli, 2001, 2004, 2006; Conti et al., 2006) but also of the cross-country distribution of per capita income (see Quah, 1996a,b, 1997; Bianchi, 1997, Jones, 1997; Paap and van Dijk, 1998; Johnson, 2000; Holzmann et al., 2007; Henderson et al., 2008; Pittau et al., 2010; Anderson et al., 2012; and others). The analysis of the shape of the income distribution provides a picture from which at least three important distributional features can be observed simultaneously (Cowell et al., 1996): income levels and changes in the location of the distribution as a whole; income inequality and changes in the spread of the distribution; clumping and polarization; changes in patterns of clustering at different modes.

Finally, a rather recent (yet non-parametric) approach that combines the strengths of summary polarization indexes with the details of distributional change offered by the kernel density estimates—the so-called "relative distribution"—has been employed by Alderson et al. (2005), Massari (2009), Massari et al. (2009a,b), Alderson and Doran (2011, 2013), Borraz et al. (2013), Clementi and Schettino (2013, 2015), Guangjin (2013, 2014), Molini and Paci (2015), Nissanov and Pittau (2016), Petrarca and Ricciuti (2016), Nissanov (2017), Clementi et al. (2017, 2018b), and Kabudula et al. (2017) to assess the evolution of the middle class and the degree of income polarization in a number of low- to high-income countries around the world.

Not much discussed, but growing in recent years, is inequality in developing countries, specifically, in Africa. This is important to observe, for example, if there is a connection between inequality and different problems about the continent, from the question of poverty to

economic growth to social and violent conflicts. The central objective of this thesis is to propose an in-depth picture of the distribution of income in Africa from different points of view.

1.2 The non-inclusive growth of African economy and the problem of inequality

Despite experiencing stable and sustained growth for almost two decades, several Sub-Saharan Africa (SSA) countries have not experienced a commensurate reduction in poverty.

Recent estimates, based on an international poverty line of US$1.90 (in 2011 PPP U.S. dollars), suggest that poverty declined only by 23 percent between 1990 and 2012 (from 56 percent to 43 percent) (Beegle et al., 2016). This rate is much lower than those experienced by countries with similar growth rates and similar poverty rates in other regions. The World Bank (2018) calculates that in a typical non-African developing country, where 50 percent of the population is living below the poverty line, a one percent yearly growth in GDP led to a reduction of 0.53 percentage points a year in the incidence of poverty. In contrast, the same one percent per capita GDP growth in a typical African country with the same poverty incidence reduced poverty by only 0.16 percentage points.

The two general explanations for this lower growth poverty-elasticity in Africa are: questioning the veracity of the recent African economic boom (the so-called African miracle); looking at the role of inequality. Jerven (2013, 2015) has provided evidence on the problems afflicting GDP calculations in Africa and argued that for many SSA countries, the recent high growth is merely statistical or in other words, a feature of adding the informal sector that previously was not counted (Jerven, 2015). Since growth is overstated, it is thus not surprising that poverty did not fall so rapidly.

Another interesting study regarding the aspect of growth in the Sub-Saharan African economy is proposed by Rodrik (2016). The author underlines the exogenous characteristic of the economic growth of the last two decades, guided from the high price of the commodities and low interest rate. Furthermore, the author underlines the importance of structural changes in the policy of African countries such as the initiation of reforms that have led to the openness of international trade and the end of numerous conflicts.

Moreover, the author shows that in order to have an effective "miraculous growth", countries must invest in the fundamentals (human capital, education) and at the same time, carry out a structural transformation towards the modern / manufacturing sector. In this case, however, the situation is not rosy for the African countries. In fact, both the share of employees in the industry and its incidence on GDP remain low, even lower than in the 1970s: in practice, we are witnessing a de-industrialization, although many countries remain too poor to have it, unlike what is happening in Asian countries.

Figure 2.1 compares the average growth of annual GDP per capita and the average consumption[2] growth from available household surveys; consumption is the welfare measure typically used to calculate poverty rates, growth is the factor that really matters in poverty reduction (Adams, 2004; McKay, 2013). Indeed, the discrepancy between GDP per capita growth and household consumption growth is higher in SSA than in the rest of the developing world. SSA, in fact, registers an average annual growth of household consumption of about 1.02 percent per year, not much lower than the South Asia Region (SAR) and slightly higher than in Latin America. Therefore, household consumption increased in SSA similarly to other developing regions, but poverty still declined slower.

[2] For Latin America is computed average income growth for the household surveys.

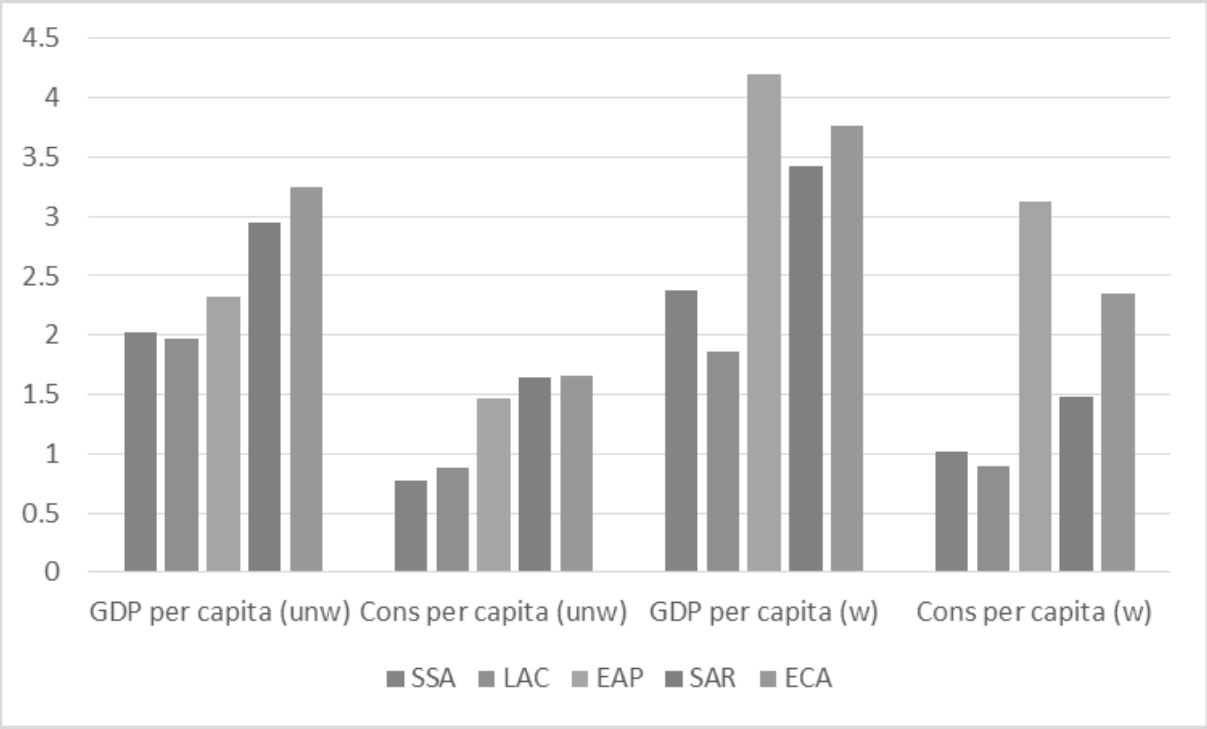


Figure 1.1: GDP per capita and household consumption average growth rates: 1999-2014. The abbreviations refer to SSA= Sub-Saharan Africa; LAC= Latin America and the Caribbean; EAP= East Asia Pacific; SAR= South Asian Region; EAC= Eastern Europe and Central Asia.

Regarding inequality, the literature has debated its relationship with growth and poverty. Dollar and Kraay (2002) show that all income groups tend to benefit proportionally from increases in economic growth and that income distribution does not really matter for poverty reduction. Bourgignon (2003) and Ravallion (2007) find that inequality reduces the poverty-reducing effects of economic growth. Thorbecke (2013) argues that the combination of high endemic poverty and inequality is, in general, responsible for the low growth elasticity of poverty. High initial poverty and inequality directly reduces the growth rate but also indirectly the poverty-reducing effect of this growth. Looking at SSA, Fosu (2009, 2015) finds that economic growth reduces poverty while growth elasticity is a decreasing function of initial inequality. Therefore, the low elasticity registered in SSA in the last two decades could potentially be attributed to an increase in inequality that limited the pro-poor content of growth.

Unfortunately, when measured with standard indicators like the Gini index or Theil index, there is no clear evidence of an increase in inequality in the last two decades. Pinkovskiy and Sala-i-Martin (2010) sustain that from the 1990s, inequality declined significantly in Sub-Saharan Africa, with a reduction of around three percent for the entire area. However, the

authors show that this reduction brought the Gini index back to the same levels as in the early 1970s.

Chotikapanich et al. (2014) find different results in ten selected countries from the 1990s to 2000s: in six countries they observe increases in inequality (i.e. South Africa and Ghana), while a marginal decrease or inverted U-shape is observed in four. Fosu (2014) finds that from the mid-1990s to the late 2000s, the Gini index grew in nine countries but dropped in thirteen and remained constant in one. Beegle et al. (2016), analyzing the SSA countries for which there are two comparable surveys, conclude that about half of them experienced a decline in inequality while the other half saw an increase.

Similar contrasting results are shown by Cornia et al. (2017) where, for the same period but for a larger sample of countries, four different trends of the Gini index are observed: for thirteen countries, there is a decrease in inequality, for seven countries, there is an increase, for four countries, an inverted U-shaped is observed, and a U-shaped is seen in five.

At first glance, therefore, there is no clear pattern in SSA that can explain the low elasticity of poverty through increasing inequalities. From a distributional point of view, it is still unclear why growth does not translate into greater household consumption at the bottom of the income distribution, at rates comparable with those experienced in other regions of the world (Christaensen et al., 2014; Thorbecke, 2013).

To answer at the previous problems, the first about the measures of inequality in Sub-Saharan Africa and the second about how the inequality affects the reduction of poverty, the first chapter proposes two different approaches, each one regarding one of the two items.

The first one aims to evaluate the distribution of wealth not only by observing inequality by using the standard measures like Gini Index or Theil index but also analyzing the polarization of the consumption with the method of relative distribution (Handcock and Morris, 1998, 1999). The polarization of income can be defined as the clustering of the population around two or more poles of the distribution (Esteban and Ray, 1994).

The relative distribution method is not well known but has already been used in several studies to observe the distribution of income in the countries and their polarization.

Clementi et al. (2015) use this method to observe the evolution of the distribution in Nigeria after the significant increase in GDP in the 2000s and how this change has emptied the middle class. The authors observe that the growth that occurred was not inclusive but led to an increase in polarization with a change in distribution. This change led to an emptying of the

middle class and to a concentration of households in the two tails of the distribution. This distributional change was not captured by standard measures of inequality, such as the Gini index.

Nissanov and Pittau (2015) use the same method to observe changes in income distribution in Russia between the 1990s and 2000s. Contrary to standard measures of inequality, the authors show a declining of the middle class and a significant increase in polarization in the lower tail, in the period 2000-2008. They underline the fact that this change is caused by the failure of the labor market in the country during the economic crisis. In this period, in fact, members of the middle class changed work, experiencing wage reductions.

Alderson et al. (2005) analyze the polarization trend in 16 core countries in the LIS (Luxembourg Income Study) dataset. In seven countries, like the United Kingdom, the United States and Italy, the authors observed an increase in inequality and polarization. In the other seven countries, the changes are modest, positive or negative, and heterogeneous. In Sweden and Canada, the inequality and polarization decline, with a significant shift of the population in the lower tail to the middle class.

In the second approach, a novel method to decompose the effect that changes in the distribution have on the reduction of poverty is proposed. Differently from the previous approach (Datt and Ravallion, 1992), this method is polarization-poverty and growth decomposition based. In their paper, Datt and Ravallion (1992) fix their model so that the level of poverty can change by two factors: a change in the average income compared to the poverty line (*growth effect*) or a change in the relative inequality (*redistribution effect*). Applying their model for India and Brazil, they observe that a negative redistributive effect (increase in inequality) leads to a negative effect on the reduction of poverty.

1.3 A global overview: An analysis of polarization without the barriers

Recently, there is considerable interest in the economic literature in the level of relative inequality of incomes found among all people in the world regardless of their country of residence. Notable recent contributions include, among others, Anand and Segal (2008, 2015), Atkinson and Brandolini (2010), Bourguignon (2017), Bourguignon and Morrison (2002),

Lakner and Milanovic (2015), Milanovic (2002, 2005, 2012, 2016), and Niño-Zarazúa et al. (2017). The predominant methodology involves constructing a distribution of income of all the citizens of the world, using national accounts and/or survey data. Inequality is subsequently measured based on this global distribution of income.

As it emerges from most of these studies, in the last 30 years – the so-called globalization era – the global income distribution switched from a bi-modal to a unimodal distribution. This change occurs under the effect of two interrelated processes: an increase in inequality within-country and a fast decline of inequality between-countries (Milanovic, 2010; Luiten van Zanden et al., 2013). Thanks to an unprecedented period of increasing interconnectedness between domestic economies, the global income distribution has evolved away from the 'twin peaks' identified by Quah (1996) into a less polarized one (Roope, 2018).

Regional distributions tend to mirror the global one. Luiten van Zanden et al. (2013) document a generalized decline in the between-country inequality concomitant to the economic integration within the region. In different periods, this applies to Western Europe, North America, Latin America, and Eastern Asia. Sub-Saharan Africa represents a notable exception since throughout the twentieth century, the between-country inequality does not decrease. Starting from the 1980s, it increases (Luiten van Zanden et al. 2013), and this tendency protracts to the first decade of 2000 (Jirasavetakul and Lakner, 2016). From this evidence, it can be inferred that SSA looks like a highly polarized region; there are some relatively successful economies (predominantly in the Southern cone) and a big cluster of unsuccessful ones, recording among the lowest GDP per capita in the world. Be that as it may, there is a limited analysis that explicitly analyzes polarization in SSA.

Following Milanovic (2005) and Anand and Segal (2008), it is possible to define four concepts of the global distribution of income and their level of inequality based on the population unit and welfare concepts. The first one is the distribution of income by country. In this case, the "population unit" is the country and the "income concept" is the (total) national income of the country. This approach does not consider the dimension of the population of the country, and the differences are based only on the wealth of the country in its entirety.

In the second concept, the population unit remains the country, but in this case, the measure to observe the well-being is the national income per capita.

The third concept uses the national income per capita, but the population unit is the individual. In this case, the population dimension of each country is important because in observing a global distribution, every nation will have its specific weight.

The fourth concept considers both the individual and household and is considered the per-capita income of the individual or household to which the individual belongs. This approach allows us to observe the distribution of income (or consumption) and inequality in a similar way to the analyses carried out within individual countries.

The last concept is actually the one most used in global inequality literature.

Milanovic (2005) constructs inequality estimates over time for a common sample of countries, using 345 national surveys. The author builds three benchmark years (1988, 1993, 1998). For his analysis of the distribution within countries, he uses the deciles, assuming that the individuals within them have the same income/consumption. The results show that the inequality (Gini and Theil indexes) rises between 1988 and 1993 and declines between 1993 and 1998 but remains at a higher level with respect to 1988. Very interesting is the decomposition of indexes that shows that between-country inequality is the biggest part of total inequality (between 71 and 83 per cent) and remains stable over time.

Jirasavetakul and Lakner (2016) improve upon research about global inequality focusing on Sub-Saharan Africa. In this case, the authors created a global survey for specific benchmark years, following the example of Milanovic (2012) and Lakner and Milanovic (2015). Country-year consumption distribution is derived by fitting a parametric Lorenz curve to the decile shares. The authors find a rise in regional inequality, which is driven by increasing inequality between-countries with an increase in the difference in living conditions.

Polarization is an appealing alternative indicator to inequality as a measure of changes in the welfare distribution. While inequality provides an indication of the overall dispersion of a distribution, polarization considers how distributional changes affect the income or consumption distribution between subgroups of society. More specifically, it is interesting how the dynamic process leads to the shrinkage of the middle class, the group of people in the center of the distribution, relative to the (two) groups on both extreme tails of the distribution (see, for instance, Foster and Wolfson, 1992 and Wolfson, 1994, 1997). Framing the problem using Duclos et al.'s (2004) formulation, polarization can be intended as the combination of two opposite forces: the "*identification*" within two or more groups and "*alienation*" or increasing (socio-economic) distance between the same groups.

While polarization analysis is typically undertaken at the country level, in the third chapter it is argued that there are good reasons to look at polarization at the regional level.

First, as pointed out by Roope et al. (2018), in an interconnected world, there is a clear parallel between the positive impact on economic growth and social cohesion that a domestic middle class has on a global/regional middle class. SSA, however, saw its middle class growing much slower than in the rest of the developing world (AfDB, 2011) and much less socio-economic integration. Internal tariffs reduced slower than in other regions, free mobility of goods and people is far from being achieved (UN, 2010; World Bank, 2011), and it is very difficult to reach a political consensus on a common economic agenda. This fragmentation, if not caused by, certainly in on par with the increasing economic polarization characterizing the region.

Second, polarization is strongly linked to the emergence of internal conflicts and civil wars (Esteban and Ray, 1999, 2008, 2011). Whereas these conflicts in SSA manifested typically at country level (Azam, 2001, 2006), the recent conflict episodes in the Sahelian belt (Mali, Niger, Northern Nigeria, Burkina Faso and Chad) or in the Great Lakes region (Burundi, Rwanda, Uganda and DRC) show that they can easily escalate at the sub-regional level. This likely is because, in presence of fragile states, the mechanisms that determine the identification/alienation duality can transcend national borders; ethnic or religious allegiances (Basedau et al., 2016; Allansson et al., 2017) can be a much stronger element of identification (and alienation from compatriots) than national identity. Just looking at the country level data, we argue, does not fully capture the full picture, while a regional perspective, we think, sheds some additional light, and the first step is clearly having a good sense of regional polarization patterns.

In the second chapter, an analysis of the polarization in Sub-Saharan Africa without considering the barriers and "global" distribution of consumption for the area, like in Jirasavetakul and Lakner (2016), are realized. The new significant elements introduce, with respect to the previous studies, are, firstly, are used directly the data from household surveys, combined to obtain a unique survey for determined benchmark years.

Secondly, the indexes are decomposed to see the composition of within-country and between-countries inequality and finally breaking down polarization, to see the territorial concentration of consumption in the area and observe which sub-areas compose the deciles of distribution.

1.4 The North African countries and the Arab Spring: a different perspective of inequality

In the last part of this thesis, we will analyze the situation of the North Africa countries, specifically Morocco, Tunisia and Egypt. In the last years, this region has been the scene of massive protests by the population, which in some cases, evolved into violent conflicts. These events are known as the "Arab Spring".

Economic literature started to observe the situation of income distribution and inequality in MENA countries and if the trend of inequality can be linked to revolutions. About this question, there are two different approaches.

The first sustained that the inequality decline in the region could not be the cause of the revolution.

Devarajan and Ianchovinchina (2017) sustain that the revolts in the Arab countries and inequality are disconnected. The authors find that consumption inequality is low and declines in the 2000s and remains lower than in the rest of the world. Following Hassine (2015), the authors show that total expenditure inequality declined in Tunisia, Egypt and Jordan, and in the other MENA countries that show an increase in the Gini index, it remains moderate.

The authors identified that with the fall of individuals' welfare such as quality of life, expectations about the future or perceptions of declining standard of living caused social conflicts, and subsequently, the riots. All this was due to a change in the "social contract" in the MENA countries. In the past, the government was the main employer, provided free access to public services, and subsidized the purchases of goods. In the 2000s, this situation has not been sustainable, and governments have started to withdraw from the labor market and offer fewer subsidies.

Similar conclusions are provided by Hlasny and Verme (2013) for Egypt. The authors impute top income on the data derived from the Household Surveys, find a good quality of Egyptian expenditure data, and compare the consumption inequality between Egypt and another 107 countries, demonstrating that inequality in Egypt is lower. They sustained, like the previous study, that the riots in Egypt derived from social problems and not from income inequality.

The second group of research sustained, instead, that inequality in MENA countries is higher respective to other regions, and this may have influenced the riots during the "Arab Spring".

Alvaredo et al. (2018), combining Household survey and tax data, show that the top 10 per cent's share rises 64% in the Middle East between the 1990s and 2010s, compared to 37% in Western Europe or 39% in all of Europe. From another point of view, they observe that the between-countries inequality in the area is very high, with oil-rich countries that represent only 15% of the Middle East population, receive more than 40% of the whole Middle East income.

Lakner et al. (2016) come back to the question of underestimation of top income. Top income is under-estimated when using only the Household survey data (Atkinson et al., 2011). One way to estimate the top tail of the income distribution is using data from income tax records, but in less developed countries, these data are limited. For this reason, the authors used data on house price to estimates the top income of the distribution in Egypt. Using this method, the authors find that inequality is underestimated in Egypt, with the Gini index in 2009 rising at 47%, with respect to a survey estimate of 36.4%.

In this chapter, the analysis is focused on three countries of North Africa: Morocco, Tunisia, and Egypt. These countries experienced a different situation during the "Arab Spring". Compared to the situation in Tunisia and Egypt, the uprisings did not result in violent riots in Morocco.

Like in previous chapters, we observe the differences among these three countries in terms of inequality. Besides inequality, the polarization of consumption will also be observed. In measuring polarization, we use the same methods observed in previous chapters: the Forster-Wolfson Index (Forster and Wolfson, 1992, 2010), the Duclos-Esteban-Ray Index (Duclos et al., 2004), and the method of relative distribution (Handcock and Morris, 1998, 1999).

Moreover, a parametric imputation estimation is used for the distribution of consumption of Tunisia in 2015. For this year, only grouped data from the national household survey are available.

Chapter 2

Polarization in Sub-Saharan Africa[3]

2.1 Preface

The central argument of this chapter is that significant distributional changes against poverty reduction have, in fact, taken place in most of SSA countries we analyze. These changes affected predominantly the lower part of the welfare distribution and went undetected by standard inequality measures. The reason is simple. Summary measure like Gini don't assign a weight to the different percentiles; if a pro inequality change in one part of the distribution is more than compensated by a pro-equality change in the rest of the distribution, Gini will decline. The distributional changes, however, that matter most for poverty reduction are those localized in the lower part of the distribution but can be detected only if we are able to focus on this part only.

To analyze these changes, in this chapter is applied a different type of decomposition based on the "relative distribution" method (Handcock and Morris, 1998, 1999). The advantage of this method consists of providing a non-parametric framework for taking into account all the distributional differences that could have affected the variation in the poverty rate and countered the pro poor effect of growth. In this way, it enables to summarize multiple features of the welfare distribution that a standard decomposition based on summary inequality measures would have not detected (Datt and Ravallion, 1992; Kolenikov and Shorrocks, 2005).

The chapter is organized as follow: Section 2 explicates the methodology used for analyzing polarization, the relative distribution method, and the approach to decompose growth and decomposition effect, that influence the reduction of poverty. Section 3 introduces the data used and the summary statistics. Section 4 provides the results of relative distribution method and the decomposition. Section 5 introduces the Oaxaca-Blinder decomposition method, to

[3] This chapter, modified and adapted according to needs, has been published as World Bank Working Paper in June 2018

observe the impact of the covariates on the distribution of household consumption. Section 6 provides a summary and conclusions.

2.2 Methodology

2.2.1 Polarization: an introduction

Over the last two decades, the issue of polarization has gained increasing importance in the analysis of income distribution (Foster and Wolfson, 1992; Levy and Murnane, 1992; Esteban and Ray, 1994; Wolfson; 1994, 1997) and now it seems to be widely accepted that polarization is a distinct concept from inequality.

A general notion of income polarization (Esteban and Ray, 1994) regards it as "clustering" of a population around two or more poles of the distribution, irrespective of where they are located along the income scale. The notion of income polarization in a multi-group context is an attempt at capturing the degree of potential conflict inherent in a given distribution (see Esteban and Ray, 1999, 2008, 2011). The idea is to consider society as an amalgamation of groups, where the individuals in a group share similar attributes with its members (i.e. have a mutual sense of "identification") but they are different from the members of the other groups (i.e. have a feeling of "alienation").

Political or social conflict is therefore more likely the more homogeneous and separate the groups are, that is when the within-group income distribution is more clustered around its local mean and the between-group income distance is longer (see, *inter alia*, Gradín, 2000, Milanovic, 2000, D'Ambrosio, 2001, Zhang and Kanbur, 2001, Reynal-Querol, 2002, Duclos et al., 2004, Lasso de la Vega and Urrutia, 2006, Esteban et al., 2007, Gigliarano and Mosler, 2009, and Poggi and Silber, 2010).

A different approach regards the concept of bi-polarization (Foster and Wolfson, 1992, 2010): in this case, the two poles are formed on the two sides of the median, in the tails of distribution. The principal reason for looking at polarization this way is that a large and wealthy middle class contributes to economic growth in many ways, and hence is important to every society.

The middle class occupies the intermediate position between the poor and the rich and a society with thriving middle class contributes significantly to social and political stability as well (Easterly, 2001; Pressman, 2007).

There are two characteristics that are considered as being intrinsic to the notion of bi-polarization: *increased spread* implies that moving from the central value (median) to the extreme points of the income distribution make the distribution more polarized than before; *increased bi-polarity* refers to the case where incomes on the same side of the median get closer to each other.

Thus, bi-polarization involves both an inequality-like component, the "increased spread" principle, which increases both inequality and polarization, and an equality-like component, the "increased bi-polarity" criterion, which increases polarization but lowers inequality.

2.2.2 Relative distribution

The use of summary measures of income polarization is common in literature. The approach used in this paper, the so-called "relative distribution", combines the strengths of summary polarization indices with details of distributional change that the kernel density estimates yields. The relative distribution method has been employed by Alderson et al. (2005), Massari (2009), Massari et al. (2009a,b), Alderson and Doran (2011, 2013), Borraz et al. (2013), Clementi and Schettino (2013, 2015), Clementi et al. (2017, 2018), Molini and Paci (2015), Petrarca and Ricciuti (2016), Nissanov and Pittau (2016), and Nissanov (2017).

More formally,[4] let Y_0 be the income variable for the reference population and Y the income variable for the comparison population. The relative distribution is defined as the ratio of the density of the comparison population to the density of the reference population evaluated at the relative data r:

$$g(r) = \frac{f\left(F_0^{-1}(r)\right)}{f_0\left(F_0^{-1}(r)\right)} = \frac{f(y_r)}{f_0(y_r)}, \qquad 0 \le r \le 1, \quad y_r \ge 0, \tag{2.1}$$

[4] Here we limit ourselves to illustrating the basic concepts behind the use of the relative distribution method. Interested readers are referred to Handcock and Morris (1998, 1999) for a more detailed explication.

where $f(\cdot)$ and $f_0(\cdot)$ denote the density functions of Y and $Y0$, respectively, and $y_r = F_0^{-1}(r)$ is the quantile function of Y_0. When no changes occur between the two distributions, $g(r)$ has a uniform distribution; a value of $g(r)$ higher (lower) than 1 means that the share of households in the comparison population is higher (lower) than the corresponding share in the reference population at the r^{th} quantile of the latter.

One of the major advantages of this method is the possibility to decompose the relative distribution into changes in location and changes in shape. The decomposition can be written as:

$$\underbrace{\frac{f(y_r)}{f_0(y_r)}}_{Overall} = \underbrace{\frac{f_{0L}(y_r)}{f_0(y_r)}}_{Location} \times \underbrace{\frac{f(y_r)}{f_{0L}(y_r)}}_{Shape}. \tag{2.2}$$

$F_{0L}(y_r)$ is the median-adjusted density function:

$$f_{0L}(y_r) = f_0(y_r + \rho), \tag{2.3}$$

where the value ρ is the difference between the medians of the comparison and reference distributions—alternative indices like the mean and/or multiplicative location shift can also be considered.

The first ratio term in the right-hand side of Equation (2) is an estimate of the "location effect", i.e. the pattern that the relative distribution would have displayed if there had been no change in distributional shape but only a location shift of the consumption distribution over time. When the median-adjusted and unadjusted reference populations have the same median, the ratio for location differences will have a uniform distribution. Conversely, when the two distributions have different median, the location effect is increasing (decreasing) if the comparison median is higher (lower) than the reference one.

The second term (the "shape effect") represents the relative distribution net of the location effect and is useful to isolate movements (re-distribution) occurred between the reference and comparison populations. For instance, one could observe a shape effect with some sort of (inverse) U-shaped pattern if the comparison distribution is relatively (less) more spread around

the median than the median-adjusted reference distribution. Thus, it is possible to determine whether there is polarization of the consumption distribution (increases in both tails), "downgrading" (increases in lower tail), "upgrading" (increases in the upper tail) or convergence towards the median (decreases in both tails).

The relative distribution approach also includes a median relative polarization index, which is a measurement of the degree to which the comparison distribution is more polarized than the reference one:

$$MRP = \frac{4}{n}\left(\sum_{i=1}^{n}\left|r_i - \frac{1}{2}\right|\right) - 1. \tag{2.4}$$

The values of the MRP index ranges between -1 and 1: positive values represent more income polarization and negative values represent less polarization; a value of 0 indicates no differences in distributional shape. The MRP index can be additively decomposed into the *lower relative polarization index* and the *upper relative polarization index*, enabling one to distinguish downgrading from upgrading. The two indices can be defined as:

$$LRP = \frac{8}{n}\left(\sum_{i=1}^{n/2}\left(\frac{1}{2} - r_i\right)\right) - 1 \tag{2.5}$$

$$URP = \frac{8}{n}\left(\sum_{i=\frac{n}{2}+1}^{n}\left(r_i - \frac{1}{2}\right)\right) - 1 \tag{2.6}$$

with MRP= (1/2) (LRP + URP). As the MRP, LRP and URP range from -1 to 1 and equal 0 when there is no change.

2.2.3 Decomposition method

The relative distribution is a well-established approach to distributional analysis, whereas novel is the polarization-poverty and growth decomposition we develop for showing how the distributional changes we observed in many SSA countries have effectively limited the impact of growth on poverty reduction.

In general terms, poverty $P(z, \mu, L)$ is expressed in terms of poverty line, z, mean income level, μ, and the Lorenz curve, L, representing the structure of relative income inequalities. Assuming the poverty line is fixed at a given level, poverty is given by $P(\mu, L)$. The total change in poverty, ΔP, is then decomposed into two components. The first component is the growth component due to changes in the mean income while holding the Lorenz curve constant at some reference level, and the second a redistribution component due to changes in the Lorenz curve while keeping the mean income constant at some reference level.

Following Heshmati (2007), one can compute growth and inequality decompositions in various ways. Kakwani and Subbarao (1990) introduced the following decomposition:

$$\Delta P = P(\mu_1, L_1) - P(\mu_0, L_0) = \underbrace{[P(\mu_1, L_0) - P(\mu_0, L_0)]}_{G} + \underbrace{[P(\mu_1, L_1) - P(\mu_1, L_0)]}_{R}, \quad (2.7)$$

where μ and L are mean income and the Lorenz curve characterizing the distribution of income. The subscripts 0 and 1 denote the two (consecutive or non-consecutive) initial and final periods of observation, and G and R are contributions from the growth and redistribution components.

Jain and Tendulkar (1990) suggested an alternative formulation:

$$\Delta P = P(\mu_1, L_1) - P(\mu_0, L_0) = \underbrace{[P(\mu_1, L_1) - P(\mu_0, L_1)]}_{G} + \underbrace{[P(\mu_0, L_1) - P(\mu_0, L_0)]}_{R} \quad (2.8)$$

which differs from the previous decomposition by the reference point (base year versus final year) that is initially chosen for computation of growth and redistribution components.

Kakwani (2000) suggested a simple averaging of both the growth and inequality components from Equations (7) and (8), which is:

$$\Delta P = \underbrace{\frac{1}{2}\{[P(\mu_1, L_0) - P(\mu_0, L_0)] + [P(\mu_1, L_1) - P(\mu_0, L_1)]\}}_{G} + \underbrace{\frac{1}{2}\{[P(\mu_1, L_1) - P(\mu_1, L_0)] + [P(\mu_0, L_1) - P(\mu_0, L_0)]\}}_{R} \quad (2.9)$$

Datt and Ravallion (1992) found the above decompositions of poverty changes as being time path dependent, arising through and dependent on the choice of reference levels. To make the changes path independent they proposed adding an extra residual E as follows:

$$\Delta P = P(\mu_1, L_1) - P(\mu_0, L_0) = \underbrace{[P(\mu_1, L_0) - P(\mu_0, L_0)]}_{G} + \underbrace{[P(\mu_1, L_1) - P(\mu_1, L_0)]}_{R} + E \quad (2.10)$$

The residual in (10) can be interpreted as the difference between the growth (redistribution) components evaluated at the terminal and initial Lorenz curves (mean incomes), respectively.

Another strand of the research literature has used panel data to explore cross-country differences in the growth-inequality-poverty relationship. Some recent contributions following this approach include Kalwij and Verschoor (2007) and Fosu (2015, 2017a, 2017b, 2018). These authors decompose poverty changes into growth and inequality (redistribution) effects as follows:

$$\Delta \ln P_{it} = \underbrace{\varepsilon_{\bar{y}_{it}} \Delta \ln \bar{y}_{it}}_{G} + \underbrace{\varepsilon_{G_{it}} \Delta \ln G_{it}}_{R} + E, \quad (2.11)$$

where i and t are country and time indices, $\Delta \ln P_{it}$, $\Delta \ln \bar{y}_{it}$, and $\Delta \ln G_{it}$ are growth rates (logarithmic changes) of poverty, income and inequality (the Gini coefficient), $\varepsilon_{\bar{y}_{it}}$ and $\varepsilon_{G_{it}}$ are the income and inequality elasticities with respect to poverty, and E is a residual term. The income and inequality elasticities determine the responsiveness of poverty to growth and redistribution of benefits from growth, respectively, and are estimated through an econometric specification in which both the income and the inequality elasticity of poverty depend on two statistics of the initial income distribution: initial Gini and the ratio poverty line over mean

income.[5] Multiplying the growth rates of income and inequality by the corresponding elasticities gives the contribution to poverty change by, respectively, income growth (G) and inequality (R).

The above decompositions compute the growth and redistribution effects of poverty change through an analysis of mean incomes and relative inequalities. However, results would be different if the analysis is carried out through median incomes and absolute income gaps—as it is in the spirit of the relative distribution approach.[6] In such an eventuality, the poverty change between two periods, t_1 and t_2, into growth and redistribution components is decomposed as follows:[7]

$$\underbrace{HCR_{t_2} - HCR_{t_1}}_{\text{Variation}} = \underbrace{\left(HCR^{L}_{t_1} - HCR_{t_1}\right)}_{G_1} + \underbrace{\left(HCR_{t_2} - HCR^{L}_{t_1}\right)}_{R_1}, \tag{2.12}$$

when t_1 is the period of reference, and:

$$\underbrace{HCR_{t_2} - HCR_{t_1}}_{\text{Variation}} = \underbrace{\left(HCR_{t_2} - HCR^{L}_{t_2}\right)}_{G_2} + \underbrace{\left(HCR^{L}_{t_2} - HCR_{t_1}\right)}_{R_2}, \tag{2.13}$$

when t_2 is the period of reference. In the above:

- $HCR_{t_1} = \frac{\sum_{i=1}^{N} 1\left(y_i^{t_1} < z\right)}{N}$: poverty headcount ratio of the first period.[8]
- $HCR_{t_2} = \frac{\sum_{i=1}^{N} 1\left(y_i^{t_2} < z\right)}{N}$: poverty headcount ratio of the second period.
- $\text{Variation} = HCR_{t_2} - HCR_{t_1}$: difference in poverty headcount ratio between t_2 and t_1.

[5] For more details on the estimation framework, see the Appendix A.1

[6] On the importance of paying more heed to *absolute* difference as well, rather than to relative difference only, see e.g. Atkinson and Brandolini (2010) and references therein.

[7] Here, we assume that the headcount ratio is the poverty measure's precise functional form. In Section 2.3, we shall apply the decompositions to another common poverty measure, the poverty gap index, given by the aggregate income short-fall of the poor as a proportion of the poverty line and normalized by population size, i.e. $PG = \frac{1}{N}\sum_{i=1}^{q}\left(\frac{z-y_i}{z}\right)$, where q is the number of poor people in the population.

[8] The "1" indicator at the numerator is a function assuming value 1 if the i^{th} individual has income y below the poverty line z, and assuming value 0 otherwise. Note that N is the size of total population, and not the total number of poor individuals.

- $G_1 = HCR_{t_1}^L - HCR_{t_1}$: growth component when t_1 is the period of reference; $HCR_{t_1}^L$ is the poverty headcount ratio of the first period when all incomes $y_i^{t_1}$ of the first period are additively shifted by $\rho_1 = m_{t_2} - m_{t_1}$, where m_{t_1} and m_{t_2} are the medians of the two distributions.
- $R_1 = HCR_{t_2} - HCR_{t_1}^L$: redistribution component when t_1 is the period of reference.
- $G_2 = HCR_{t_2} - HCR_{t_2}^L$: growth component when t_2 is the period of reference; $HCR_{t_2}^L$ is the poverty headcount ratio of the second period when all incomes $y_i^{t_2}$ of the second period are additively shifted by $\rho_2 = m_{t_1} - m_{t_2}$, where m_{t_1} and m_{t_2} are the medians of the two distributions.
- $R_2 = HCR_{t_2}^L - HCR_{t_1}$: redistribution component when t_2 is the period of reference.

Taking the average of (11) and (12) yields the following decomposition of the variation in the poverty headcount between the two periods t_1 and t_2:

$$\underbrace{HCR_{t_2} - HCR_{t_1}}_{\text{Variation}} = \underbrace{\frac{1}{2}(G_1 + G_2)}_{G} + \underbrace{\frac{1}{2}(R_1 + R_2)}_{R}, \tag{2.14}$$

which is the one we shall use in the subsequent empirical analysis.

2.3 Data and summary statistics

The data used in the paper are obtained from national household surveys from as many countries as possible through PovcalNet.[9] PovcalNet is the global database of national household surveys compiled by the research department of the World Bank, and it is the source of the World Bank's global poverty estimates.

[9] GLOBAL TSD/GPWG ([year of access (2017. As of [date of access (12/10/2017)] via Datalibweb Stata Package, downloaded during the period when the author was a short term Consultant at the headquarters of the World Bank Group in Rabat.

In the analysis, are use 48 comparable household surveys for 24 Sub-Saharan Africa countries, the same Beegle et al. used (2016).[10] According to the research, it's not possible to use the Household surveys of the other countries because these surveys are comparable between them. For the authors, household surveys can be considered comparable if they have specific characteristics: a nationally representative sample, where in some case the survey is realized in a specific area (rural/urban); seasonally, as the agricultural sector is very important in SSA, it is necessary to take into account of harvests and dwindles during the lean season; data collection instruments and the period, since, to be comparable, they must be collected using the same tools (i.e. diary form) and spending periods.

For each country, are consider two survey years distant enough in time to allow for meaningful comparisons of consumption distributions. This distance varies between 5 and 14 years, because the household surveys are not released every year in every country but take place in different periods for each country. Overall, the period observed covers two decades, since the late '90s to the early years of this decade.

Household expenditure (per capita) are used as the main welfare indicator throughout the analysis.[11,12] In that, we depart from the literature using income as a measure of well-being. In economies where agriculture is an important and established sector, consumption has indeed proven preferable to income because the latter is more volatile and more highly affected by the harvest seasons, so that relying on income as an indicator of welfare might under- or over-estimate living standards significantly (see, for instance, Deaton and Zaidi, 2002). On the theoretical ground, as consumption gives utility to individuals, the analysis of its distribution should be the most natural approach to study wellbeing. Income matters insofar as it gives access to consumption, which is the ultimate source of individual welfare. Consumption is a better measure of long-term welfare also because households can borrow, draw down on savings, or receive public and private transfers to smooth short-run fluctuations.

In the Table 1 is possible to observe the main statistics. As the data show, for many of the countries studied average household consumption increased over time, following the significant

[10] Namely, the countries analyzed are: Botswana, Burkina Faso, Cameroon, Chad, Democratic Republic of the Congo, Ivory Coast, Ethiopia, Ghana, Madagascar, Malawi, Mauritius, Mauritania, Mozambique, Namibia, Nigeria, Rwanda, Senegal, Sierra Leone, South Africa, Swaziland, Tanzania, Togo, Uganda, Zambia.

[11] To enhance comparability among the very different surveys, all consumption are expressed in 2011 international dollars (PPP).

[12] For Ghana, we use the national poverty line in local currency. For Nigeria, we estimate the consumption distribution for 2003/04 using a "survey-to-survey" imputation method. For more details, see Clementi et.al. (2015).

economic growth Sub-Saharan Africa experienced over the last decades (e.g. Beegle et al., 2016).

Standard measures of inequality seem not to capture this widening gap between rich and poor: both the Gini and Theil indices declined for most of the analyzed countries, even though they start from a very high level. In precedent studies, inequality in Sub-Saharan African countries is not clear and show different trend of Gini Index: Pinhovskiy and Sala-i-Martin (2014) show that the recent SSA growth spurt was, in fact, accompanied by a generalized decrease of inequality. Beegle et al. (2016) analyzing the SSA countries for which there are two comparable surveys, conclude that about half of them experienced a decline in inequality while the other half saw an increase. Cornia et al. (2017) find a bifurcation in inequality trends in SSA: 17 countries experienced declining inequality, whereas 12 countries, predominantly in Southern and Central Africa recorded an inequality rise.

This demonstrates the difficulty in having a consistent picture of the trend of inequality measured with standard indices (Gini and Theil) in Sub-Saharan Africa.

Table 2.1: Main statistics of consumption, inequality and polarization for each country

Countries	Statistics						
	Observation	Mean	Median	Gini	Theil	FW index	DER Index
Botswana 2002	6,047	3,024.68	1,164.12	0.65	0.90	0.77	0.39
Botswana 2009	7,731	3,484.63	1,632.64	0.60	0.82	0.61	0.35
Burkina Faso 1998	8,478	591.69	357.11	0.50	0.60	0.37	0.29
Burkina Faso 2003	8,237	861.57	580.89	0.43	0.36	0.40	0.36
Cameroon 2001	10,992	1,577.49	1,114.72	0.42	0.36	0.35	0.30
Cameroon 2007	11,391	1,490.47	1,030.04	0.43	0.34	0.40	0.26
Chad 2003	6,695	732.09	538.52	0.40	0.29	0.36	0.24
Chad 2011	9,259	1,177.66	876.66	0.43	0.35	0.38	0.26
Dem. Rep of Congo 2004	11,903	275.78	196.04	0.42	0.32	0.38	0.25
Dem. Rep of Congo 2012	21,239	549.97	396.26	0.42	0.32	0.38	0.25
Ivory Coast 2002	10,798	1,492.75	1,056.21	0.41	0.32	0.34	0.29
Ivory Coast 2008	12,600	1,431.70	1,021.13	0.43	0.34	0.39	0.33
Ethiopia 2000	16,672	776.83	649.87	0.30	0.18	0.23	0.20
Ethiopia 2010	27,829	1,050.70	857.20	0.33	0.23	0.25	0.21
Ghana 1991	4,523	459.90	352.65	0.38	0.25	0.33	0.23
Ghana 2012	16,772	883.43	655.60	0.41	0.29	0.38	0.24
Madagascar 2001	5,080	708.26	448.60	0.47	0.41	0.46	0.31
Madagascar 2010	12,460	575.29	401.75	0.42	0.37	0.34	0.26
Malawi 2004	11,278	644.53	466.44	0.40	0.33	0.32	0.24
Malawi 2010	12,082	695.24	456.13	0.46	0.45	0.38	0.27
Mauritania 2000	5,862	1,657.83	1,258.22	0.39	0.26	0.36	0.30
Mauritania 2008	13,676	1,922.63	1,567.15	0.36	0.21	0.33	0.27
Mauritius 2006	6,720	4,023.09	3,132.25	0.36	0.24	0.29	0.23
Mauritius 2012	6,700	4,217.94	3,313.35	0.36	0.24	0.28	0.23
Mozambico 1996	8,250	521.72	290.38	0.54	0.61	0.48	0.31
Mozambico 2008	10,832	710.00	485.25	0.46	0.46	0.37	0.26
Namibia 2003	9,766	2,536.37	1,025.46	0.63	0.88	0.63	0.39
Namibia 2009	9,656	2,845.03	1,245.85	0.61	0.80	0.60	0.37
Nigeria 2003	18,930	1,067.17	894.84	0.34	0.20	0.30	0.22
Nigeria 2013	9,149	1,245.84	958.01	0.39	0.29	0.35	0.24
Rwanda 2000	6,420	649.11	404.10	0.49	0.53	0.38	0.29
Rwanda 2013	14,419	990.79	580.84	0.50	0.58	0.39	0.30
Senegal 2005	13,568	1,118.44	844.52	0.39	0.28	0.35	0.24
Senegal 2011	5,953	1,151.79	855.56	0.40	0.29	0.36	0.25
Sierra Leone 2003	3,714	844.08	608.47	0.40	0.29	0.35	0.25
Sierra Leone 2011	6,727	850.13	669.33	0.34	0.20	0.30	0.22
South Africa 2005	21,080	3,297.93	1,225.21	0.65	0.87	0.75	0.41
South Africa 2010	25,164	4,294.48	1,683.16	0.63	0.79	0.78	0.38
Swaziland 2001	3,666	1,324.17	718.50	0.53	0.58	0.48	0.32
Swaziland 2009	3,167	1,406.79	823.52	0.51	0.50	0.51	0.30
Tanzania 2000	22,176	448.30	339.33	0.37	0.25	0.33	0.23
Tanzania 2007	10,464	909.84	663.38	0.40	0.31	0.34	0.24
Togo 2006	7,472	914.30	631.76	0.42	0.32	0.39	0.26
Togo 2011	5,491	958.42	640.23	0.46	0.38	0.45	0.32
Uganda 2002	9,710	858.74	569.05	0.45	0.47	0.35	0.27
Uganda 2012	6,887	1,236.58	884.20	0.41	0.32	0.34	0.25
Zambia 1998	15,116	1,297.07	824.35	0.49	0.48	0.46	0.40
Zambia 2006	18,626	969.88	530.39	0.55	0.59	0.55	0.46

As for polarization, calculation of the Foster-Wolfson (FW) and Duclos-Esteban-Ray (DER) indices produced evidence that is mixed and thus hard to interpret.[13]

2.4 Empirical results

In this section, are provide an overview of the results of the standard relative distribution decomposition into growth effect and shape effect showing that in most analyzed countries, the consumption distribution polarized, in particular, in the lower tail of the distribution; in other words, these countries faced a significant process of lower polarization. In the second part, by decomposing the poverty variation into growth and shape effect is show how this lower polarization offset the potential gains stemming from growth in consumption.

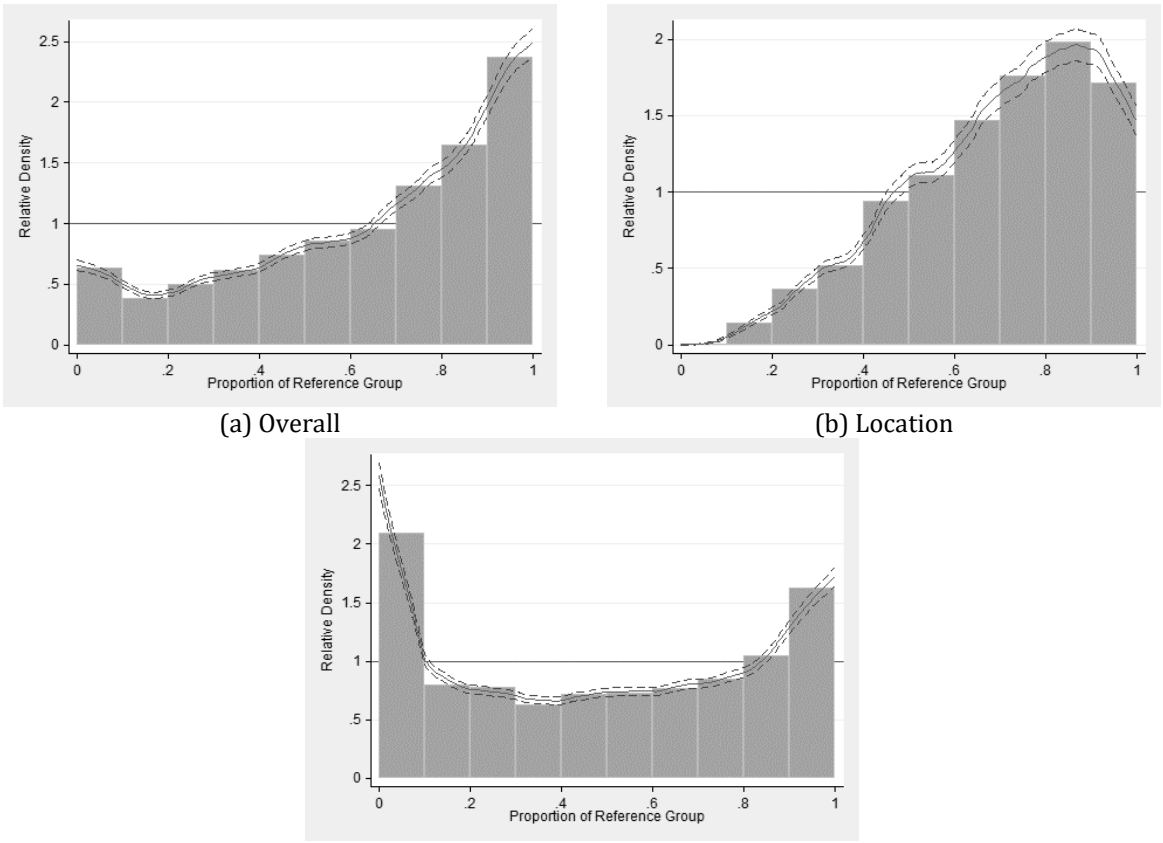
2.4.1 Changes in Sub-Saharan Africa consumption distributions

Figures 4, 5 and 6 presents the overall distribution and the decomposition into location and shape for three countries, one for each macro-region: Ghana for West Africa, Ethiopia for East Africa and South Africa for the Southern cone.[14] The results and relative graphs for the rest of Sub-Saharan African countries is exposed in Appendix A.

The panel (a) of the figures for each country depicts the overall relative distribution, showing the fraction of households in the comparison year's distribution that fall into each decile of the reference year's distribution. The location effect, i.e. the effect only due to the median shift, is shown in the panels (b) of the figures. Finally, the panels (c) of each figure display the shape effect, which represents the relative distribution net of the median influence.

[13] The inequality indices (Gini and Theil) and the polarization indices (Foster-Wolfson and Duclos-Esteban-Ray) have been estimated using the Distributive Analysis Stata Package, which is freely available at http://dasp.ucn.ulaval.ca/.

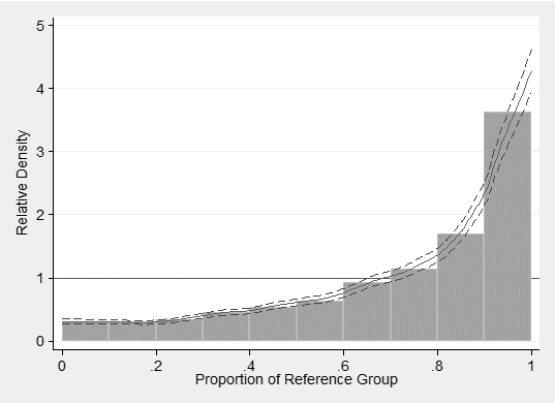
[14] The analysis has been performed using the `R` package `reldist` (Handcock, 2016). For the remaining 34 countries results, are available upon request.



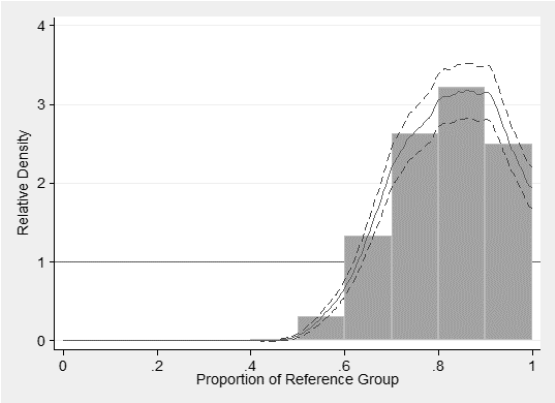
(a) Overall (b) Location

(c) Shape

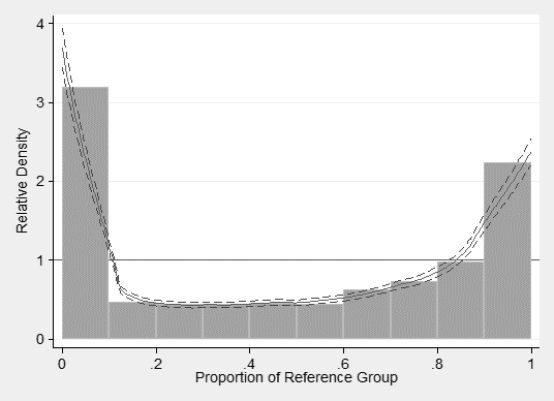
Figure 2.1: Relative consumption distribution for Ethiopia between 2000 and 2010. The bars represent the decile breakdown of the relative distribution, showing the fraction of 2010 households that fall into each 2000 decile, while dotted lines indicate the 95% point-wise confidence limits based on the asymptotic normal approximation (Handcock and Morris, 1999, p. 144)



(a) Overall

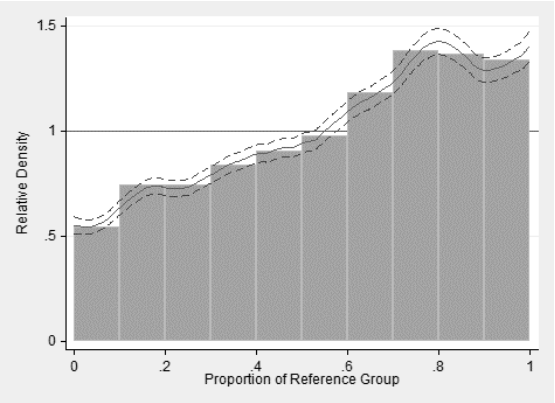


(b) Location

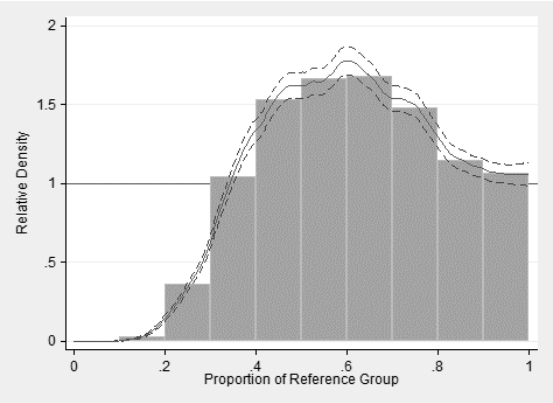


(c) Shape

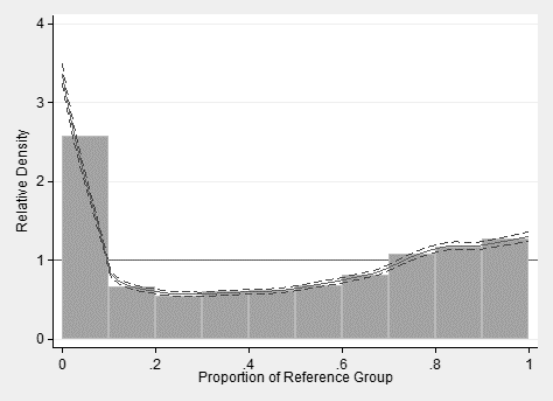
Figure 2.2: Relative consumption distribution for Ghana between 1991 and 2012. The bars represent the decile breakdown of the relative distribution, showing the fraction of 2012 households that fall into each 1991 decile, while dotted lines indicate the 95% point-wise confidence limits based on the asymptotic normal approximation (Handcock and Morris, 1999, p. 144)



(a) Overall



(b) Location



(c) Shape

Figure 2.3: Relative consumption distribution for South Africa between 2005 and 2010. The bars represent the decile breakdown of the relative distribution, showing the fraction of 2010 households that fall into each 2005 decile, while dotted lines indicate the 95% point-wise confidence limits based on the asymptotic normal approximation (Handcock and Morris, 1999, p. 144)

Looking at the shape effect graphs, we observe a clear concentration in the lowest decile. Values above 1 indicate that, in relative terms, there are more households in that decile of the distribution at the end of the period than there were at the beginning, vice versa less than 1 means there are less, and equal to 1 means that things haven't changed: 10 percent of households were in that decile at the beginning and 10 percent remained there. Therefore, relative to the initial period, households in the lowest percentiles of each country increased by 14 percentage points (+1.4 over 1) in Ethiopia, 20 (+2 over 1) in Ghana and 15 in South Africa (+1.5 over 1). In the three countries, this concentration in the lower tails (downgrading) is paralleled by a similar but smaller concentration in the upper tails (upgrading). Overall, the two effects produce a U-shaped relative density; households are concentrated in the tails of the distribution while the middle of the distribution hollows out.

The trends of the graphs above are confirmed by the observation of the relative polarization indices; these keep track of changes in the shape of the distribution and measure their direction and magnitude. Table 2 shows the median, lower and upper polarization indexes for each country whit their *p-value*.

The type of distributional change observed for Ghana, Ethiopia and South Africa is closely replicated by 16 countries other countries; all of them experience a significant increase in polarization that is predominantly driven by a downgrading of the consumption distribution, the only notable exception being Nigeria where upgrading and downgrading are almost equivalent (see Clementi et al., 2017). Interestingly, the polarization phenomenon appears widespread in the region, while only in Madagascar and Zambia it decreased significantly.

Table 2.2: Polarization Indexes

Countries	Polarization Indexes					
	MRP	*p-value*	LRP	*p-value*	URP	*p-value*
Botswana	0.1730	*0.0000*	0.3210	*0.0000*	0.0251	*0.1050*
Burkina Faso	0.3314	*0.0000*	0.3933	*0.0000*	0.2695	*0.0000*
Cameroon	0.0096	*0.1070*	-0.0220	*0.0775*	0.0412	*0.0037*
Chad	0.3520	*0.0000*	0.5015	*0.0000*	0.2026	*0.0000*
Dem. Rep. of the Congo	0.4093	*0.0000*	0.5247	*0.0000*	0.2939	*0.0000*
Ethiopia	0.2198	*0.0000*	0.2709	*0.0000*	0.1687	*0.0000*
Ghana	0.4380	*0.0000*	0.5327	*0.0000*	0.3432	*0.0000*
Ivory Coast	0.0714	*0.0000*	0.1121	*0.0000*	0.0308	*0.0227*
Madagascar	-0.2063	*0.0000*	-0.2336	*0.0000*	-0.1789	*0.0000*
Malawi	0.0917	*0.0000*	0.0966	*0.0000*	0.0867	*0.0000*
Mauricius	0.0318	*0.0007*	0.0600	*0.0012*	0.0036	*0.4330*
Mauritania	0.1278	*0.0000*	0.2049	*0.0000*	0.0507	*0.0026*
Mozambique	0.2192	*0.0000*	0.3670	*0.0000*	0.0715	*0.0000*
Namibia	0.1321	*0.0000*	0.2011	*0.0000*	0.0630	*0.0000*
Nigeria	0.1202	*0.0000*	0.1125	*0.0000*	0.1278	*0.0000*
Rwanda	0.2126	*0.0000*	0.2733	*0.0000*	0.1519	*0.0000*
Senegal	0.0198	*0.0414*	0.0238	*0.0821*	0.0158	*0.2100*
Sierra Leone	-0.0229	*0.0266*	-0.0177	*0.2273*	-0.0282	*0.1187*
South Africa	0.2564	*0.0000*	0.3815	*0.0000*	0.1313	*0.0000*
Swaziland	0.1685	*0.0000*	0.2520	*0.0000*	0.0849	*0.0012*
Tanzania	0.3981	*0.0000*	0.4946	*0.0000*	0.3016	*0.0000*
Togo	0.1124	*0.0000*	0.1643	*0.0000*	0.0604	*0.0015*
Uganda	0.2578	*0.0000*	0.3459	*0.0000*	0.1697	*0.0000*
Zambia	-0.2306	*0.0000*	-0.3683	*0.0000*	-0.0929	*0.0000*

The null hypothesis of no change with respect to the reference distribution is tested for each index and in 21 out of 24 countries, the variation in the indices is significant. The type of distributional change observed for the majority of countries has a common pattern: all of them experience a significant increase in polarization that is predominantly driven by a downgrading of the consumption distribution, the only notable exception being Nigeria where upgrading and downgrading are almost equivalent (see Clementi et al., 2017). Interestingly, the polarization phenomenon appears widespread in the region, while only in Madagascar and Zambia it decreased significantly.

Figure 3 represent the distribution of the indices from a geographic point of view. More the colors are dark, more the polarization indices are high.

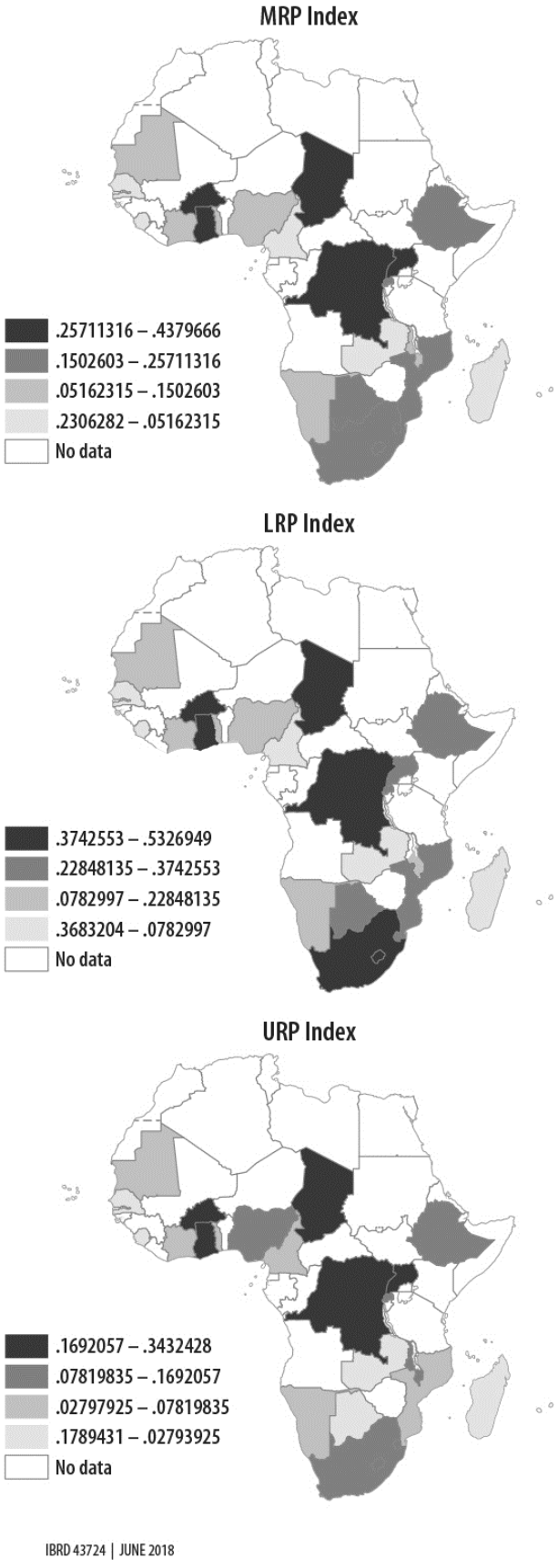


Figure 2.4: Relative polarization indices, geographical distribution

The maps show that the distribution not follow a very clear geographical pattern, but the phenomena of polarization is diffused in all Sub-Saharan area.

Another common feature of the group of polarizing countries is that the Gini index either increased little or, as mentioned before, decreased. It is interesting to note that in the same period, economies more advanced than the SSA African ones, but equally reliant on commodities such as Russia and Brazil, experienced similar distributional changes. Nissanov and Pittau (2015) find that during the commodity boom of the 2000's household net income restarted to grow after a long decline, Gini decreased while polarization increased, driven mainly by a downgrading in the income distribution. Likewise, Clementi and Schettino (2015) find that the decline in Gini experienced in Brazil between 2000-12 is accompanied by a hollowing out of the middle of the distribution and accentuated concentration of households in the lower tail.

2.4.2 Decomposition results

Once ascertained that there was a significant pro-polarization distributional change in the clear majority of SSA countries analyzed, we now proceed by linking this change to poverty reduction or lack thereof.

Figure 4 displays the results of the poverty "growth and polarization" decomposition (11) that explicitly links the downgrading of the distribution to the reduced impact of growth on poverty. The detailed results are reported in Table 1 in the Appendix A.

Results are self-explanatory: in the 13 out of 19 countries where the lower polarization took place, it offset the poverty reduction benefits that could have arisen from growth. The magnitude differs from a minimum registered by Senegal to a maximum registered by South Africa; on average, this effect contributed to a 5-6 percentage points lessening in poverty reduction.

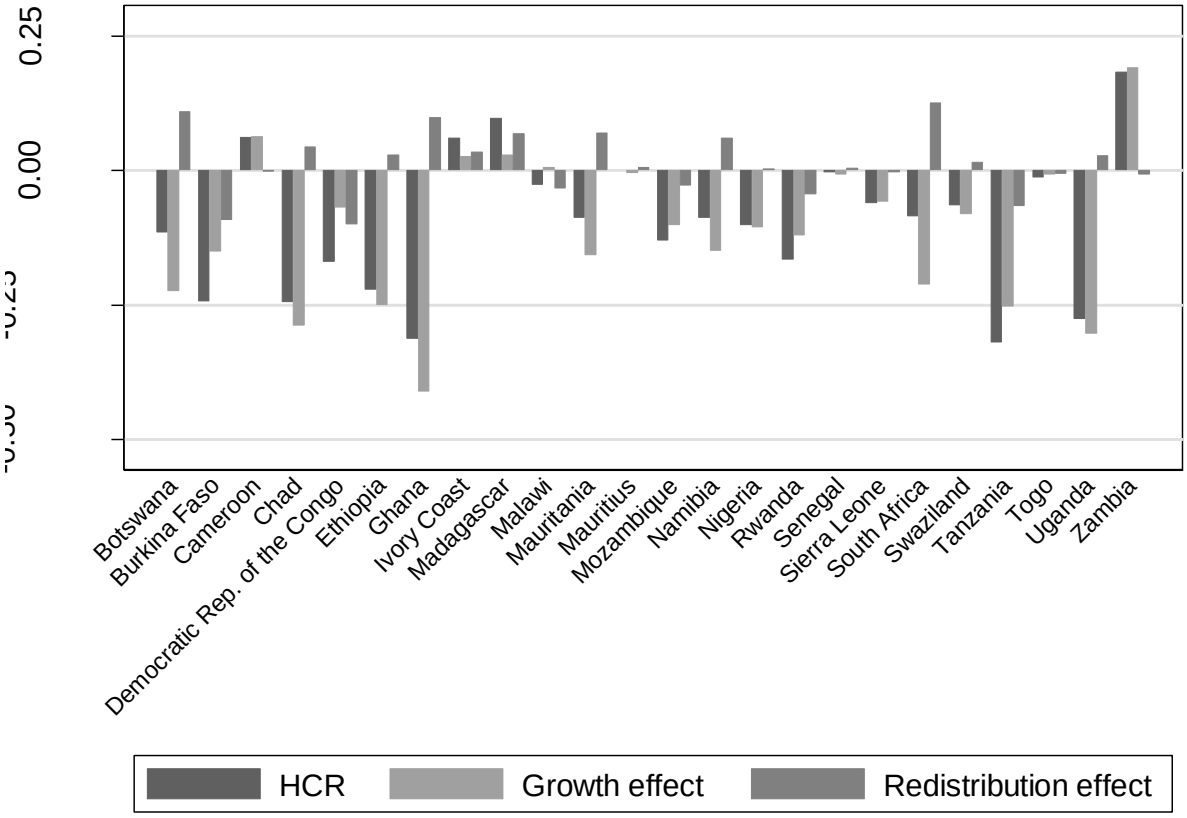


Figure 2.5: Variation in the poverty headcount ratio and decomposition into growth and redistribution components (Author method)

The question then arises of why standard measures/decompositions did not capture this effect. Figures 2.6 and 2.7 compare the growth and distributive effects of our approach with those of the Datt and Ravallion's and the panel-based decomposition methodologies for the poverty headcount and poverty gap. As it appears, the negative distributive effect (against poverty reduction) of the Datt and Ravaillon's decomposition is always minimal, or in many cases the distributional change is pro-poor, while the inequality effects of the panel-based methodology are usually larger in magnitude, though in many cases they tend to reinforce the growth effects when driving the change in poverty.

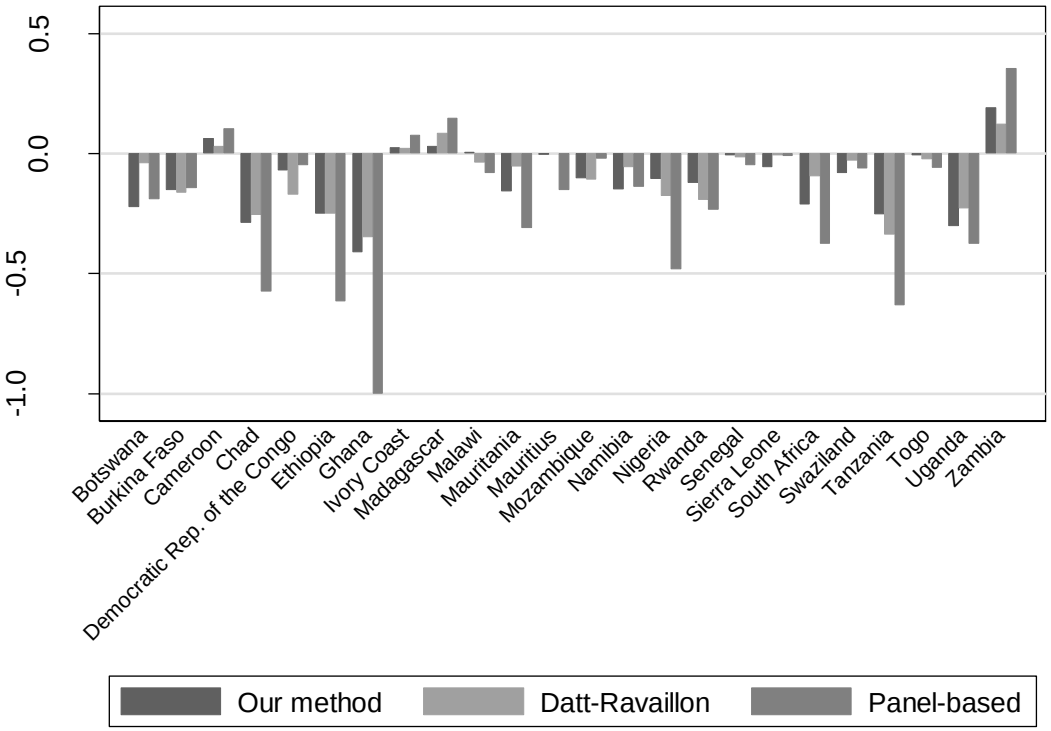


Figure 2.6.a: Growth components compared (headcount ratio).

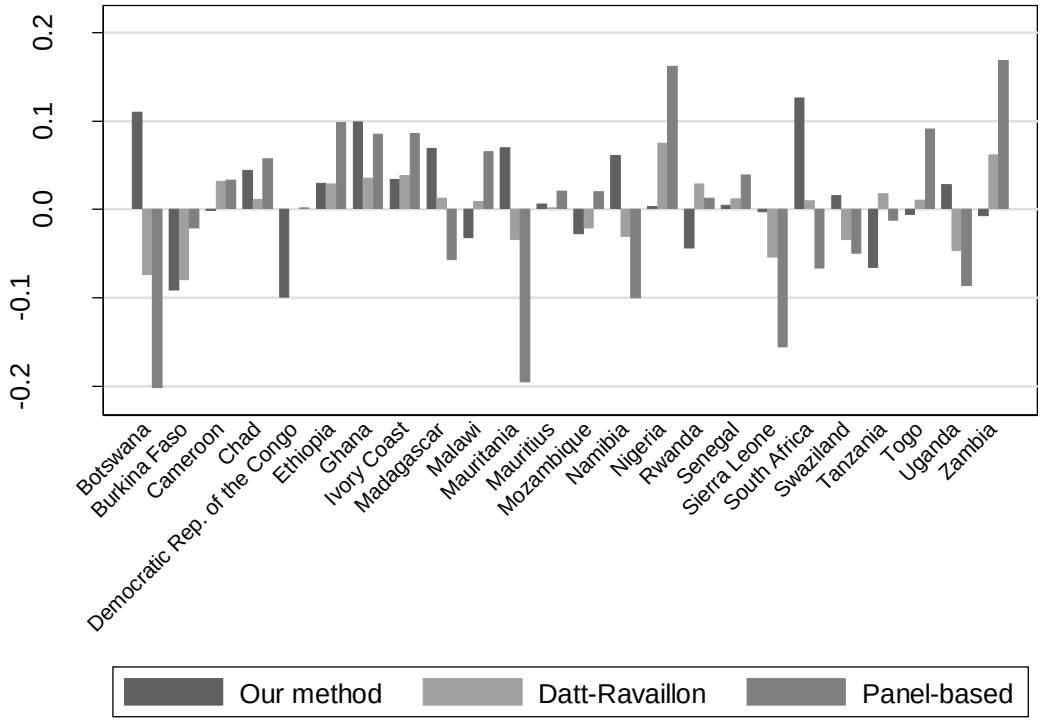


Figure 2.6.b: Redistribution components compared (headcount ratio).

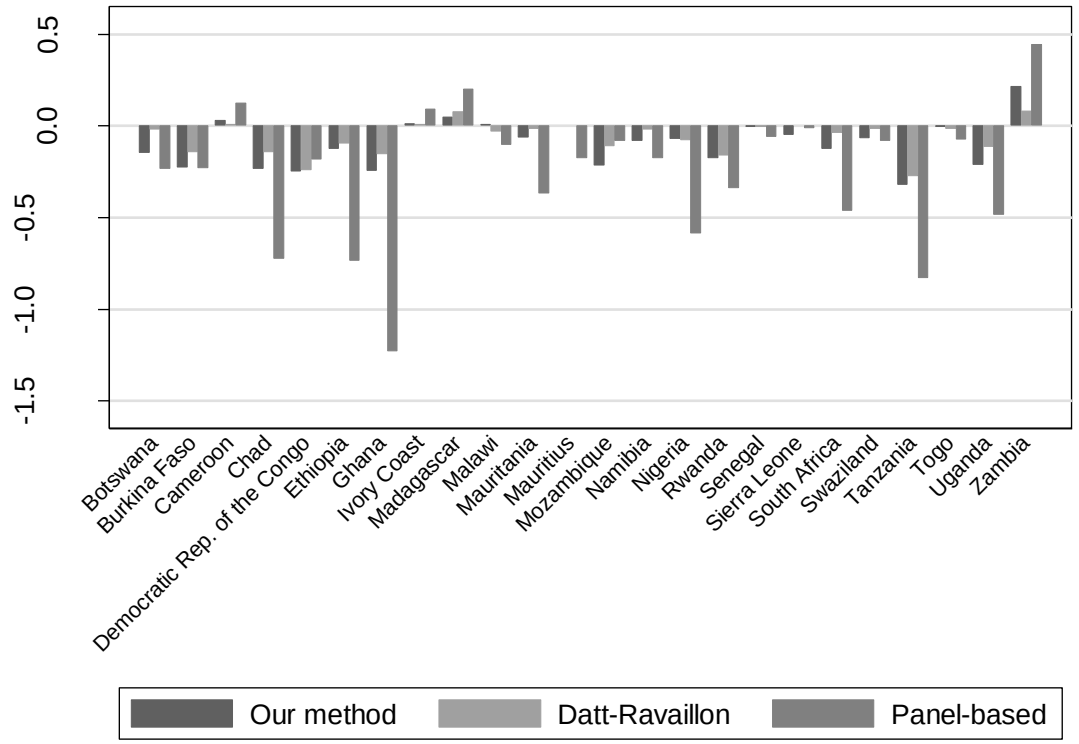


Figure 2.7(a): Growth components compared (poverty gap)

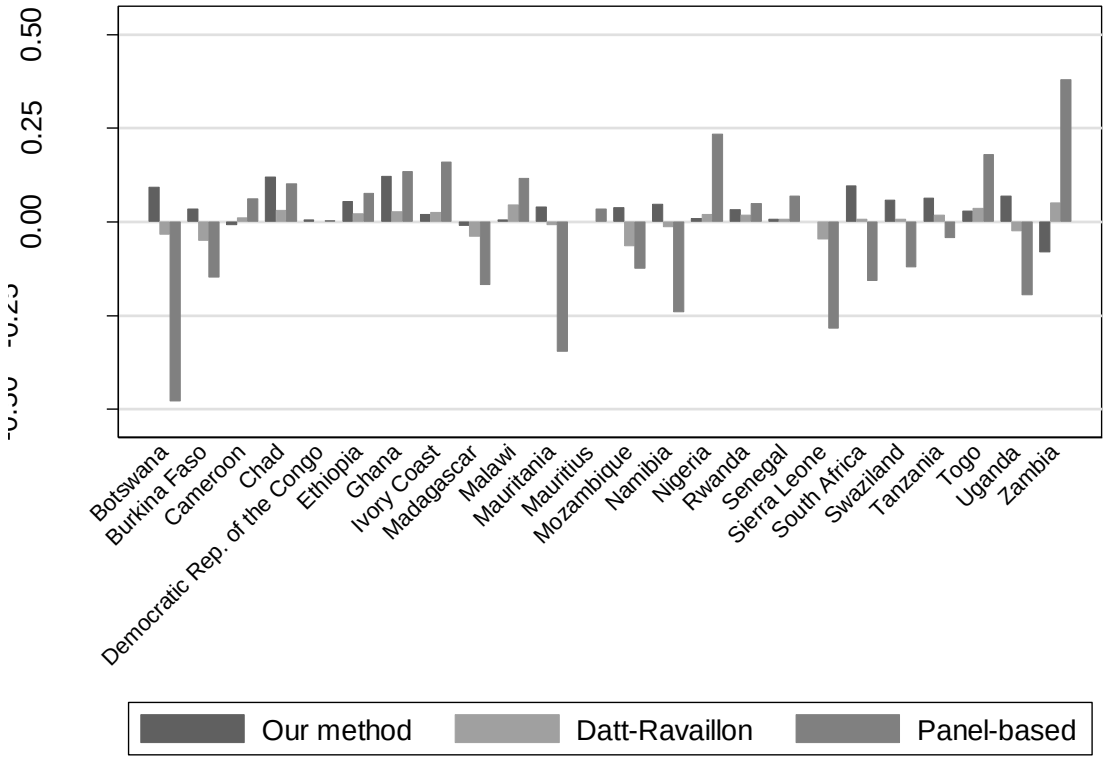


Figure 2.7(b): Redistribution components compared (poverty gap)

Our point is that the distributional change SSA countries went through could only be detected with the method we propose, and not by decompositions based on standard summary tools to measure distributional changes. The reason is simple. Summary measures like Gini analyze the dispersion around the mean of the distribution and this, as shown in Figure 3, either did not change or sometimes improved in SSA. Also, and most importantly, a summary measure does not assign a weight to the different percentiles, hence if a pro-inequality change in one part of the distribution is more than compensated by a pro-equality change in the rest of the distribution, these measures will decline. Yet, the distributional changes that matter most for poverty reduction are those localized in the lower part of the distribution but can be detected only if one can look at changes at a very granular level. The type of decomposition we propose can shed light on this, while standard decompositions based on summary measures such as the Gini likely do not.

Finally, the results of our analysis echo some recent findings from a recent World Bank (2018) report on structural transformation in Africa. While our analysis focuses on distributional changes, the report looks at changes in the labor markets and productivity that might explain the low growth-to-poverty elasticity in Africa. The low contribution of employment growth to poverty reduction, slow gains in agricultural productivity, and a transition outside agriculture towards sectors characterized by equally low productivity all contributed to characterize SSA growth as barely inclusive and consequently less able than other regions in the world in reducing poverty. From a distributional point of view, our paper complements this analysis by showing that this missed opportunity also translated into an increasing divide between the bottom 30-40 percent of the consumption distribution and the rest.

2.5 The drivers of distributional changes

In this section—within the relative distribution framework— is proposed a novel methodology (Clementi et.al., 2017) to identify the drivers of distributional changes and quantify their impact on the welfare distribution; the main value added being it enables a very granular analysis of the distributional changes that an analysis based on standard inequality decompositions would not allow.

2.5.1 Data

The data used in this section is different from previous part obtained from Povcal database. These come from national household surveys of different Sub-Saharan countries collected in the Survey-based Harmonized Indicator Program (SHIP), a program developed by the Word Bank to analyze living standards in Africa. This was necessary to obtain more information on the variables used in the analysis, which are not present in the Povcal data.

The objective of the SHIP is to facilitate the monitoring and comparison of social and economic conditions in Africa. Data comparability is achieved through the use of a common set of variable definitions to which individual surveys are harmonized. The procedures designed to ensure good data quality, transparency of data processing, and ease of analysis include verification for internal and external consistencies, extensive documentation of data processing, and harmonization of the standardized files through a common set of variables. These variables include: household consumption; access to infrastructure (water, electricity, education and health care); status of employment; education; and health.

However, it was not possible to analyze all Sub-Saharan Africa countries for the difficulties to realize household surveys in fragile countries and, in some cases, due to the lack of these surveys for two separate years. Furthermore, for some countries the SHIP data have been integrated by the International Income Distribution Database (I2D2), a worldwide database built by the World Bank that includes standardized set of demographics, education, labor market, household socio-economic and income variables.

2.5.2 Blinder-Oaxaca method

For analyzing the effect of covariates on the distributional change, both location and shape changes, we use a different method, yet introduced in previous work (Clementi et al., 2017). This method combines relative distribution approach with a regression-based decomposition. Thus, we obtained results with easily interpretation.

We decompose the component relative distribution that represent differences in location and shape, using an unconditional quantile regression to observe the impact of the covariate on the entire distribution of dependent variable (in our case, consumption) (Firpo et al., 2009) and

using Blinder-Oaxaca decomposition to decompose differential at selected quantiles of the distribution.

First, we derive the re-centered influence function (RIF) for the rth quantile of the consumption distribution. This method is originally proposed by Firpo (2009) for the decomposition of wage differentials.

A RIF-regression is like a standard regression, except the dependent variable, y, is replaced by the (re-centered) influence function of the statistic of interest.

Formally, consider IF(y;v), the influence function corresponding to an observed variable y for the distributional statistic of interest, v(Fy).

The Recentered Influence Function (RIF) is defined as RIF(y;v)=v(Fy)+IF(y;v), so that it aggregates back to the statistics of interest ($\int RIF(y;v) \cdot dF(y) = v(Fy)$).

In its simplest form, the approach assumes that the conditional expectation of the RIF(y;v) can be modeled as a linear function of the explanatory variables,

$$E[RIF(Y;v)|X] = X\beta \tag{2.15}$$

where the parameters β can be estimated by OLS.

The RIF-regression at y gives the influence on v(Fy) of on infinitesimal increase in the density of the data at y. Regression coefficient reveal how much the average influence of observation vary with X, holding other covariates constant.

This method has several advantages. It's straightforward to invert the proportion of interest by dividing the density. Since the inversion can performed locally, another advantage is that we don't need to evaluate the global impact at all points of the distribution and worry about monotonicity. One gets a simple regression which is easy to interpret. Thus, resulting decomposition is path independent (Fortin et al., 2011).

Using results from RIF-regression, a decomposition for location and shape can be realized with Blinder-Oaxaca method of mean differential.

The aim of Blinder-Oaxaca decomposition is to explain how much of the difference in mean outcome across two groups is due to group differences in the levels of explanatory variables, and how much is due to differences in the magnitude of regression coefficients (Oaxaca, 1973; Blinder, 1973).

The difference between the mean outcome of two groups can be expressed as

$$R = E(Y_A) - E(Y_B) \tag{2.16}$$

where E(Y) contains the mean value of the outcome, is accounted for by group differences in the predictors.

Based on the linear model

$$Y_\varphi = X'_\varphi \beta_\varphi + \epsilon_\varphi, \quad E(\epsilon_\varphi) = 0 \quad \varphi \in (A, B) \tag{2.17}$$

where X is a vector containing the predictors and a constant, β contains the slope parameters and the intercept, and ϵ is the error, the mean outcome difference can be expressed as the difference in the linear prediction at the group-specific means of the regressors:

$$R = E(Y_A) - E(Y_B) = E(X_A)'\beta_A - E(X_B)'\beta_B \tag{2.18}$$

Because

$$E(Y_\varphi) = E(X'_\varphi \beta_\varphi + \epsilon_\varphi) = E(X'_\varphi \beta_\varphi) + E(\epsilon_\varphi) = E(X_\varphi)'\beta_\varphi \tag{2.19}$$

Where $E(\beta_\varphi) = \beta_\varphi$ and $E(\epsilon_\varphi) = 0$ by assumption.

To identify the contribution of group differences in predictors to the overall outcome difference, (1) can be rearranged, for example, as follows (see Winsborough and Dickinson [1971]; Jones and Kelley [1984]; and Daymont and Andrisani [1984]):

$$R = \{E(X_A) - E(X_B)\}'\beta_B + E(X_B)'(\beta_A - \beta_B) + \{E(X_A) - E(X_B)\}'(\beta_A - \beta_B) \tag{2.20}$$

This is a "threefold" decomposition; that is, the outcome difference is divided into three components:

$$R = E + C + I \tag{2.21}$$

The first component,

$$E = \{E(X_A) - E(X_B)\}'\beta_B \tag{2.22}$$

amounts to the part of the differential that is due to group differences in the predictors (the "endowments effect"). The second component,

$$C = E(X_B)'(\beta_A - \beta_B) \tag{2.23}$$

measures the contribution of differences in the coefficients (including differences in the intercept). And the third component,

$$I = \{E(X_A) - E(X_B)\}'(\beta_A - \beta_B) \tag{2.24}$$

is an interaction term accounting for the fact that differences in endowments and coefficients exist simultaneously between the two groups. The decomposition shown in (2) is formulated from the viewpoint of group B. That is, the group differences in the predictors are weighted by the coefficients of group B to determine the endowments effect (E). The E component measures the expected change in group B's mean outcome if group B had group A's predictor levels. Similarly, for the C component (the "coefficients effect"), the differences in coefficients are weighted by group B's predictor levels. That is, the C component measures the expected change in group B's mean outcome if group B had group A's coefficients.

In Blinder-Oaxaca decomposition, to avoid multicollinearity, can be omitted baseline category where categorical variables are included as covariates (Oaxaca and Ransom, 1999). These categorical variables are introduced as a set of dummy variables, and researcher can be omitted one of these for each variable, that will to represent the baseline category.

Differentials of the formula can be interpreted in follow manner: negative differentials for deciles below the median suggest an increasing in polarization, because the population shift from the "center" of the distribution to the lower tail, while positive results above the median suggest a shift of population to the upper tail.

2.5.3 The drivers of polarization

In this section, we analyzed the drivers of growing polarization for 11 countries among those objected before. The choice of these countries is provided by the fact that there are available, for the used surveys, data relating to the working situation of families, education and other variables of interest.

The Oaxaca-Blinder methodology (Oaxaca 1973), decomposes the difference that is due to group differences in the magnitudes of the determinants (*endowments effect*) of consumption and group differences in the effects of these determinants (*coefficients effect*).

Coefficient and endowment variations are aggregated by groups of variables: primary, secondary and tertiary education are grouped into the education group; private, public and self-employment workers are grouped into employment category; the infrastructure index captures the access to basic services; urbanization and residence in north/south (east/west) regions are grouped into spatial group and household group includes household size and all other household characteristics.

We chose not to comment on the econometric results of the unconditional quantile regression and the location effect decomposition, and we put these results in the appendix; regarding the polarization decomposition results, we focus our attention on the top two and bottom two percentiles results. In Figure 6 is possible to observe the results of Oaxaca-Blinder decomposition for the first two and the last two deciles.

Burkina Faso, for the period analyzed, polarization grows significantly, especially whit respect the lower tail of distribution. The polarization decomposition shows that household composition, education and employment status increased the lower polarization, while infrastructure index, spatial effect and constant tended to reduce the effect. On the upper decile, the same variables, whit household composition, increase polarization. Education and employment status have the opposite effect.

In Cameroon, we can observe a situation similar to Burkina Faso, whit a significant concentration of the distribution in the lower deciles. The increase of polarization in lower tail is influences by household composition, employment status and spatial effect. Education status, infrastructure index and constant have a decrease effect on the polarization. In top deciles, the only set of variables that reduce the polarization is the employment status, while the other variables have an increase effect.

For Ivory Coast, we observed an opposite situation in lower deciles and upper deciles: while in the lower tail only household composition increase polarization, while education and employment status, infrastructure index, spatial effect and constant decrease polarization, in upper tail the influence of the variables is perfectly opposite.

In Ghana, we observed a marked U-shape distribution. The polarization effect in lower tail is influenced by household composition and infrastructure index. The other variables tended to reduce the effect. In higher deciles, education and employment status, infrastructure index and constant have a pro-polarization effect.

In Guinea, the distribution is like Burkina Faso, whit an increase of polarization imputable primarily to the concentration of consumption in the lower tail. This concentration is influenced mainly by spatial effect, and then by education status and infrastructure index. Constant reduce polarization. In the upper deciles, infrastructure index and constant have a pro-polarization effect, while the other variables have the opposite effect.

Mauritania present similar situation to Guinea and Burkina Faso, whit the lower polarization higher than the polarization in top deciles. For the lower deciles, this concentration can be explicated by household composition, while the others variables reduce polarization. Similar situation can be observed in the upper deciles, where only constant has a pro-polarization effect.

In Mozambique, in the lower deciles constant has a pro-polarization effect, while household composition, education and employment status and spatial effect reduce polarization. In the upper tail, spatial effect and constant have the major effect on polarization, while education and employment status have a marginal effect.

In Niger, for the lower deciles only education status and infrastructure index have a marginal effect on the increase of polarization, while these variables have a larger pro-polarization effect in the upper deciles, combined whit the spatial effect.

For Nigeria, constant has a large pro-polarization effect in the lower deciles, while household composition, education and employment status and infrastructure index reduce polarization. Completely opposite situation is observable in the upper deciles, where the same variables have a pro-polarization effect.

In Democratic Republic of Congo, where the concentration of consumption in the tails of distribution is marked, the lower polarization is influenced only by household composition, while education and employment status and constant have the opposite effect. In the upper

deciles, the polarization is explained by education status, infrastructure index, spatial effect and constant, while household composition and employment status reduce polarization.

Lastly, in Senegal, in the lower deciles only spatial effect is pro-polarization. The other variables reduce polarization. In the upper deciles, education status and constant have a pro-polarization effect.

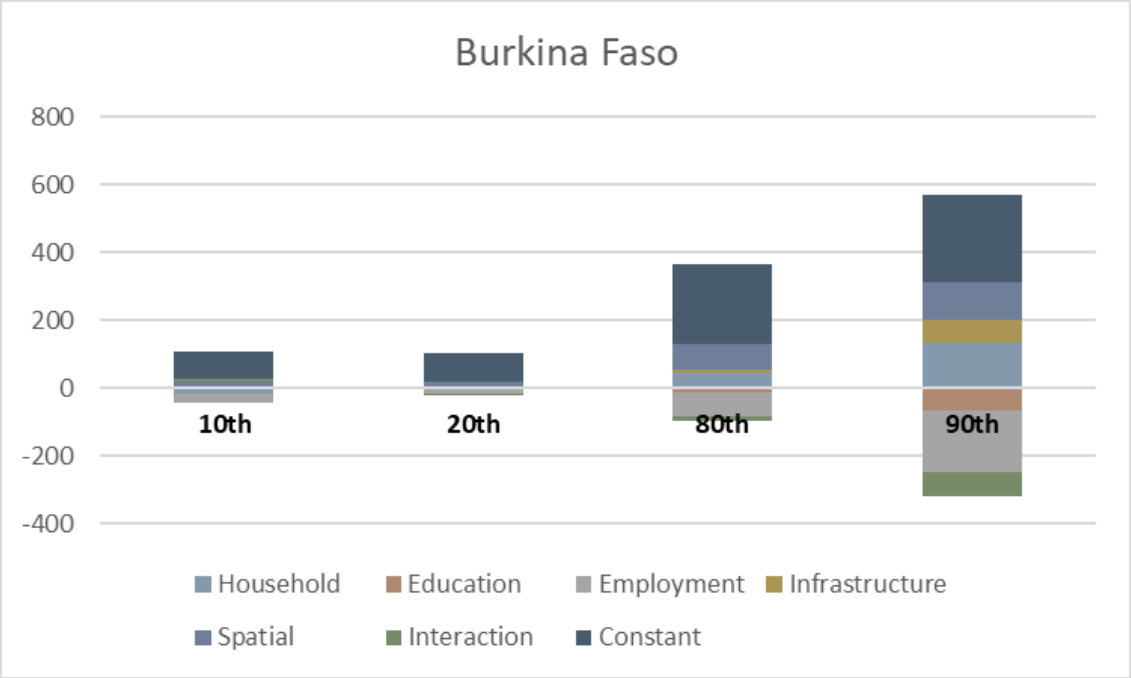


Figure 2.8: Oaxaca-Blinder decomposition results for Burkina Faso

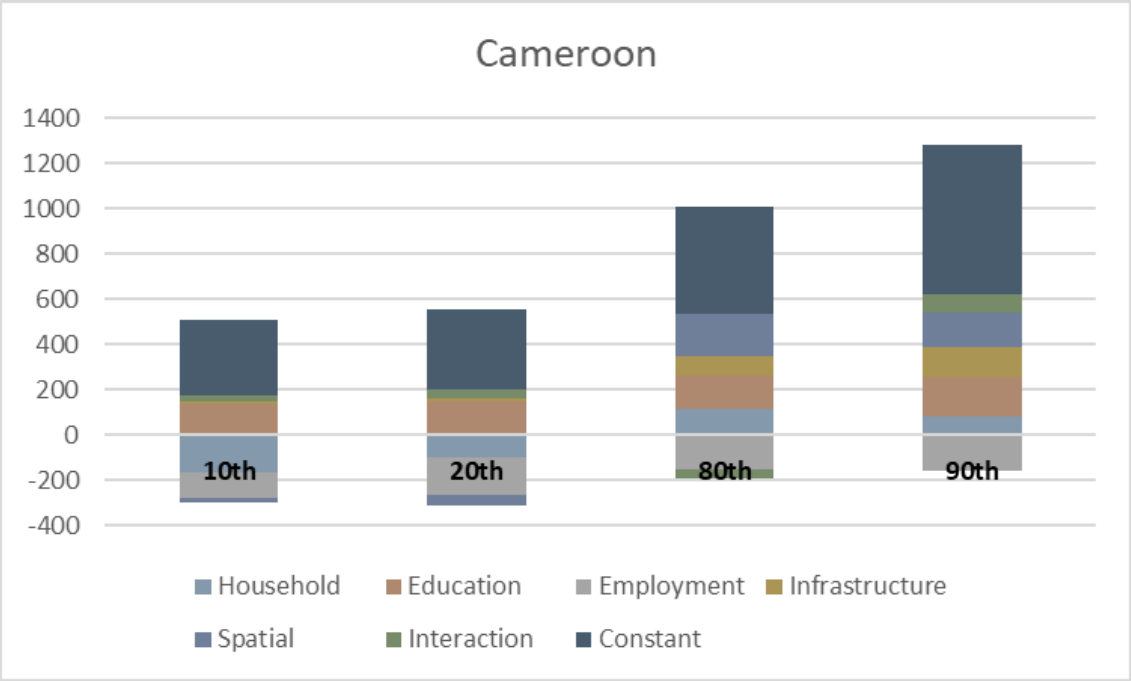


Figure 2.9: Oaxaca-Blinder decomposition results for Cameroon

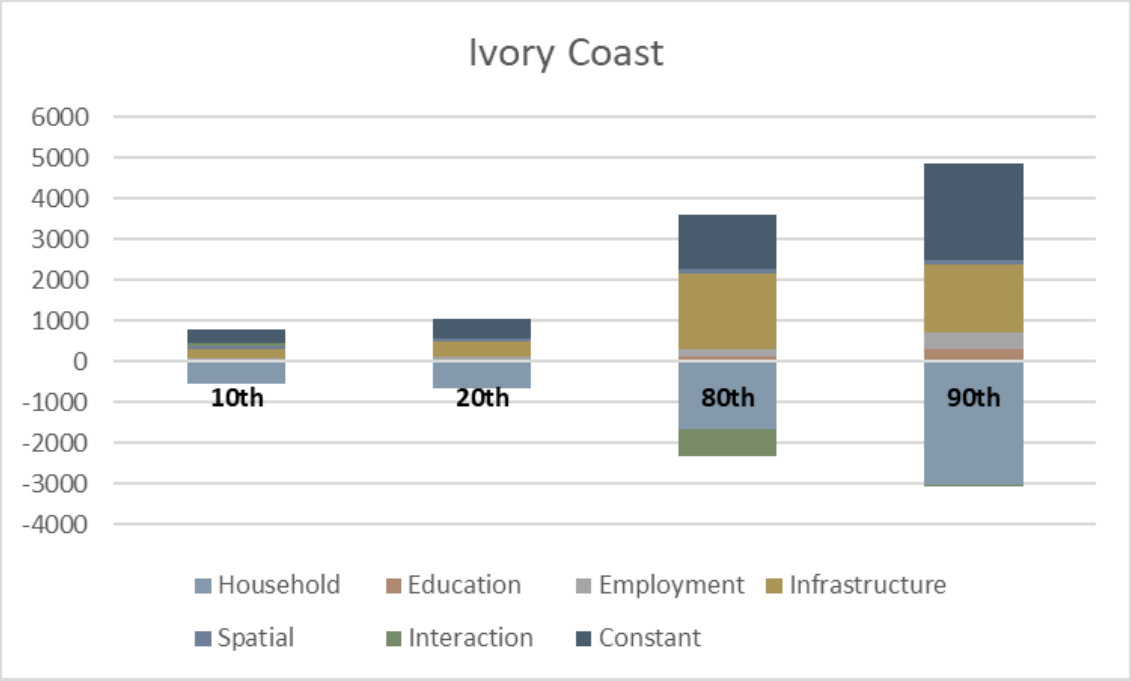


Figure 2.10: Oaxaca-Blinder decomposition results for Ivory Coast

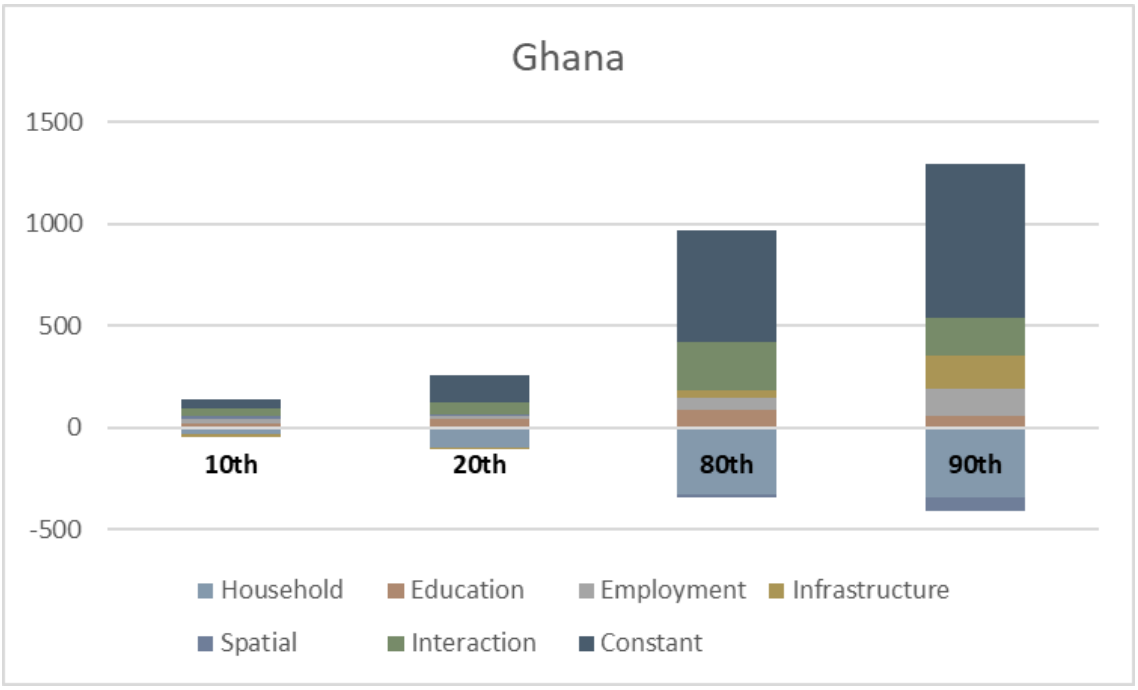


Figure 2.11: Oaxaca-Blinder decomposition results for Ghana

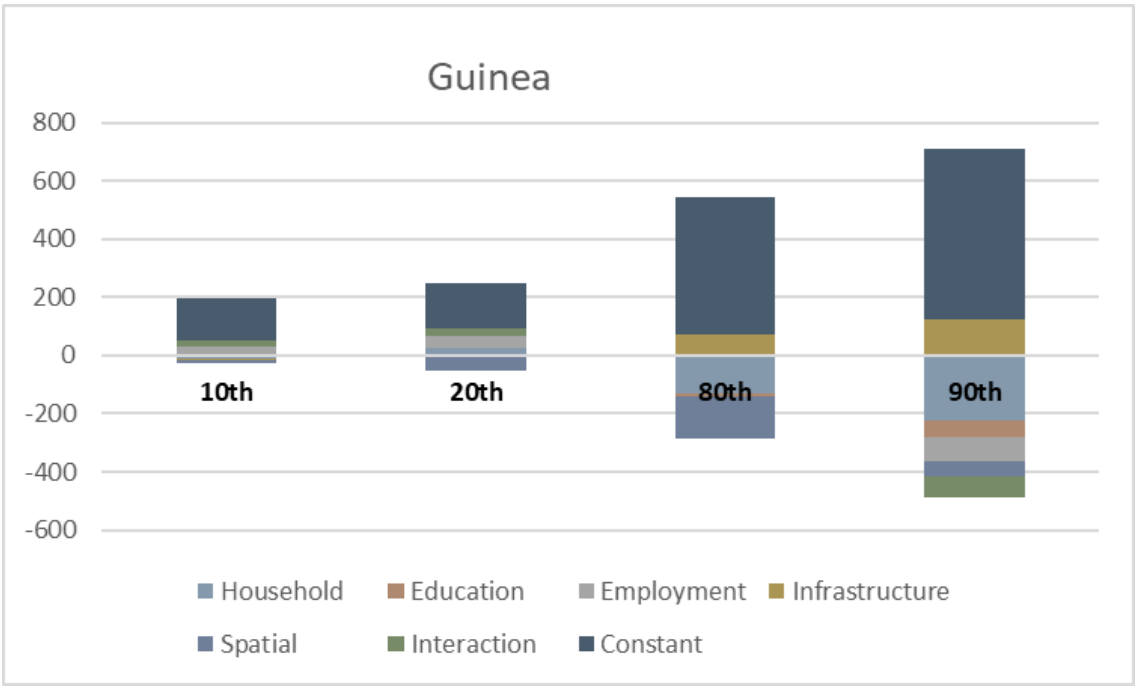


Figure 2.12: Oaxaca-Blinder decomposition results for Guinea

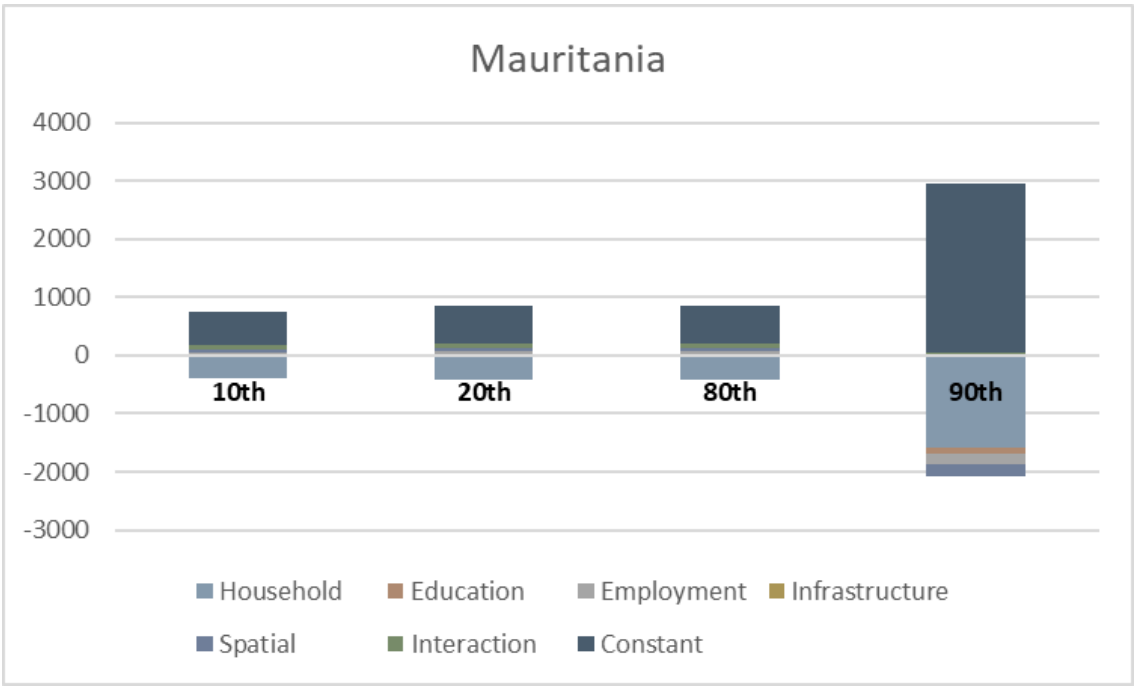


Figure 2.13: Oaxaca-Blinder decomposition results for Mauritania

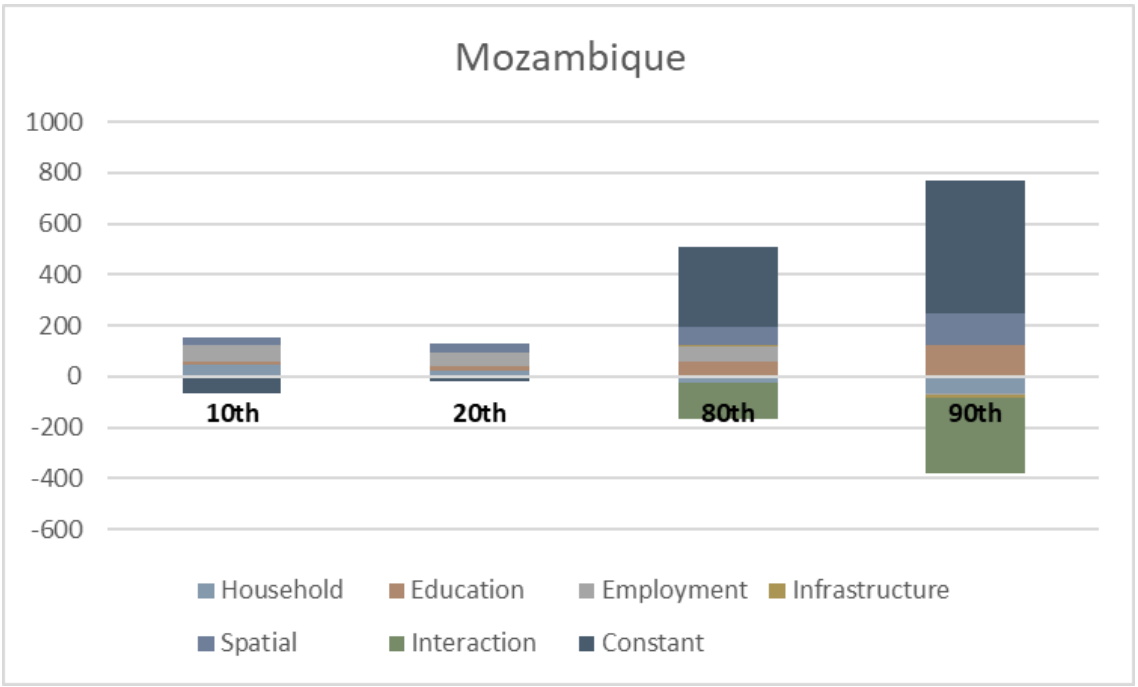


Figure 2.14: Oaxaca-Blinder decomposition results for Mozambique

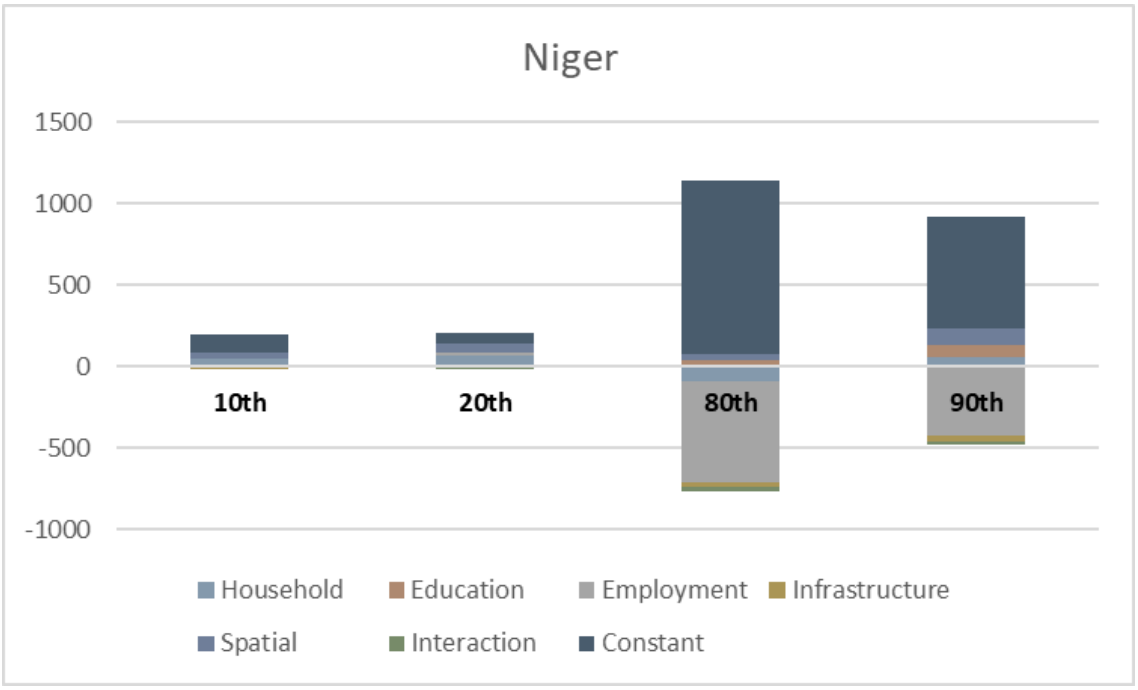


Figure 2.15: Oaxaca-Blinder decomposition results for Niger

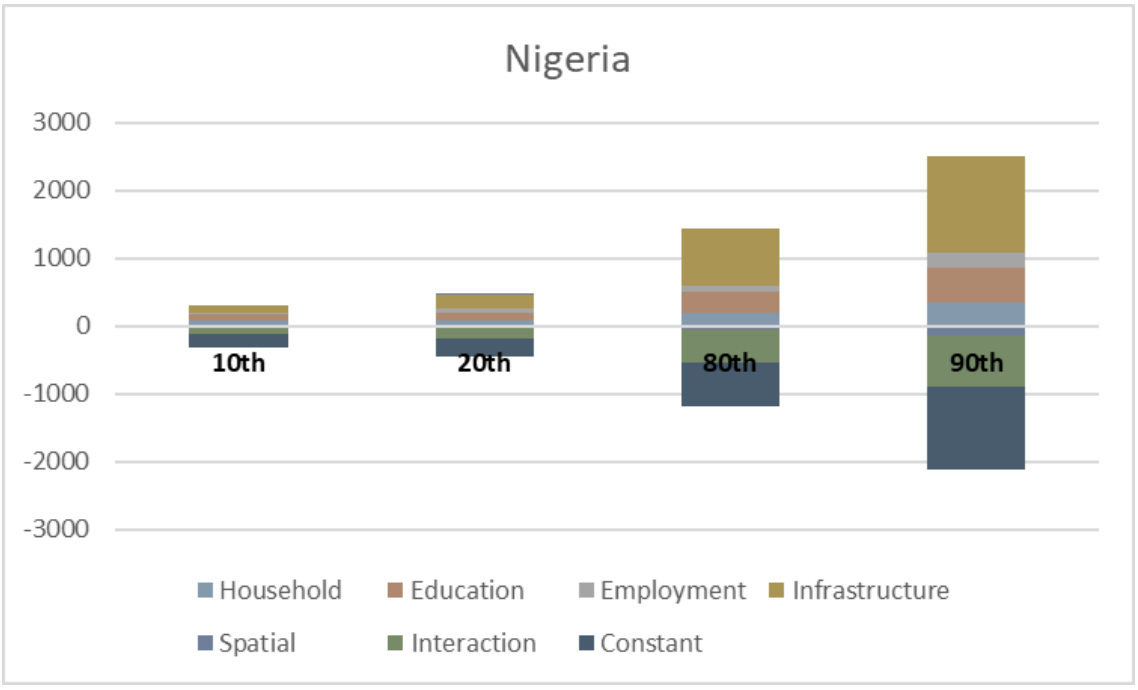


Figure 2.16: Oaxaca-Blinder decomposition results for Nigeria

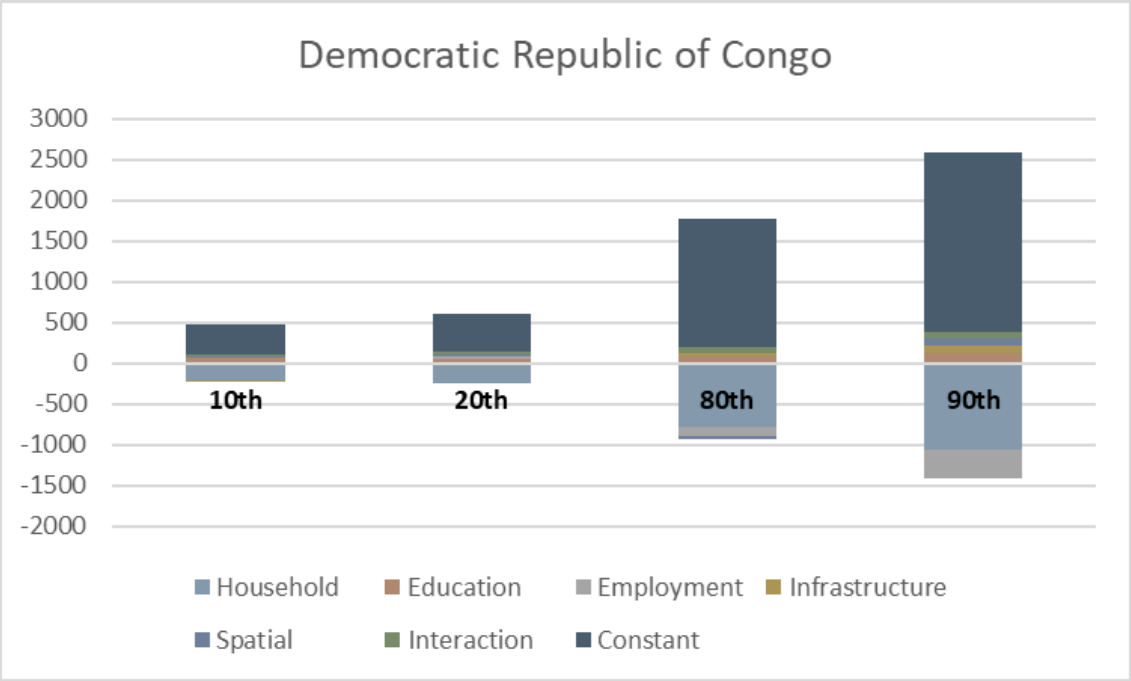


Figure 2.17: Oaxaca-Blinder decomposition results for Democratic Republic of Congo

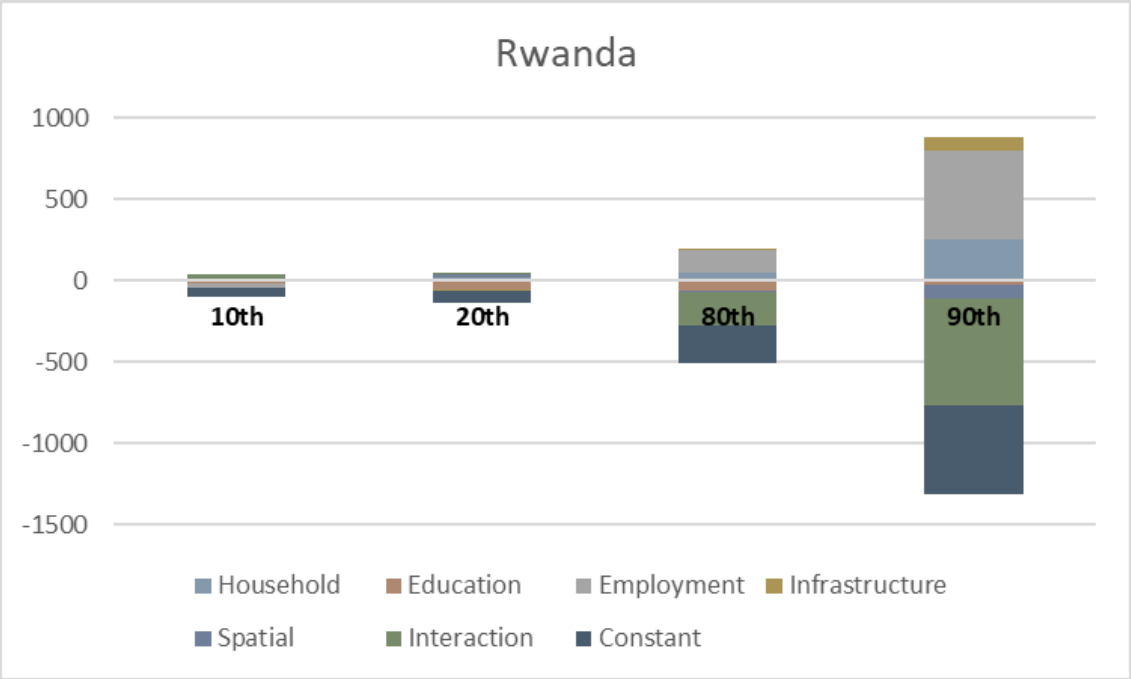


Figure 2.18: Oaxaca-Blinder decomposition results for Rwanda

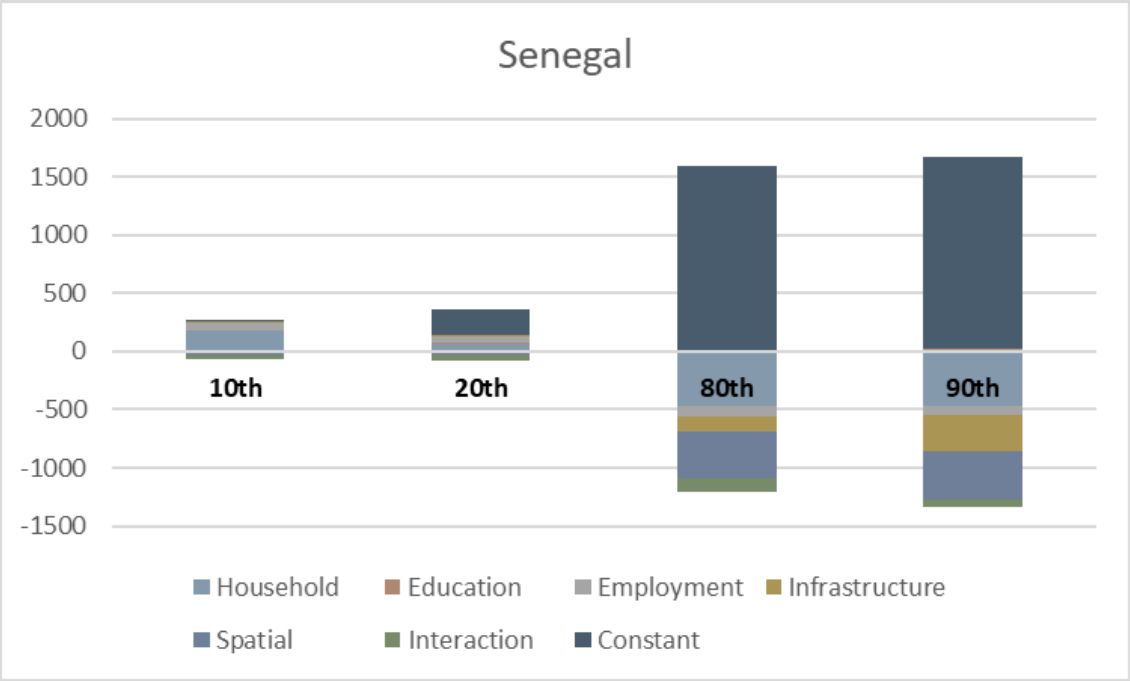


Figure 2.19: Oaxaca-Blinder decomposition results for Senegal

What is possible to observe in this analysis is that, for the selected countries, is not present a clear relation between covariates and polarization. Results are different between countries, and every country had internal problem that influence the distribution of consumption.

2.6 Summary and conclusions

Since the end of the 90's, two leading narratives prevailed when analyzing Sub-Saharan Africa. The first, predominant, painted a picture of a continent on track in reducing poverty, where middle classes were expanding, and prosperity was reaching large swaths of the population (African Development Bank, 2011; The Economist, 2011, 2013; McKinsey, 2012). The other narrative acknowledged the relatively robust growth, with a slow reduction in poverty without, however, conclusive evidence on the mechanisms that hindered growth from trickling down.

This paper, to our knowledge, is the first attempt to provide a comprehensive explanation from a distributive point of view, of this low growth elasticity to poverty that characterized SSA in a time when other regions in the world, growing as much as Africa, fared much better in terms of poverty reduction.

To show that important distributional changes took place in SSA and that these played against inclusive growth, this paper develops a novel, yet simple decomposition based on the "relative distribution" method (Handcock and Morris, 1998, 1999). Whereas the standard "relative distribution" method enables to summarize multiple features of the welfare distribution, our small innovation links these changes to the poverty reduction process producing a poverty growth polarization decomposition.

In a nutshell, we find that the vast majority of SSA countries we analyze (about 80 percent) between the late 1990s and early 2010s experienced a very similar distributional change of lower polarization—that is the clustering of the poorest 30-40 percent around a local mean and an increasing divide between this group and the rest of the distribution. We also observe an upgrading in the distribution that is the fattening of the upper tail of the distribution (upper polarization), but only in the case of Nigeria this is commensurate to the lower polarization.

This low polarization process has important implications for poverty reduction. The proposed decomposition shows that polarization substantially reduces the positive effect of growth on poverty reduction: on average without downgrading, poverty could have been 5-6 percentage points lower in SSA. Standard decompositions of poverty into growth and inequality components fail to capture the impact of this distributional change on poverty also because there is hardly a common Gini pattern in SSA whereas we show there is clear downgrading pattern.

Looking at the impact analysis of the covariates of the polarization effect, the results show that is not a clear common trend for all countries. In few words, is clear that a better instruction, an easy access to the infrastructure and the composition of household can be influence the distribution of income and allow household to improve their well-being, but these problems are specific and particular of each country.

The potential policy implications are numerous. First, we show that the type of growth SSA experienced in the last decade was a sort of double edged sword. It certainly reduced poverty but at the same time it increased the divide between the bottom 40 percent (World Bank, 2012) and the rest of the population. Therefore, since SSA's growth is not inclusive *per se*, more efforts should be put to expand the benefits of growth by diversifying economies into labor intensive sectors and reducing the divide between advanced and underdeveloped regions within each country. Second, it looks like this divide is a slow-motion process that accumulated

over many years; evidence from Ghana and Nigeria for example (Bertoni et al., 2016; Clementi et al., 2017, 2018) indicates that human capital, demography and basic infrastructures are the main drivers of the polarization process. Reversing this trend will require time and resources in a macroeconomic context that has substantially worsened after 2014; many SSA countries yet again experienced sluggish growth, high inflation rates and falling fiscal revenues.

Chapter 3

A global view of African distribution of consumption

3.1 Preface

In recent years, the issue of global inequality has come to the fore of economic debate. There is now considerable interest in the economic literature in the level of relative inequality of incomes found among all people in the world regardless of their country of residence.

Similar to previous studies, such as Jirasavetakul and Lakner (2016), in this chapter are ignore national boundaries and analyze the fourth concept of global inequality (Milanovic, 2005 and Anand and Segal, 2008) as applied to Sub-Saharan Africa as a whole, hence the analysis is perhaps best seen as referring to a sub-region of the global distribution. The analysis uses household survey data from many African countries as possible to study the region's distribution of consumption expenditure among individuals during 1997 to 2012. Sub-Saharan Africa possibly represents an interesting case study from this specific perspective, due to the low growth-to-poverty elasticity registered in the region that limited the pro-poor content of the last two decades' growth and that could potentially be attributed to an increase in inequality (e.g. Fosu, 2009, 2015).

The chapter is organized as follows. Section 2 introduces the data used in the empirical and explains the approach to inequality measurement. Section 3 shows the results of polarization indices, the relative distribution method and the decomposition within and between countries. Section 4 provides a summary and conclusion.

3.2 Data construction and methodology

3.2.1 The regional Sub-Saharan African distribution of consumption expenditure

The regional distribution analyzed in this paper is built upon nationally representative household surveys for as many countries as possible; these are obtained through PovcalNet, the global database of national household surveys compiled by the research department of the World Bank.[15] In the analysis, are used eighty-nine household surveys for forty-one Sub-Saharan African countries.[16] Overall, the data cover two decades, from the late '90s to the early years of the current decade.

Since the household surveys are not released every year in each country, and took place in different periods for each country, are defined four benchmark years (see also Milanovic, 2012; Lakner and Milanovic, 2015; Jirasavetakul and Lakner, 2016; Niño-Zarazúa et al., 2017). In these benchmark years are matched the different household surveys in order to obtain a single survey for each benchmark year representing a "global" survey for Sub-Saharan Africa—i.e. a survey for the overall region (e.g. without borders between countries). The four benchmark years are: 1997, 2002, 2007, and 2012.[17] For allocating surveys to the four years, are followed the same rules used by Lakner and Milanovic (2015) and Jirasavetakul and Lakner (2016): first, surveys need to be within two years of a benchmark year; second, surveys in consecutive benchmark years should be at least three and no more than seven years apart from each other; third, it is not possible to have two surveys of the same country within the same benchmark year.[18]

Throughout, is used per capita household expenditure as the main welfare indicator. In that, depart from the literature that uses income as a measure of well-being. In economies where agriculture is an important and established sector, consumption has indeed proven preferable to

[15] http://iresearch.worldbank.org/PovcalNet/. Data accessed on 12 October 2017 via `datalibweb` Stata module.

[16] Namely, the countries analyzed are: Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Democratic Republic of the Congo, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Ivory Coast, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Republic of the Congo, Rwanda, Senegal, Sierra Leone, South Africa, South Sudan, Swaziland, Tanzania, Togo, Uganda, and Zambia.

[17] The analysis begins in 1997 because the availability of household surveys in Sub-Saharan Africa is more limited before this date.

[18] Lakner and Milanovic (2015) and Jirasavetakul and Lakner (2016) also rely on imputed country-year consumption distributions derived by fitting a parametric Lorenz curve to the decile shares available in PovcalNet. However, the cost of the underlying parametric assumption may be cumbersome, and given the large number of surveys, is prefered using directly the micro-data in our analysis.

income because the latter is more volatile and more highly affected by the harvest seasons, so that relying on income as an indicator of welfare might under- or over-estimate living standards significantly (see, inter alia, Deaton and Zaidi, 2002, and Haughton and Khandker, 2009). On the theoretical ground, as consumption gives utility to individuals, the analysis of its distribution should be the most natural approach to study wellbeing. Income matters insofar as it gives access to consumption, which is the ultimate source of individual welfare. Consumption is a better measure of long-term welfare also because households can borrow, draw down on savings, or receive public and private transfers to smooth short-run fluctuations.

To allow for meaningful comparisons, and to overcome the problem of different national currencies, is replicated the approach followed by PovcalNet. First, we use the local consumer price index (from PovcalNet and World Development Indicators[19]) to deflate consumption to 2011 domestic prices. Then, is applied the 2011 Purchasing Power Parities (PPP) conversion factors for private consumption (also from World Development Indicators) to convert into 2011 PPP-adjusted US dollars. Furthermore, we use population weights throughout calculations.

Table 1 shows the main features of our database of national household surveys. The number of surveys per benchmark year vary between twelve for 1997 and twenty-nine for 2007. Given our interest in estimating the Sub-Saharan African distribution of consumption expenditure, it is important that the surveys included in our database cover as much of the region as possible. On average, we cover 54% of regional GDP and a somewhat lower share of the regional population (52%). The highest population coverage is found for 2002 and 2007, with respectively 61% and 68% of the regional population, whereas the GDP coverage is better in 2007 and 2012 (more than 70% in both years). In contrast, in the first benchmark year our surveys cover only 33% of the population and around 20% of regional GDP, which is largely explained by the inclusion of surveys by low-income countries. This means that the results for 1997 should be interpreted with caution, and are probably a lower bound on Sub-Saharan African polarization during the late '90s.[20] Finally, looking at the dimension of our database by

[19] https://datacatalog.worldbank.org/dataset/world-development-indicators.

[20] Another reason for why our estimates over the benchmark years are likely to be a lower bound is that is used consumption expenditure surveys. As already discussed, it is appropriate to use consumption as the welfare indicator, since it can be measured more easily than income in low-income countries, such as Sub-Saharan African countries. However, relative to income surveys, consumption expenditure surveys tend to show lower levels and slower increases in inequality and polarization. This can be explained by a declining marginal propensity to consume and difficulties in capturing expenditures on the types of items consumed at the top end of the distribution (e.g. Clementi et al., 2018a). Therefore, if incomes at the top increase faster than in the rest of the distribution, consumption surveys would register this increase in inequality and polarization only to a limited extent.

sub-region, we find a prevalence of household surveys among Eastern and Western African countries, which appear in our database in the various benchmark years thirty-one and thirty-five times, respectively. Central and Southern African countries, instead, appear only thirteen and ten times.

Table 3.1: Composition of benchmark years

	Benchmark year				Total
	1997	2002	2007	2012	
Number of surveys	12	24	29	24	89
Number of observations	85,258	228,688	296,297	281,490	891,733
GDP (% of regional GDP represented in the database)	20	42	84	71	54
Population (% of regional population represented in the database)	33	61	68	47	52
Number of surveys by sub-region[1]	6	7	9	9	31
Eastern Africa[2]	1	4	5	3	13
Central Africa[3]	5	9	11	10	35
Western Africa[4]	0	4	4	2	10
Southern Africa[5]	6	7	9	9	31

[1] Distribution defined according to the United Nations geoscheme for Africa (https://unstats.un.org/unsd/methodology/m49/).
[2] Burundi, Comoros, Ethiopia, Kenya, Madagascar, Malawi, Mauritius, Mozambique, Rwanda, South Sudan, Tanzania, Uganda, and Zambia.
[3] Angola, Cameroon, Central African Republic, Chad, Democratic Republic of the Congo, Gabon, and Republic of the Congo.
[4] Benin, Burkina Faso, Cape Verde, Gambia, Ghana, Guinea, Guinea-Bissau, Ivory Coast, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, and Togo.
[5] Botswana, Lesotho, Namibia, South Africa, and Swaziland.

3.2.2 Methods for assessing polarization in Sub-Saharan Africa

To quantify polarization in the regional distribution analyzed in this paper, we employ the bi-polarization index developed by Foster and Wolfson (1992, 2010) and the polarization index derived by Duclos et al (2004). Following Handcock and Morris (1998, 1999), we also use the "relative distribution" approach as described in the previous chapter.

The index proposed by Foster and Wolfson (1992, 2010) is based on the idea that movements away from the middle via increased spread, or more distant extremes in the income distribution, lead to a rise in bi-polarization. Formally, the index is defined as:

$$P^{FW} = 2(G^B - G^W)\frac{\mu}{m} \tag{3.1}$$

where μ, m, G^B and G^W are, respectively, the mean, the median, the between-group Gini coefficient and the within-group Gini coefficient[21], and there it is assumed that there are only two income groups, those with income below the median and those with income above the median. The index ranges within the interval [0,1], begin equal to 0 in case of a perfectly equal distribution, where half of the population has no income and each member of the other half has income equal to twice the mean income.

Equation (1) reflects the fact that an increment in inequality between the two defined groups raises polarization, i.e. polarization is positively correlated with inter-group heterogeneity as measured by G^B. however, an increment in inequality within each group decreases polarization, that is polarization is negatively correlated with intra-group heterogeneity as measured by G^W. Equation (1) also tells us that polarization increases depend on the source of inequality, and thus polarization and inequality may or may not move in the same direction. For example, a rise in the spread of income distribution as a result of a regressive transfer tends to enhance both polarization and inequality. On the other hand, an increment in bi-polarization as result of a progressive transfer leads to an increase in polarization but not in inequality.

The polarization measure presented above is focused on the idea of only two income groups. In order to relax this assumption, and based on the indentification/alienation framework, Duclos et al. (2004) develop a polarization index in which the number of income groups is determined endogenously via estimation of a non-parametric kernel density for the income variable. Precisely, the index can be written as follows:

$$P^{DER}(\alpha) = \int_y f(y)^{\alpha}\, a(y)\, dF(y) \tag{3.2}$$

[21] The between-group Gini coefficient, G^B, is the Gini coefficient of a "smoothed" distribution where all incomes above (respectively, below) *m* are assigned the mean of those incomes; it captures the inequality due to variability of income across the two different groups. Conversely, the within-group Gini coefficient, G^W, is the weighted average of the Gini inequality indexes of each group, with weights represented by the total income share-the product of population shares and relative mean incomes; it captures the inequality due to variability of income within each group.

whit:

$$a(y) = \mu + y[2F(y) - 1] - 2\int_{-\infty}^{y} xdF(x) \tag{3.3}$$

Where *y* and *x* denote the incomes of two individuals belonging to different groups and *F(·)* is the income distribution function. The parameter *α* is a normative parameter that expresses the sensitivity of the index to identification, given by $f(y)^{\alpha}$: higher values of *α* emphasize the role of this component in the construction of the index, while lower values put more importance on the alienation component $a(y)$.[22] As indicated by Duclos et al. (2004, pp. 1746-1747), this parameter must be bounded and is between 0.25 and 1; this interval is derived by the authors to respect the alienation/identification structure and to have an optimal trade-off for the sensitivity of this index between the alienation and identification components.

For estimation of their polarization index in practical applications, Duclos et al. (2004, p. 1750) state that a natural estimator of $P^{DER}(\alpha)$ is:

$$\widehat{P^{DER}} = \frac{1}{n}\sum_{i=1}^{n} \hat{f}\,(y_i)^{\alpha}\hat{\alpha}(y_i) \tag{3.4}$$

where $\hat{\alpha}(y_i)$ is given by:

$$\hat{\alpha}(y_i) = \hat{\mu} + y_i\left[\frac{1}{n}(2i-1) - 1\right] - \frac{1}{n}\left(2\sum_{j=1}^{i-1} y_j + y_i\right) \tag{3.5}$$

In (5), $\hat{\mu}$ is the sample mean, while in (4) $\hat{f}(y_i)^{\alpha}$ is estimated non-parametrically using kernel estimation procedures. To make the polarization measure scale-free, $\widehat{P^{DER}}(a)$ has to be divided by $\hat{\mu}^{1-a}$. In addition, the index is usually divided by the scalar 2 to make its interval lie between 0 and 1. Hence, the normalized DER polarization index used in this chapter is defined as:

[22] In the limit case α = 0, no weight is placed on identification and the polarization index (2) equals the Gini coefficient.

$$\widehat{\overline{P^{DER}(a)}} = \frac{\widehat{P^{DER}(a)}}{2\hat{\mu}^{1-a}} \tag{3.6}$$

The polarization index $P^{DER}(\alpha)$ can be decomposed as follows (Duclos et al., 2004, p. 1748):

$$P^{DER}(\alpha) = \bar{a}\bar{\imath}_{\alpha}[1 + p] \tag{3.7}$$

where $\bar{a} = \int_y \ a(y)\, dF(y)$ is the average alienation effect (which is equal to the Gini index), $\bar{\imath}_a = \int_y \ f\,(y)^{\alpha} dF(y)$ is the average identification effect, and:

$$\rho = \frac{\int_y \ f\,(y)^{\alpha}\, a(y)\, dF\,(y) - \bar{a}\bar{\imath}_{\alpha}}{\bar{a}\bar{\imath}_{\alpha}} = \frac{P^{DER}(\alpha)}{\bar{a}\bar{\imath}_{\alpha}} - 1 \tag{3.8}$$

is the normalized covariance between $\bar{a}$ and $\bar{\imath}_{\alpha}$. This decomposition provides interesting information, since is possible to observe the contribution of each component to polarization.

Araar (2008) also proposed a group-based decomposition of the polarization index (2) to assess the proportion of overall polarization linked to within-group polarization and between-group polarization, respectively. Formally, the decomposition takes the following form:

$$P^{DER}(\alpha) = \sum_{g} \varphi_g^{1+\alpha}\ \psi_g^{1-\alpha}\, R_g\, P_g^{DER}(\alpha) + \tilde{P}^{DER}(\alpha) \tag{3.9}$$

whit:

$$R_g = \frac{\int a_g\,(y)\, \pi_g(y)\, f(y)^{1+\alpha}\, dy}{\varphi_g \int a_g(y)\ f_g(y)^{1+\alpha}\, dy} \tag{3.10}$$

where φ_g is the population share of group g, ψ_g is the income share of group g, $P_g^{DER}(\alpha)$ is the polarization index of group g, $f_g\,(y)$ is the density function for group g, $a_g(y)$ is the alienation for the individual at the level of its group g, and $\pi_g(y)$ is the local proportion of

individuals belonging to group *g* and having income *y*. The first term in (9) measures the within-group component, whereas the term $\tilde{P}^{DER}(\alpha)$ measures the between-group component – this is equivalent to the index (2) when the within-group polarization is ignored, i.e. when is assume that every household earns the mean income of its group. If the groups of incomes do not overlap, $\pi_g(y)$ and consequently $R_g = 1$. When α = 0, then $R_g = 1$ and the decomposition (9) is similar to that of the Gini index.

3.3 The consumption distribution in Sub-Saharan Africa and its polarization

In this section we analyze the evolution of polarization in Sub-Saharan Africa during the 1997-2012 period by applying the methodology laid down in the previous section. For ease of comparison with other existing studies, such as Jirasavetakul and Lakner (2016), we also provide a regional perspective on inequality for Sub-Saharan Africa as a whole.

3.3.1 Overall results

Figure 1 shows the Sub-Saharan African distribution of log consumption expenditure and how it evolved over time.[23] Two major observations are apparent from this figure. First, the whole distribution is unimodal and has a long right-hand tail. Second, there is a rightward movement of the distribution over time that follows the increment in the mean—with the exception of 2002, when mean consumption per capita declined by around 6.3% per annum compared to the previous benchmark year.

[23] All annual distributions have been derived using kernel density estimation.

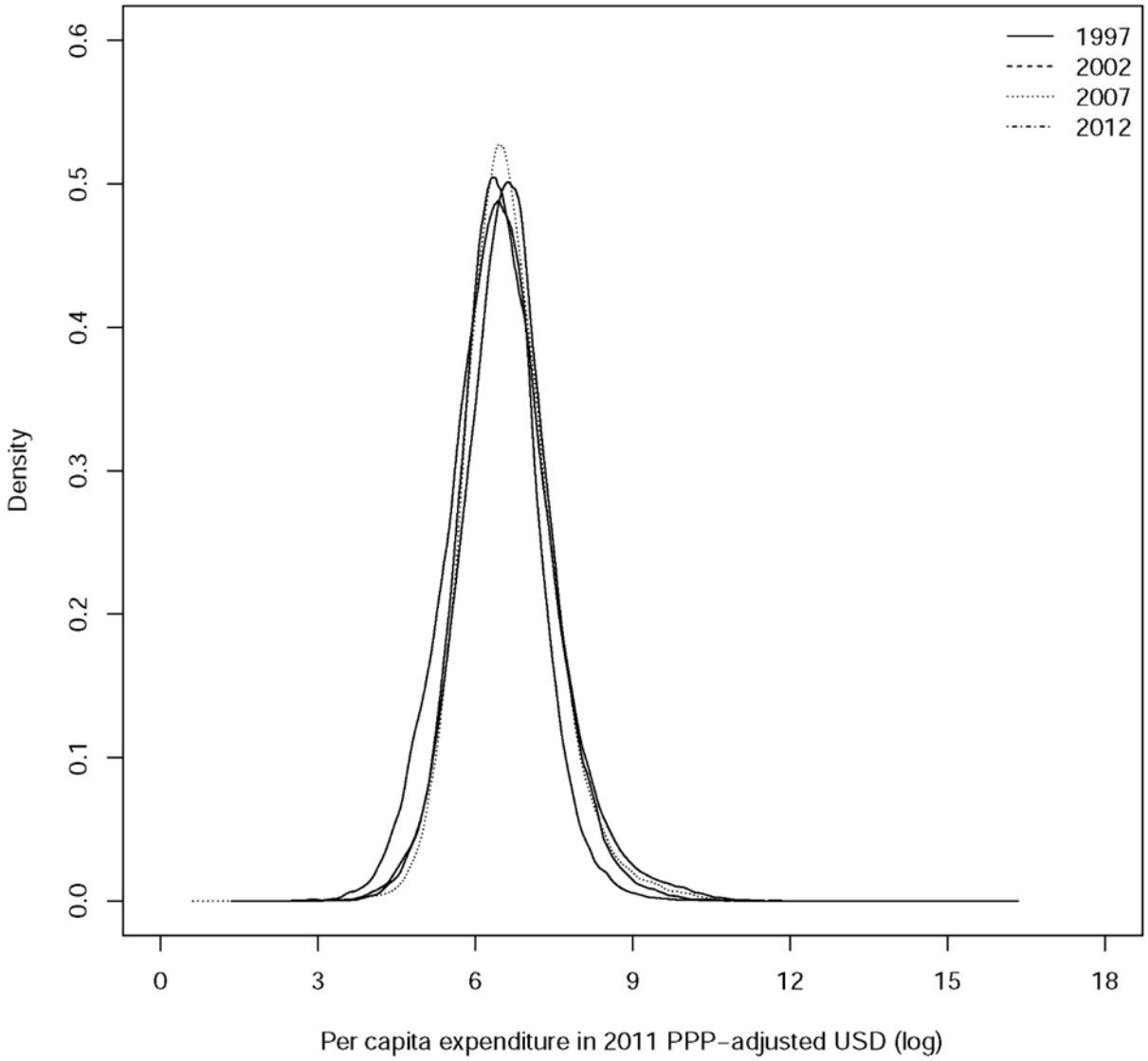


Figure 3.1: Changes in the Sub-Saharan African distribution of consumption expenditure between 1997 and 2012

Table 2 presents summary statistics that help to describe the regional consumption distribution for the different benchmark years. As possible to see in the table, the mean and the median of the consumption distribution fall between 1997 and 2002 and both increase thereafter. The mean is greater than the median in all benchmark years, indicating that expenditures are more spread out on the right side. Looking at concentration, the bottom quintile has a consumption share approximately 4%, while the top quintile share is on average 56%. Interestingly, the consumption shares of the first four quintiles of the population decreased between approximately 0.7% and 1.1% a year in the period examined, in contrast to what we

observed for the richest quintile, whose share experienced an average yearly increase of around 0.6%.

Table 3.2: Summary measures of Sub-Saharan African consumption distribution

Statistic	Benchmark year				Change over the previous benchmark year		
	1997	2002	2007	2012	2002-1997	2007-2002	2012-2007
Mean	1,129.096	813.448	1,228.396	1,403.557	–	–	–
Median	683.322	571.772	714.562	768.337	–	–	–
Median/mean	0.605	0.703	0.582	0.547	–	–	–
Consumption shares (%)							
1st quintile	4.396	4.286	4.425	3.718	–	–	–
2nd quintile	8.131	8.987	7.921	7.229	–	–	–
3rd quintile	12.196	14.137	11.736	11.025	–	–	–
4th quintile	19.342	21.585	18.208	17.102	–	–	–
5th quintile	55.935	51.005	57.709	60.924	–	–	–
Inequality measures[1]							
Gini	0.506	0.463	0.521	0.558	**-0.043**	**0.058**	**0.037**
	(0.010)	(0.002)	(0.005)	(0.002)	**(0.010)**	**(0.003)**	**(0.003)**
Mean logarithmic deviation	0.449	0.388	0.471	0.551	**-0.061**	**0.083**	**0.080**
	(0.020)	(0.003)	(0.004)	(0.005)	**(0.020)**	**(0.005)**	**(0.007)**
Theil	0.678	0.434	0.621	0.724	-0.245	**0.188**	**0.103**
	(0.144)	(0.005)	(0.010)	(0.011)	(0.144)	**(0.011)**	**(0.015)**
Polarization measures[1]							
Foster-Wolfson	0.443	0.411	0.432	0.453	**-0.032**	**0.021**	**0.020**
	(0.004)	(0.002)	(0.002)	(0.002)	**(0.005)**	**(0.003)**	**(0.003)**
Between-group Gini	0.320	0.304	0.324	0.341	–	–	–
Within-group Gini	0.186	0.159	0.198	0.217	–	–	–
Duclos-Esteban-Ray	0.288	0.263	0.297	0.313	**-0.025**	**0.034**	**0.016**
	(0.005)	(0.001)	(0.001)	(0.002)	**(0.005)**	**(0.002)**	**(0.002)**
Alienation	0.506	0.463	0.521	0.558	–	–	–
Identification	0.675	0.597	0.653	0.706	–	–	–
Correlation	0.844	0.950	0.872	0.796	–	–	–

[1] Numbers in parentheses denote standard errors. For single measures of inequality and polarization, standard errors are derived by using an asymptotic normal approximation to the sampling distribution of the estimator as implemented within the DASP Stata package (Araar and Duclos, 2013). As for the difference in an inequality or polarization measure between two years, the standard error is calculated using $\sqrt{SE_s^2 + SE_t^2}$, where SE denotes the standard error of the inequality or polarization estimator while s and t are the two consecutive benchmark years (inequality or polarization measures in the two years are assumed to be uncorrelated). Boldface entries denote indexes for which the ratio between the estimated difference and its standard error (i.e. the *t*-ratio) is bigger than the 95th percentile of the *t*-distribution—and thus the change over the previous benchmark year is statistically significant at the 5% level.

These preliminary findings denote a clear tendency toward rising inequality over the period, a perception that is confirmed by inequality measures reported at the bottom of Table 2 that indicate a sharp increase between 1997 and 2012. For instance, the Gini index rises from 0.506 in 1997 to 0.558 in 2012 – a jump of about 10%. The mean logarithmic deviation and the Theil index increase by 22.7% and 6.8%, respectively. Sub-Saharan African inequality has also fallen between 1997 and 2002, by around 8% and 36% depending on the measure one looks at[24].

This period of growing inequality is also accompanied by a rise in polarization. The Duclos-Esteban-Ray index grows by around 0.6% per annum between 1997 and 2012[25]. In order to analyze the contribution of each of the sources of polarization, according to Equation (7) the index can be decomposed into three (multiplicative) components: identification, alienation (which is equal to the Gini index) and one plus the normalized covariance (correlation) between the two measures. It is interesting to note that both the alienation and the identification components evolve positively over the 1997-2012 period, increasing respectively by 0.7% and 0.3% per year. In other words, polarization increases because both the degree of association within the identified groups and the distance between them rise. Between 1997 and 2002, however, polarization declines slightly: the Duclos el al. (2004) polarization measure decreases in a statistically significant way from 0.288 to 0.263, and this can be explained again by change in the alienation and identification components, which in this case go in the opposite direction compared whit the general trend.

The Foster and Wolfson (1992, 2010) polarization measure deserves a very similar reading. In the first sub-period, we observed a statistically significant decline in the bi-

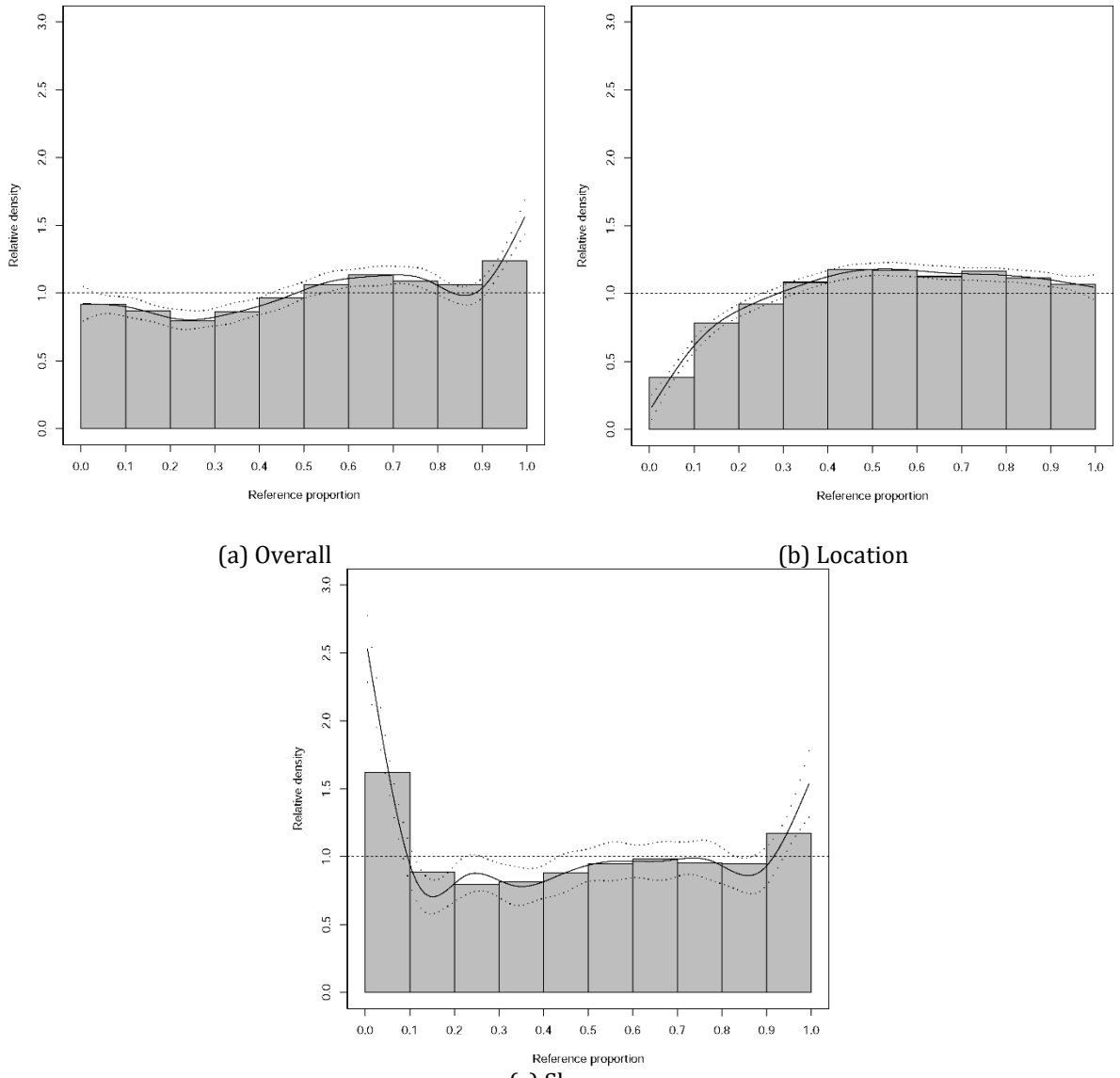
[24] Jirasavetakul and Lakner (2016) estimate a substantially higher inequality for the same sub-period, which *increases* between 1998 and 2003 (the two benchmark years closest to 1997 and 2002). For example, they report a Gini of around 0.522 in 1998 and 0.541 in 2003, compared whit 0.506 in 1997 and 0.463 in 2002 for our estimates. Furthermore, their paper reports 0.47/0.56 in 1998 and 0.51/0.75 in 2003 for the mean logarithmic deviation and the Theil index, respectively, compared with 0.45/0.68 in 1997 and 0.39/0.43 in 2002 for our estimates. These discrepancies, especially those concerning the change of inequality between 1997 and 2002, are likely related to methodological differences, the most important being the use of imputed country-year consumption distributions by Jirasavetakul and Lakner (2016).

[25] Both the Foster-Wolfson and the Duclos-Esteban-Ray (bi-)polarization measures have been estimated using the latest version of DASP, the Distributive Analysis Stata Package (Araar and Duclos, 2013). The Duclos-Esteban-Ray index has been computed with the parameter α set at 0.5.

polarization index, from 0.443 to 0.411, driven by the reduction in the between-group Gini index[26]. The within-group Gini also declines between 1997 and 2002, but not enough to offset the reduction in the between-Gini index. However, if we focus on the overall 1997-2012 period, the main result is a rise in bi-polarization: the Foster-Wolfson index increases, on average, by around 0.1% per year. Is also observed that the between-Gini index is on average 1.7 times larger than the within-group Gini and that both the measures evolve positively over the whole period – respectively, by around 0.4% and 1% per year. Therefore, both groups spread out over time and the distance between them increases ("increased spread" and "increased bi-polarity"). The net result due to interplay of these two forces is an increase in polarization because the fastest spreading out in the distributions of the two identified groups has not been enough to offset the slowest increasing distance between them.

In order to find changes in the entire regional consumption distribution, is apply the relative distribution approach. Figure 2(a) displays the relative density between 1997 and 2012, showing the fraction of Sub-Saharan African households in 2012 that fall into each decile of the 1997 distribution. The graph offers the immediate impression that the proportion of households in the upper decile increased throughout the period, while the proportion in the bottom and around the middle decline. Indeed, if is choosed any decile between the first and the fifth in the 1997 distribution, the fraction of households in 2012 whose consumption rank corresponds to the chosen decile is less than the analogous fraction of households in 1997.

[26] As previously mentioned, Foster and Wolfson (1992, 2010) identify only two groups, those above and those below the median of distribution.



(a) Overall (b) Location

(c) Shape

Figure 3.2: Relative consumption distribution for Sub-Saharan Africa between 1997 and 2012. The bars represent the decile breakdown of the relative distribution, showing the fraction of 2012 households that fall into each 1997 decile, while dotted lines indicate the 95% point-wise confidence limits based on the asymptotic normal approximation (Handcock and Morris, 1999, p. 144)

While the display of the relative distribution presents the dominant trend for the entire period, this latter may be masking some subtler changes. To see these, the overall effect is decomposed thus the relative density into location and shape effects. Figure 2(b) presents the effect only due to the median shift, that is the pattern that the relative density would have displayed if there had been no change in distributional shape but only a location shift of the density. The effect of the median shift was quite large. This alone would have moved out of the three lowest deciles of the reference distribution, a substantial fraction of 2012 household, and placed them in any of the remaining deciles. Note, however, that neither tail of the observed relative distribution is well reproduced by the median shift. For example, the top decile of 2(b) is about 1.1, below the value of 1.2 observed in the actual data, and the bottom deciles of the same figure are also substantially lower than observed.

These (and other) differences are explained by the shape effect presented in Figure 2(c), which shows the relative density net of the median influence. Without the higher median, the greater dispersion of consumption expenditures would have led to relatively more low-consuming households in 2012, and this effect was mainly concentrated in the bottom decile. In contrast, at the top of the distribution the higher spread worked in the same direction of the location shift: alone, it would have increased the share of households in the top decile of the 2012 consumption distribution by nearly 20%. In sum, once changes in real median expenditure are netted out, a U-shaped relative density is observed, which supports prior findings concerning a more unequal and more polarized distribution of consumption expenditure throughout the 1997-2012 period.

To summarize these changes, is presented in Table 3 the set of relative polarization indexes. These indexes track changes in the shape of the distribution only, and they code the direction as well as the magnitude of the change. The median index is significantly positive, implying a dispersion of the consumption distribution from the middle toward either or both of the two tails. The lower and upper polarization estimates indicate that both tails of the distribution are significantly positively polarized. The lower index, however, is larger, indicating greater polarization in the lower tail of the distribution than in the upper tail.

Table 3.3: Relative polarization indices

Index[1]	Value	LB[2]	UB[3]	*p*-value[4]
MRP	0.090	0.086	0.095	0.000
LRP	0.140	0.132	0.148	0.000
URP	0.041	0.032	0.049	0.000

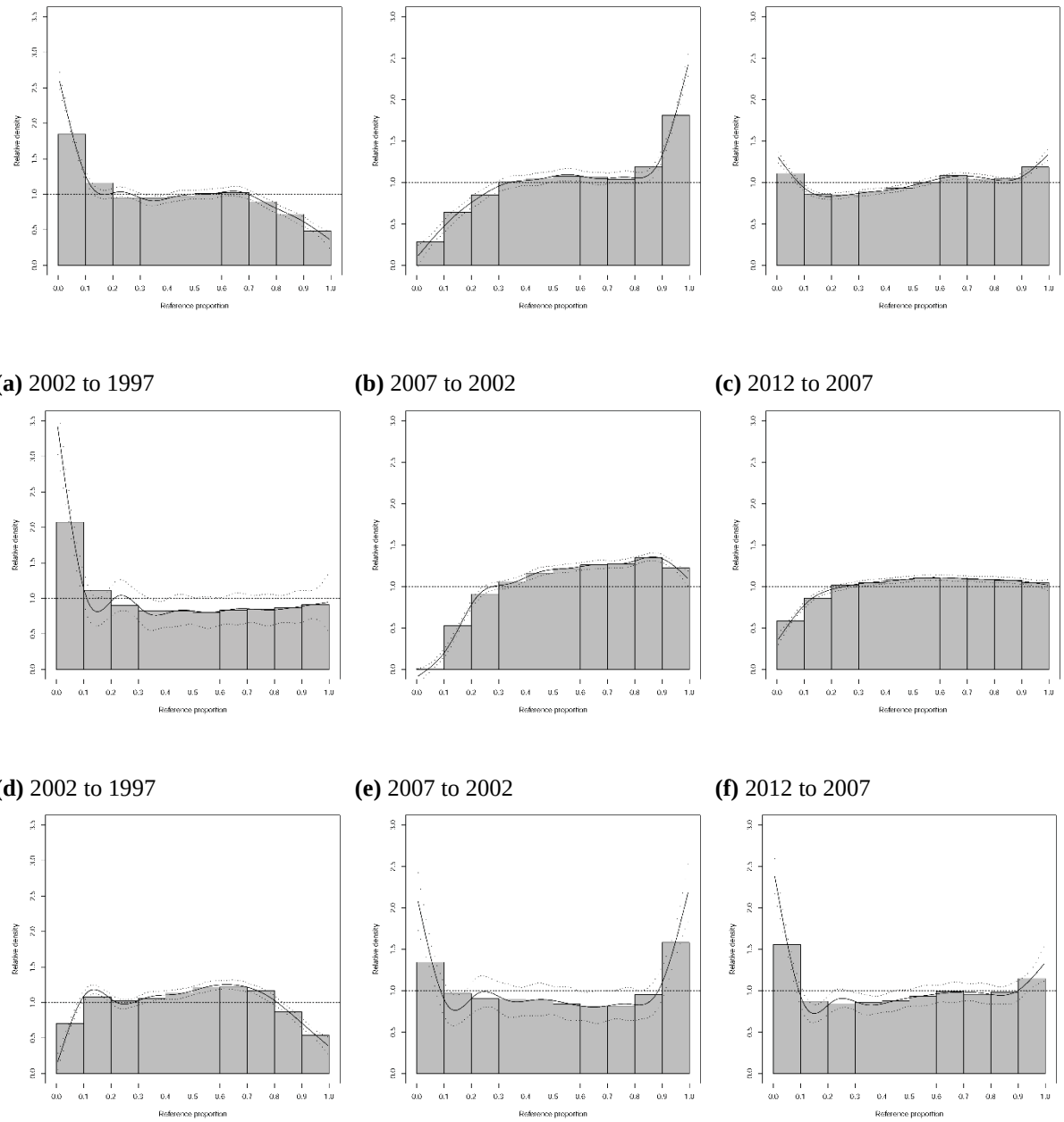
[1] MRP = median relative polarization index; LRP = lower relative polarization index; URP = upper relative polarization index.
[2] Lower bound of the 95% confidence interval.
[3] Upper bound of the 95% confidence interval.
[4] Refers to the null hypothesis of no change with respect to the reference distribution, i.e. that the index equals 0.

3.3.2 Temporal decomposition

To get a more compact picture of the timing and nature of the polarization trend described above, the 15-year period are break into 3 sub-periods—1997-2002, 2002-2007, and 2007-2012—and highlight the changes that took place within each of them. The top three panels of Figure 3 show the relative distribution for each sub-period. In contrast to the 15-year decile series, which takes 1997 as the reference distribution, each panel here takes the beginning year of the sub-period for the reference distribution and the end year for the comparison.

As pointed out previously, after the sluggish performance of the 1980's and 1990's, the rapid growth registered after 2000 was positive news for Africa; yet not everyone equally benefitted from it. Once changes in location are netted out—Figure 3, panels (e) and (f)—there is indication of growing polarization that is not evident in the overall distributional comparisons—Figure 3, panels (b) and (c).

Looking at the shape effect graphs in Figure 3, panel (h) and (i), is indeed observe a clear concentration in the lowest deciles in both the 2000's sub-periods. Values above 1 indicate that, in relative terms, there are more households in that decile of the distribution at the end of period than there were at the beginning. Therefore, relative to the initial period, households in the lowest percentiles increased. In both periods, this concentration in the lower tail ("downgrading") is paralleled by a similar but smaller concentration in the upper tail ("upgrading"). Overall, the two effects produce a U-shaped relative density; households concentrate in the tails of the distribution while the middle of the distribution hollows out. It is also interesting to note that while in the first period the upgrading prevails over the downgrading, in the second the hollowing out of the middle is predominantly driven by the downgrading.



(a) 2002 to 1997 **(b)** 2007 to 2002 **(c)** 2012 to 2007

(d) 2002 to 1997 **(e)** 2007 to 2002 **(f)** 2012 to 2007

(g) 2002 to 1997 **(h)** 2007 to 2002 **(i)** 2012 to 2007

Figure 3.3: Location and shape decomposition of the relative consumption distribution for Sub-Saharan Africa by sub-periods. The top row shows the overall change by sub-period, the middle shows the effect of the median shift (the shape-adjusted relative distribution), and the bottom shows the effect of the shape changes (the median-adjusted relative distribution)

The relative polarization indexes, shown in Figure 4, capture these changes well. In the first sub-period, the three indexes are all negative and statistically significant (*p*-value=0.00). This means that polarization decreases between 1997 and 2002, which is in line with our previous findings. By contrast, in the last two sub-periods the MRP index is always significantly

positive. Decomposing the MRP into the contributions to distributional change made by the segments of the distribution above and below the median, it appears that "downgrading" dominated "upgrading" in the polarization upswing over the 2007-2012 period: the value of the LRP index is indeed greater than that of the URP index—0.12 vs. 0.03, respectively—which is consistent with the visual impression from the shape shifts displayed in Figure 3. The values of the two indexes in the 2002-2007 period (0.09 and 0.14, respectively) denote instead more polarization in the upper tail.

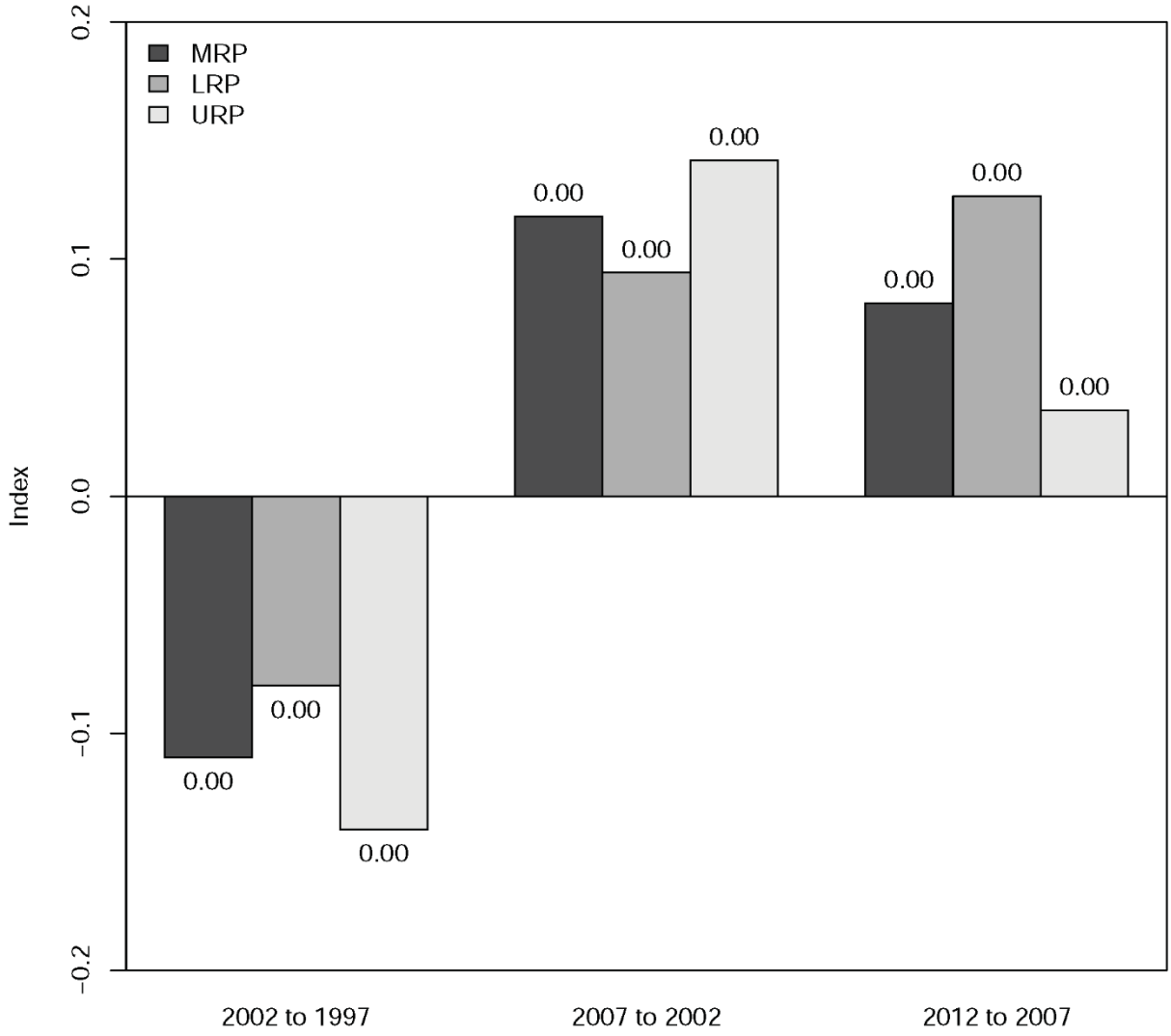


Figure 3.4: Relative polarization indexes by sub-periods. The number above or below each bar indicates the *p*-value for the null hypothesis that the index equals 0

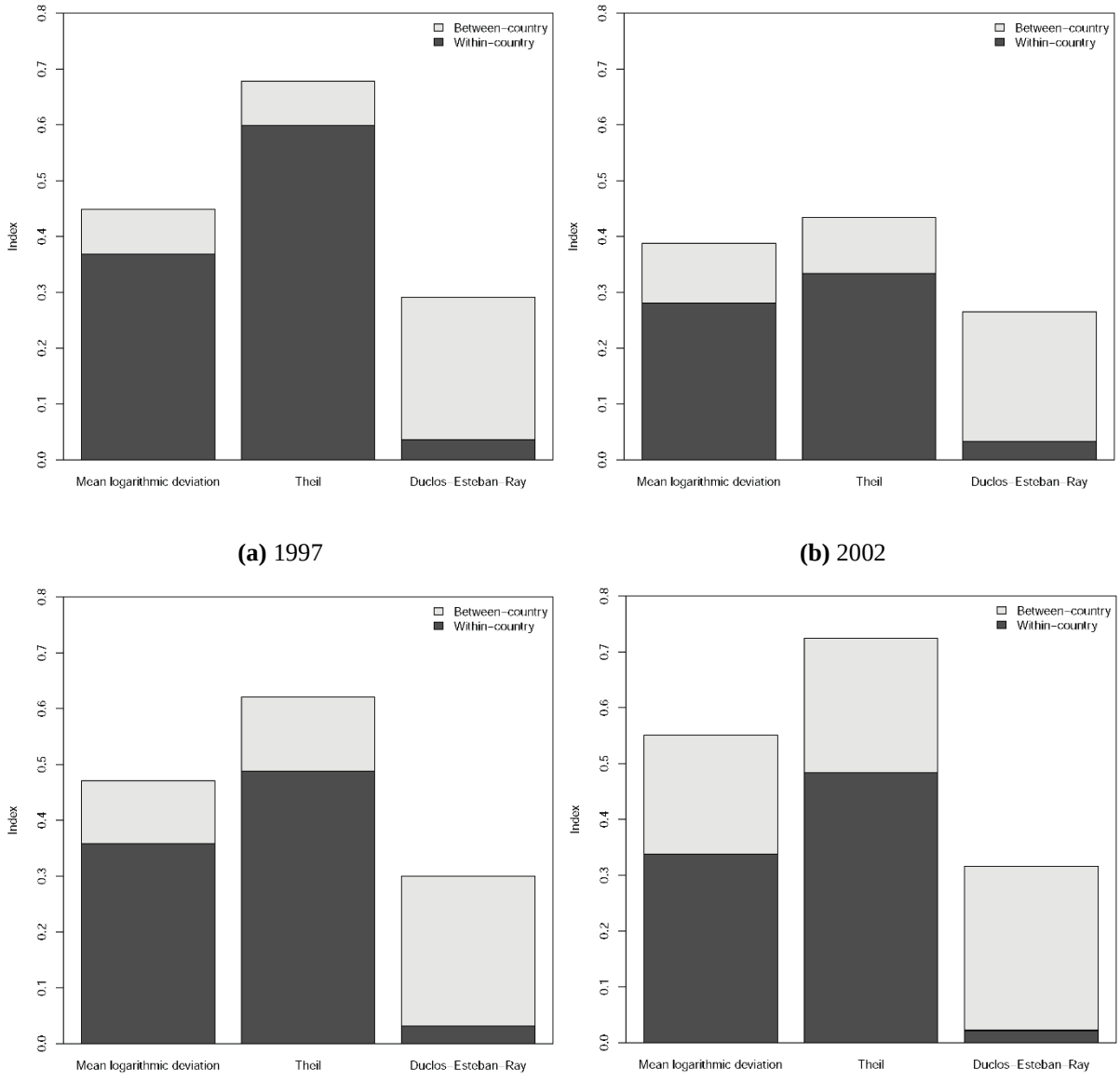
3.3.3 Decomposition into differences between and within countries

The increasing inequality between countries, i.e. an increasing dispersion in average consumption, drives the regional inequality. However, within-country differences continue to dominate the level of Sub-Saharan African inequality. This is in line with the results of Jirasavetakul and Lakner (2016) and can be seen in Figure 5, where country-decompositions of the mean logarithmic deviation and the Theil index are split up into the separate within- and between-country contributions—the total height of the bars is the total level of inequality as measured by the two indexes.[27] For both the measures, differences within countries account, on average, for more than 70% of overall inequality. However, the increasing inequality between countries drives the increase observed between 1997 and 2012. While the level of within-country inequality declined by around 2% per year for both the indexes, the inequality between countries increased by 5% (for the mean logarithmic deviation) and 7% (for the Theil index) over the whole period. Therefore, an increasing share of Sub-Saharan African inequality is explained by gaps across countries in terms of average consumption expenditure.

[27] The figure does not present decompositions of the Gini coefficient by countries because it is not perfectly decomposable in this case, as it has a non-zero residual term besides the within and between inequality the meaning of which is not very intuitive. In general, the Gini index is perfectly decomposable when rankings by sub-groups from the poorest to the richest do not overlap, i.e. the relative position of each individual is the same as in the total distribution. The residual term is positive, instead, when rankings by sub-groups overlap, i.e. when the relative position of a given individual in the sub-group distribution differ from its position in the total distribution. Unlike the Gini index, the mean logarithmic deviation and the Theil index—which are members of the generalized entropy (GE) class of inequality measures—are instead perfectly decomposable without a residual term. Their economic interpretation is therefore straightforward. Recalling the general formula of the GE class, the decomposition can be expressed as follows (e.g. Foster et al., 2013, ch. 2):

$$GE(\alpha) = \underbrace{\sum_g \left(\frac{\bar{y}_g}{\bar{y}}\right)^{\alpha} \left(\frac{n_g}{n}\right)^{1-\alpha} GE_g(\alpha)}_{\text{WITHIN}} + \underbrace{\frac{1}{\alpha^2-\alpha}\left[\sum_g \frac{n_g}{n}\left(\frac{\bar{y}_g}{\bar{y}}\right)^{\alpha} - 1\right]}_{\text{BETWEEN}},$$

where $GE_g(\alpha)$ is the GE index of the g^{th} sub-group. As usual, the WITHIN part is the weighted average of GE indexes for each group—with weights represented by population shares and relative mean incomes—whereas the BETWEEN element is calculated as a GE index where actual consumption expenditures are replaced by sub-group means, in order to pick up variability only among groups and not within them. Choosing the desired value of α gives decompositions for the members of the GE class—namely, $\alpha = 0$ gives the decomposition for the mean logarithmic deviation, while for $\alpha = 1$ the focus is on the Theil index.



(a) 1997 **(b)** 2002

(c) 2007 **(d)** 2012

Figure 3.5: Decomposition of Sub-Saharan African inequality and polarization into differences between and within countries

Figure 5 also shows the country-decompositions of the Duclos-Esteban-Ray polarization index using the method proposed by Araar (2008. One can note that within-country polarization slightly decreased over the 1997--2012 period, and that the between-country

differences are the dominant source of polarization. These results suggest that Sub-Saharan African population is spatially polarized in consumption. To shed light on this, is splited the height of the bars of Figure 2(c)—representing the median-adjusted relative consumption distribution between 1997 and 2012—into exclusive groups of countries formed according to the four main geographical regions of Sub-Saharan Africa (see Table 1 and footnotes given therein for a list of such regions and their composition). The results are shown in Figure 6.[28]

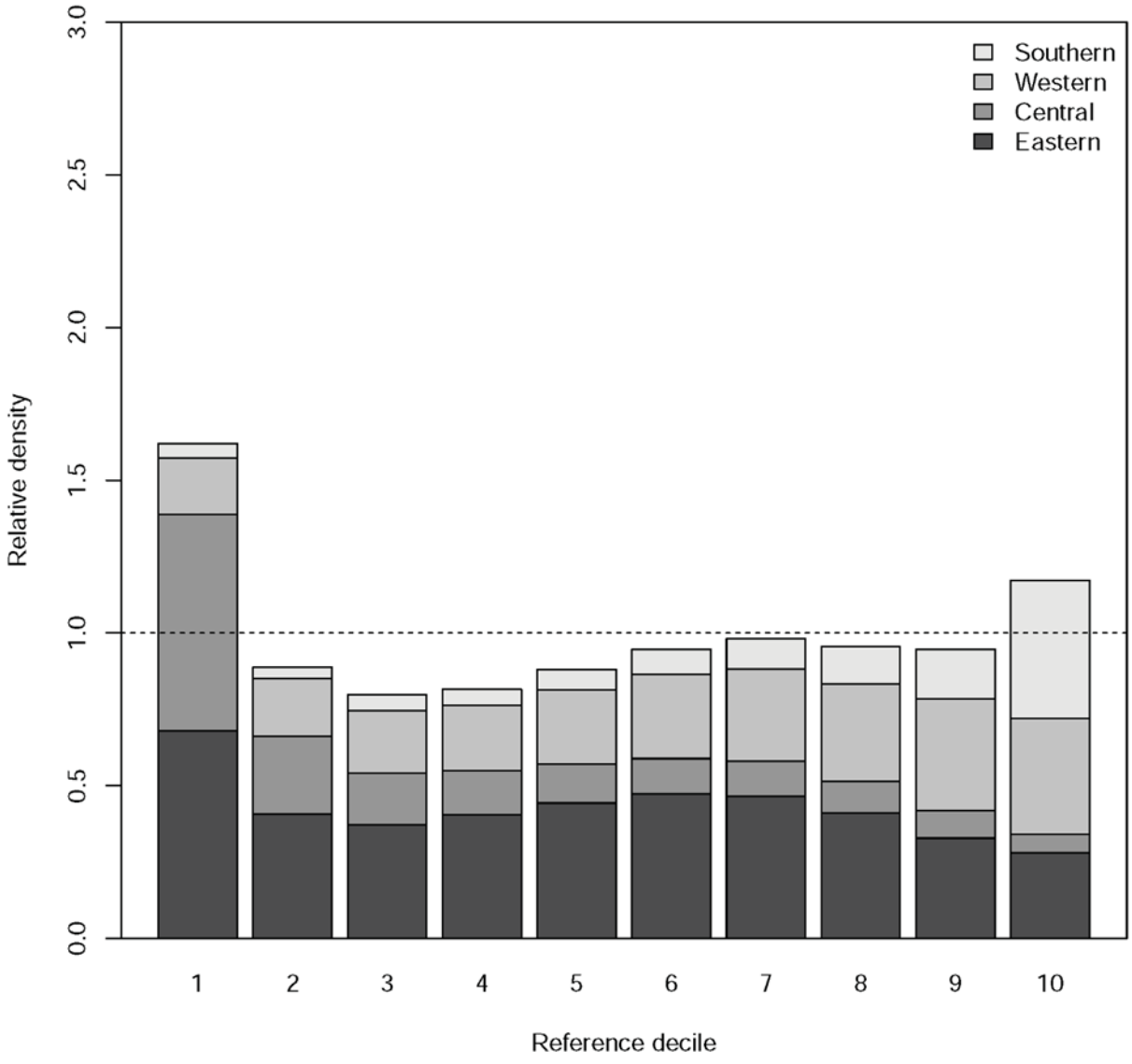


Figure 3.6: The median-adjusted relative consumption distribution by sub-regions, 2012 to 1997

[28] For the sake of space, are only display the results for the overall 1997-2012 period. Results for the three sub-periods 1997-2002, 2002-2007, and 2007-2012 are similar and available from the authors upon request.

What is possible to see is that the lower deciles tend to be populated by household residing in Central and Eastern African countries, while for households in Western and Southern African countries there is a clear tendency to occupy deciles higher up in the consumption distribution.

3.4 Summary and conclusion

The last two decades resurgence of economic growth in SSA when the region posted the highest GDP rates of growth since decolonization, had recently come under scrutiny by scholars. To the extent that growth had been driven by external conditions such as a rise in commodity prices and low interest rates, there were concerns that this growth proved highly volatile; the post 2015 performance of many SSA countries indeed confirmed these bleak expectations. Moreover, this new 'African growth model' showed to underperform in creating enough jobs (Diao et al., 2018; Rodrik, 2016) and generated disparities.

Whereas country level analyses -e.g using inequality indicators at country level- abound (Beegle et al., 2016; Odusola et al., 2017; Fosu, 2018); to our knowledge only few recent contributions tackle the problem using a regional angle (Luiten van Zanden et al. 2013; Jirasavetakul and Lakner, 2016); they limit, however, their analysis to changes in inequality indicators and inequality decompositions while little attention is devoted for example to other distributional changes, notably polarization. In this chapter, by combining original country-level consumption distributions and computing a regional-level distribution aims at filling this analytical gap. Three results are worth mentioning.

First, using a different methodology, the chapter confirms some of the recent results on SSA region. Overall inequality increased between 1997 and 2012. Differently from a global tendency that sees a reduction in the inequality between countries and an increase in the inequality within, SSA sees exactly the opposite trend since inequality explained by between countries more than doubles. Most likely due to the lack of interconnectedness between SSA economies (XXX), the regional distribution is moving in the direction of Quah's (1996) 'twin peaks'.

Second, the byproduct of this prolonged period of non- inclusive growth, has been the surge of welfare polarization. Both standard indicators such as DER and FW and the non-parametric method-the relative distribution- we propose document this. The relative distribution, in particular, enables to analyze the ongoing distributional changes in a very

granular way. Indeed, the paper documents that the overall polarization is driven mostly by the so called lower polarization ("downgrading") or in other words, relative to the 1997 distribution, the percentage of households in the lowest decile substantially increased at the expense of central deciles that slowly hollowed out. It is interesting to note that in the same period, economies more advanced than the SSA African ones, but equally reliant on commodities such as the Russian Federation and Brazil, experienced similar distributional changes (Nissanov and Pittau 2015; Clementi and Schettino 2015).

Finally, when looking at the sub-regional trends by dividing our sample into four main geographical areas, it emerges that lower deciles tend to be increasingly filled by households residing in Central and Eastern African countries. Households in Western and mostly in Southern African countries, instead are increasingly occupying the top deciles of the regional distribution. This accentuates a tendency already identified by Luiten van Zanden et al. (2013) for the years between decolonization and 2000: a strong performance of few countries in the Southern cone and the rest of the continent increasingly lagging-behind.

Chapter 4

Polarization in North Africa at the time of Arab Spring

4.1 Preface

The study of the evolution of income and consumption inequality is well established in a number of countries in the Middle East and North Africa (Alvaredo et al., 2018; Devarajan and Ianchovinchina, 2017; Hassine, 2015; Halsny and Verme, 2013). One of the causes of this growing interest is the Arab Spring movement, how the set of revolts, violent and not, which have affected many countries of North Africa are defined.

As observed in the introduction, different papers have argued that income inequalities within these countries do not seem to be particularly high by international standards and cannot be one of the causes of the riots (see Halsny and Verne (2013). Other studies (i.e. Lakner et al., 2016, for Egypt) suggest that inequality in these countries is underestimated, and the differences in the distribution of income can trigger tension between the population and the local institution.

In this chapter, we observe that the distribution of income in three countries, Morocco, Tunisia and Egypt, hit differently from the Arab Spring, to evaluate the degree of inequality, and more specifically the polarization of consumption.

For Tunisian data in 2015, there is available grouped data of household consumption. For this reason, in this chapter, a methodology for reconstructing a realistic distribution in 2015 for Tunisia is applied, following an approach similar in spirit to that adopted by Jenkins et al. (2011).

The chapter is organized as follows. Section 2 explains the approach of the imputation of household consumption. Section 3 introduces the data used and the summary statistics. Section 4 provides the polarization results and the temporal decomposition for each country. Section 5 provides a summary and conclusion.

4.2 Imputation approach and parameter estimation

For Tunisia in 2015, only grouped data of the mean consumption of the deciles are available[29]. For this reason, we fit a parametric distribution by Maximum Likelihood (ML) to the grouped data, generating the distribution of expenditures from fitted parametric models[30].

Our approach is adapted, with differences, from earlier study by Jenkins et al. (2011). We assume that the distribution of household consumption for Tunisia in 2015 is described by the four parameter Generalized Beta of second kind (GB2) distribution, introduced by McDonald and Xu (1995a, b). The probability density function can be defined as

$$f(y) = \frac{a y^{ap-1}}{b^{ap} B(p,q)[1+(y/b)^a]^{p+q}} \, , y > 0 \tag{4.1}$$

and cumulative density function

$$F(y) = I(p, q, (y/b)^a/[1+(y/b)^a]) \, , y > 0 \tag{4.2}$$

where $B(p,q) = \Gamma(p)\Gamma(q)/\Gamma(p+q)$ is the Beta function, $\Gamma(.)$ is the Gamma function and $I(p,q,x)$ is the regularized incomplete beta function. Parameters a, b, p, q are positive: b is a scale parameter, a, p and q are each shape parameters.

GB2 distribution is a flexible functional form incorporating many distributions as special cases, and all are shown to fit real-world data across different times and countries extremely well (see inter alia McDonald, 1984, Bordley et al., 1996, Brachmann et al., 1996, Bandourian et al., 2003, and Jenkins, 2009). Two of these are the Singh and Maddala (1976) distribution, a special case of the GB2 distribution when p = 1 and the Dagum (1977)

[29] Source: INS, Enquéte Nationale sur le Budget, la Consommation et le Niveau de Vie des Ménages, 2015, www.ins.tn/sites/default/files/publication/pdf/vol1-budget-2015-site.pdf.

[30] For constructing the distribution from the grouped data, another approach is considered using the command *ungroup* from the DASP in Stata. This command generates disaggregated data from aggregate distributive information. Aggregate information is obtained from cumulative income shares or Lorenz curve ordinates at some percentiles. See for instance Jirasavetakul and Lakner (2016) for an application of this approach.

distribution, when q = 1. For more details, see McDonald (1984), McDonald and Xu (1995a, b) and Kleiber and Kotz (2003).

The distribution parameters are estimated by Maximum Likelihood (ML), the most common method of estimating the distributional parameters for these models. For individual observations ($y_i: i = 1,2, \dots, n$) and for data reported in a grouped format, the ML of θ are obtained by maximizing

$$l(\theta) = \sum_{i=1}^{N} \ln\big(f_d(y_i: \theta)\big) \tag{4.3}$$

$$l(\theta) = \ln(N!) + \sum_{i=1}^{g} \{n_i \ln[p_i(\theta)] - \ln(n_i!)\} \tag{4.4}$$

over θ, with $p_i(\theta) = F_d(Y_i: \theta) - F_d(Y_{i-1}: \theta)$ where $f_d(\cdot)$ and $F_d(\cdot)$ denote the PDF and CDF for distribution type d, θ is a vector containing the distributional parameters, Y_i and Y_{i-1} are the upper and the lower bounds of the ith of the g data groups, n_i is the number of observations in the ith group, and N is the total number of observation.

Table 4.1 presents the estimates of the parameters together with their standard errors and model selection criteria such as the Akaike (Akaike, 1973) and Bayesian (Schwarz, 1978) information criteria (AIC and BIC)[31].

[31] The expressions for the log-likelihood of the GB2 and its nested models (the Singh-Maddala and Dagum) are given in Kleiber and Kotz (2003). Model selection criteria, when comparing models with the same number of parameters, will select the model with the smallest $l = -\ln L$ according to the formula $(2\times l)+(d\times k)$, where k represents the number of parameters in the fitted model, and $d=2$ for the usual AIC or $d=\ln N$ (N being the number of observations) for the so-called BIC. Hence, when comparing models fitted by maximum likelihood to the same data, the smaller the AIC or BIC, the better the fit. When comparing models using the log-likelihood criterion, the larger the $\ln L$, the better the fit.

Table 4.1: Maximum likelihood estimation of generalized beta models for consumption distribution of Tunisia in 2015

Model	Parameter estimates[a]				Comparison fit statistics	
	$\hat{a}_c$	$\hat{b}_c$	$\hat{p}_c$	$\hat{q}_c$	AIC	BIC
Sigh-Maddala	3.46	2726	-	0.57	14687	14687.16
	(0.00)	*(1.99)*		*(0.00)*		
Dagum	2.38	2579	1.76	-	29227.71	29277.94
	(0.00)	*(3.12)*	*(0.00)*			
GB2	1.62	2485	3.26	1.985	7273.38	7273.70
	(0.02)	*(8.41)*	*(0.09)*	*(0.06)*		

[a] Numbers in parentheses: estimated standard errors

The results of the model selection for consumption distributions suggest that the GB2 model is a better fit of the data for Tunisia in 2015.

Once the parameters are obtained, we generate the distribution of expenditures from the GB2 fitted parametric model. Firstly, it is supposed that we have a sample of 10,000 observations with their distribution represented with a cumulative distribution function defined as

$$u = \hat{F}_n(t) = \frac{1}{n+1}\sum_{i=1}^{n} \mathbf{1}_{xi \leq t} \tag{4.5}$$

using n+1 observations[32].

Secondly, the parameters and the numerical sample are combined to obtain the consumption distribution assuming that expenditures follow a GB2 distribution. The quantile function can be defined as[33]

$$F^{-1}(u, a, b, p, q) = bz^{\frac{1}{a}}(1-z)^{-\frac{1}{a}} = b\left(\frac{z}{1-z}\right)^{\frac{1}{a}} \tag{4.6}$$

[32] Note that is used $\frac{i}{n+1}$ rather than $\frac{i}{n}$. Had is used $\frac{i}{n}$ then it would automatically be set to 1 when $i = n$ and the inversion of F_* would return an infinite value.

[33] For more details, see Okamoto (2013).

with *z* can be difined as

$$z = I_u^{-1}(p, q) \tag{4.7}$$

intended as a beta-cumulative function obtained from

$$I_z(p, q)\ , z = \frac{(x/b)^a}{1+(x/b)^a} \tag{4.8}$$

Figure 4.1 shows the distributions obtained from the grouped data, using the different parametric approches.

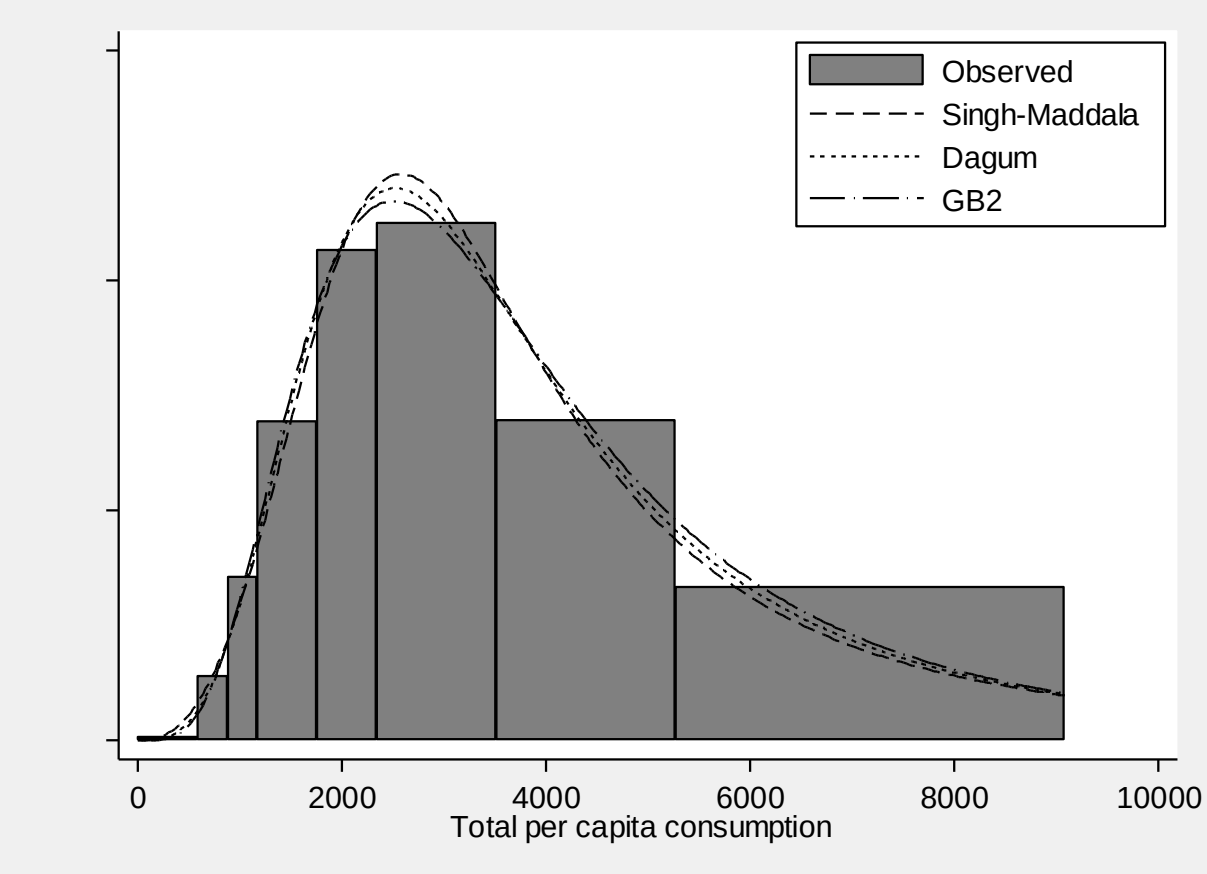


Figure 4.1: Parametric distributions from grouped data

4.3 Data and summary statistics

The data used in this chapter are obtained from national household surveys from PovcalNet as in previous chapters. For each country, three household surveys from the last two decades are available: for Egypt, the surveys cover 2008, 2012 and 2015[34], for Morocco, 2001, 2006 and 2013[35], and for Tunisia, 2005, 2010 and 2015[36].

Household expenditures (per capita) are used as the main welfare indicator throughout the analysis. For the difficult to obtain reliable income data, like in the other African countries, we use consumption as a measure of wellbeing (Deaton and Zaidi, 2002). Indeed, informal sectors are an important part of the workforce in these countries with the difficulties involved in quantifying income.

To have a common vision about the expenditures of the three countries, we use the local CPI to deflate consumption to 2011 domestic prices and the 2011 PPP conversion factors for private consumption (also from WDI) are applied to convert them into 2011 PPP-adjusted USD.

Table 4.2 presents the distributional statistics for the consumption used in this chapter.

Table 4.2: Main statistics of consumption, inequality and polarization for each country

Country and year	Statistics						
	Household	Mean	Median	Gini	Theil	FW index	DER Index
Egypt 2008	11,977	1,788.32	1,447.00	0.311	0.199	0.228	0.209
Egypt 2012	7,107	1,917.56	1,570.42	0.298	0.176	0.222	0.203
Egypt 2015	22,261	2,714.06	2,091.87	0.339	0.245	0.256	0.198
Morocco 2001	14,243	2,370.44	1,705.60	0.406	0.317	0.351	0.249
Morocco 2006	7,062	2,864.84	2,064.52	0.407	0.327	0.329	0.249
Morocco 2013	15,970	3,661.19	2,672.50	0.395	0.297	0.328	0.242
Tunisia 2005	12,316	3,044.37	2,367.19	0.377	0.253	0.326	0.232
Tunisia 2010	11,281	3,458.12	2,777.88	0.358	0.219	0.315	0.224
Tunisia 2015	10,000	4,446.32	3,526.94	0.352	0.225	0.298	0.222

During the last two decades, the three countries experienced an increase in mean household consumption with a variation of around 60%.

[34] The data of consumption for Egypt is obtained from Household Income, Expenditure, and Consumption Survey for the three analyzed periods.

[35] The data of consumption for Morocco is obtained from ENNVM: Enquéte Nationale sur les Niveaux de Vie des Ménages for the three analyzed periods.

[36] The data of consumption for Tunisia is obtained from NSHBCSL: Enquéte Nationale sur le Budget, la Consommation et le Niveau de Vie des Ménages for 2005 and 2010.

The inequality indices (Gini index and Theil index) and the polarization indices (FW index and DER index) tend to remain stable, or in any case, to decrease in a contained manner in the analyzed period, producing evidence that is mixed and thus hard to interpret.

4.4 The consumption distribution in North Africa countries

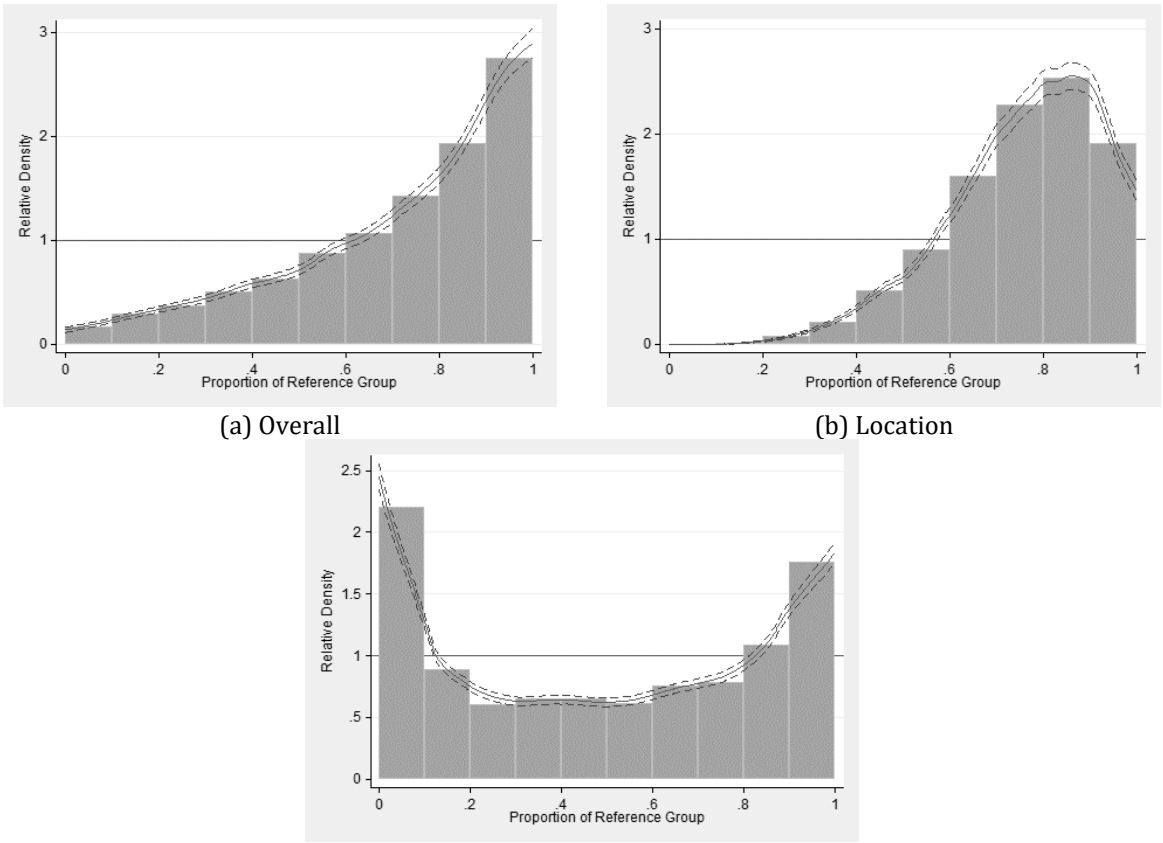
In this section, we provide an overview of the results of the relative distribution decomposition into the growth effect and shape effect (see Section 2.2.2). In the first part, the results of the longest period of analysis for the countries are presented. The results show that in the analyzed countries, the consumption distribution polarized in the lower tail of the distribution.

In the second part, the results for the other household surveys available are presented, to observe the changes in the distribution in each sub-period.

4.4.1 Polarization result

Figures 4.1, 4.2 and 4.3 present the overall results of the relative distribution and decompositions into location and shape parts for Egypt, Morocco and Tunisia. The methodology is explained in the second chapter. For Egypt, the period between 2008 and 2015, for Morocco from 2001 to 2013, and for Tunisia from 2005 to 2015 are considered.

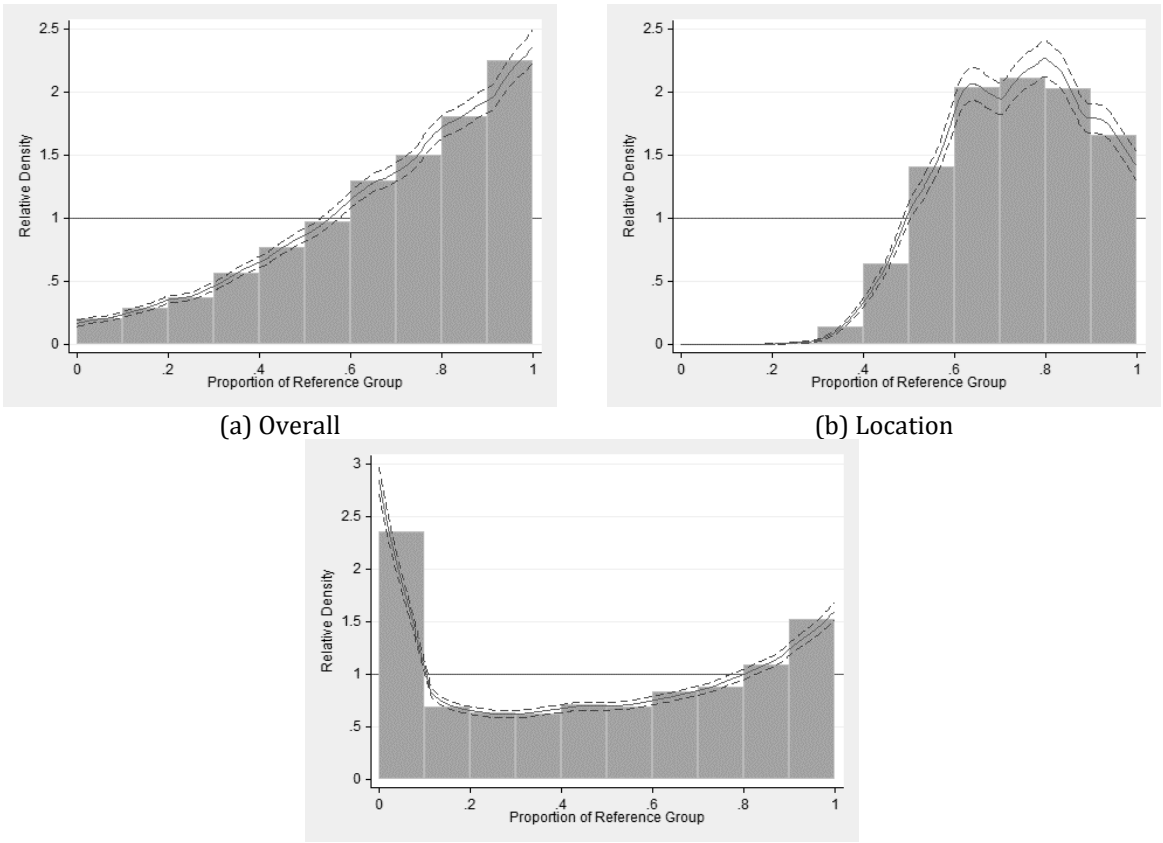
Panel (a) depicts the overall relative distribution, while the location effect, i.e. the effect only due to the median shift, is shown in the panel (b) of the figures. Finally, panel (c) displays the shape effect, which represents the relative distribution net of the median influence.



(a) Overall (b) Location

(c) Shape

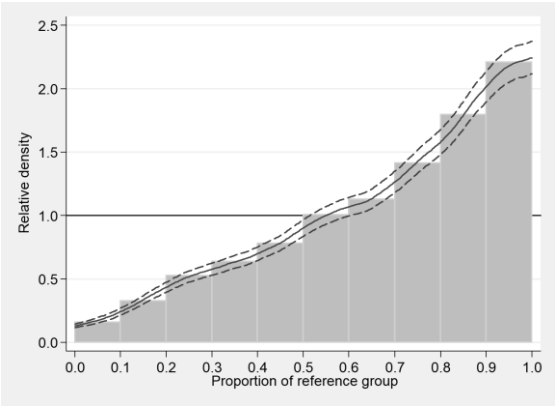
Figure 4.2: Relative consumption distribution for Egypt between 2008 and 2015. The bars represent the decile breakdown of the relative distribution, showing the fraction of 2015 households that fall into each 2008 decile, while dotted lines indicate the 95% point-wise confidence limits based on the asymptotic normal approximation (Handcock and Morris, 1999, p. 144)



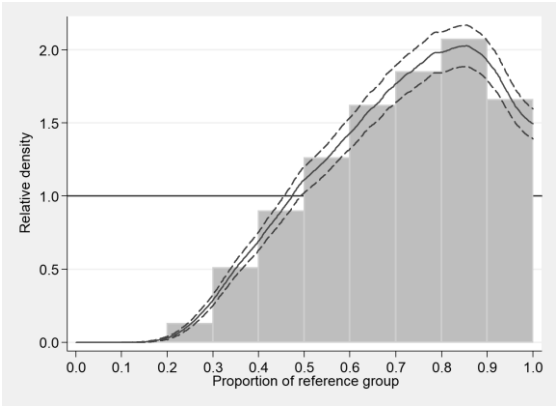
(a) Overall (b) Location

(c) Shape

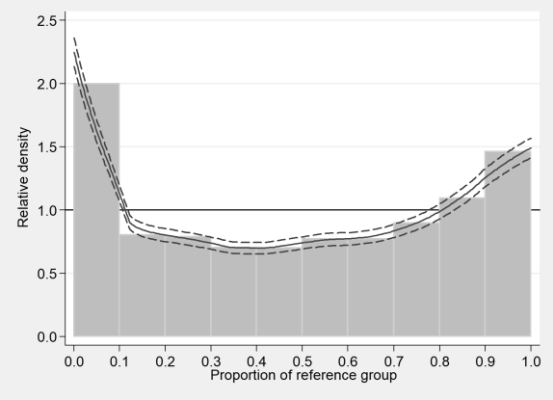
Figure 4.3: Relative consumption distribution for Morocco between 2001 and 2013. The bars represent the decile breakdown of the relative distribution, showing the fraction of 2013 households that fall into each 2001 decile, while dotted lines indicate the 95% point-wise confidence limits based on the asymptotic normal approximation (Handcock and Morris, 1999, p. 144)



(a) Overall



(b) Location



(c) Shape

Figure 4.4: Relative consumption distribution for Tunisia between 2005 and 2015. The bars represent the decile breakdown of the relative distribution, showing the fraction of 2015 households that fall into each 2005 decile, while dotted lines indicate the 95% point-wise confidence limits based on the asymptotic normal approximation (Handcock and Morris, 1999, p. 144)

The overall results show that guided by an increase in consumption, the households shift from the lower deciles of the distribution to the middle and the upper parts. Indeed, the values of the deciles in the upper tail of the distribution are higher than one, which means that there are more households in that decile of the distribution in the last year of analysis than there were in the first year.

Panels (b) presents the effect due only to the median shift, that is the pattern that the relative density would have displayed if there had been no change in distributional shape but only a location shift of the density. In the three countries, we observe a significant increase in household consumption, and the effect of the median shift would have moved out of the first lowest deciles of the reference distribution, placing them in the other upper deciles of the distribution.

Looking at the (c) panels, the shape effect panels, it is clear that there is a concentration in the tails of the distribution for all three countries. The trend is more marked in the lower part of the distribution with a significant increase in the first decile. A similar but smaller change is observed for the upper tail with an increase in the last two deciles.

In sum, once changes in real median expenditure are netted out, a U-shaped relative density is observed, which supports prior findings concerning a more unequal and more polarized distribution of consumption expenditure throughout the last two decades.

The relative polarization indexes in Table 4.3 confirm the trends of the graphs above. The three indexes are significantly positive, implying a dispersion of the consumption from the middle toward either or both of the two tails. The lower index, however, is larger, indicating greater polarization in the lower tail of the distribution than in the upper tail.

Table 4.3: Polarization Indices

Countries	Polarization Indexes					
	MRP	*p-value*	LRP	*p-value*	URP	*p-value*
Egypt	0.2373	*0.0000*	0.2765	*0.0000*	0.2001	*0.0000*
Morocco	0.1576	*0.0000*	0.1984	*0.0000*	0.1169	*0.0000*
Tunisia	0.1990	*0.0000*	0.2548	*0.0000*	0.1432	*0.0000*

4.4.2 Temporal decomposition

In this section, we provide the results of the relative distribution analysis of the sub-periods for each country and highlight the changes that took place.

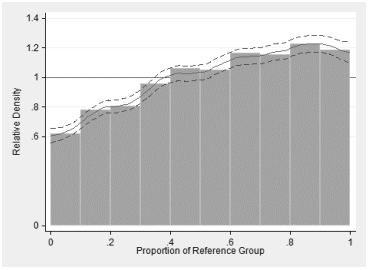
The top left-side panels of Figure 4.5 show the overall results of the relative distribution for each sub-period, the central panels show the location effect, and the right-side panels show the shape effect.

As pointed out in the previous section about Sub-Saharan African countries, a rapid growth after 2000 in North Africa is registered; the three countries confirm the trend observed in the long-period analysis, and the graphs show an increase in consumption in each sub-period.

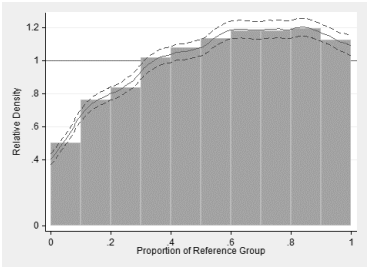
We remark on this trend when we observe the location effect with the household that shifts in the upper deciles of the distribution, emptying the lower tail of the distribution. What is possible to notice is that the growth effect is very similar in all three countries.

Looking at the shape effect graphs on the right-side panel, we indeed observe a clear concentration in the lowest deciles for each sub-period for each country. The polarization effect is low only for Egypt in the first sub-period, panel (c).

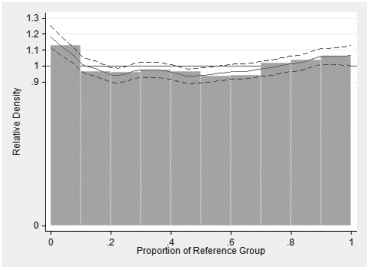
Therefore, relative to the initial period, households in the lowest percentiles increased. In both periods, this concentration in the lower tail ("downgrading") is paralleled by a similar but smaller concentration in the upper tail ("upgrading"). Overall, the two effects produce a U-shaped relative density; the downgrading is marked for Morocco in each sub-period and in Tunisia in the period 2005-2010 (panel (i), panel (n) and panel (q)), while in the others sub-period, excepted for Egypt in 2008-2012, a U-shaped relative density is visible, which indicates a concentration in both tails of the distribution (panel (f) and panel (t)).



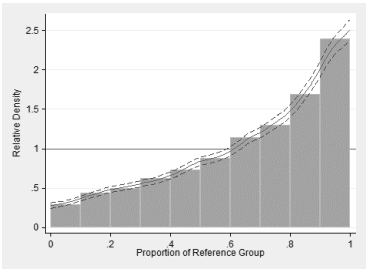
(a) Egypt, 2008 to 2012



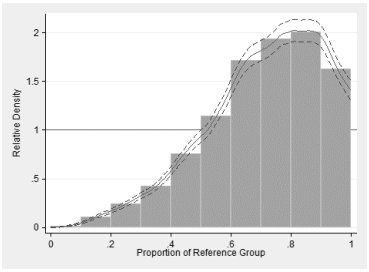
(b) Egypt, 2008 to 2012



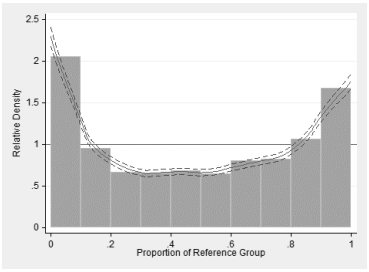
(c) Egypt, 2008 to 2012



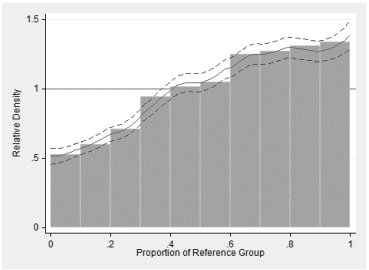
(d) Egypt, 2012 to 2015



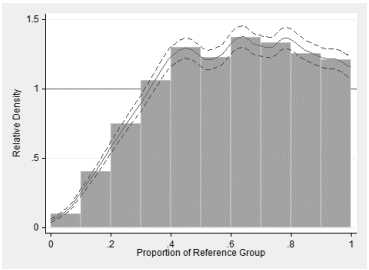
(e) Egypt, 2012 to 2015



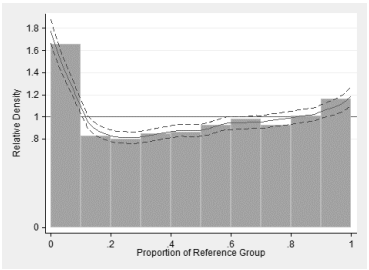
(f) Egypt, 2012 to 2015



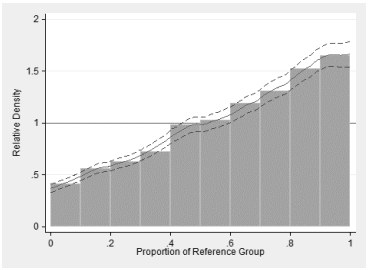
(g) Morocco, 2001 to 2006



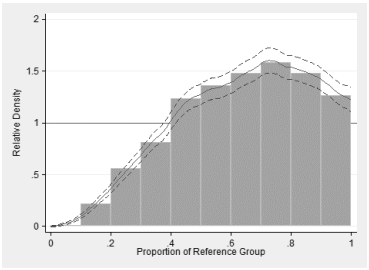
(h) Morocco, 2001 to 2006



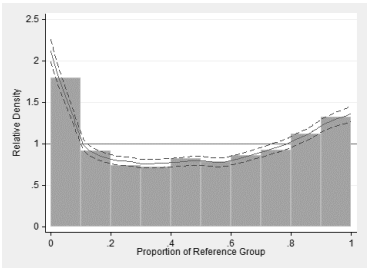
(i) Morocco, 2001 to 2006



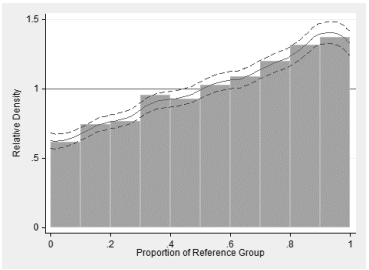
(l) Morocco, 2006 to 2013



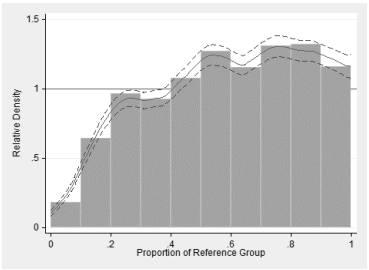
(m) Morocco, 2006 to 2013



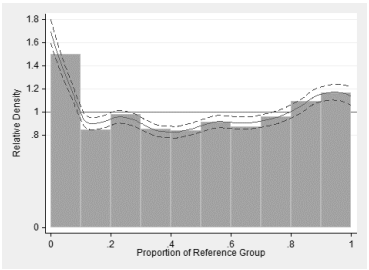
(n) Morocco, 2006 to 2013



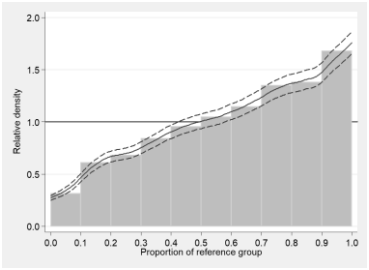
(o) Tunisia, 2005 to 2010



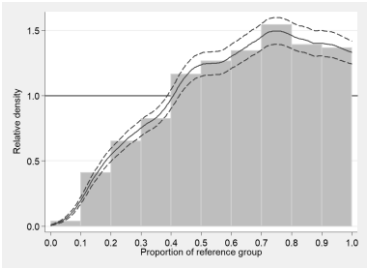
(p) Tunisia, 2005 to 2010



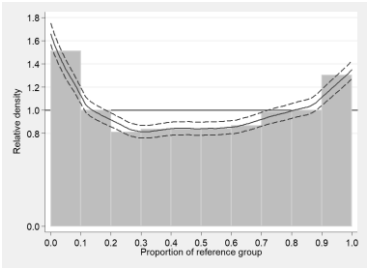
(q) Tunisia, 2005 to 2010



(r) Tunisia, 2010 to 2015



(s) Tunisia, 2010 to 2015



(t) Tunisia, 2010 to 2015

Figure 4.5: Relative distribution results, by subperiods

The relative polarization indexes, shown in Figure 4.6, capture these changes well. The MRP index is positive for all subperiods and for each country. This means that polarization increased during the entire period of analysis.

Decomposing the MRP into the contributions to distributional change made by the segments of the distribution above and below the median, it appears that "downgrading" dominated "upgrading" in the polarization.

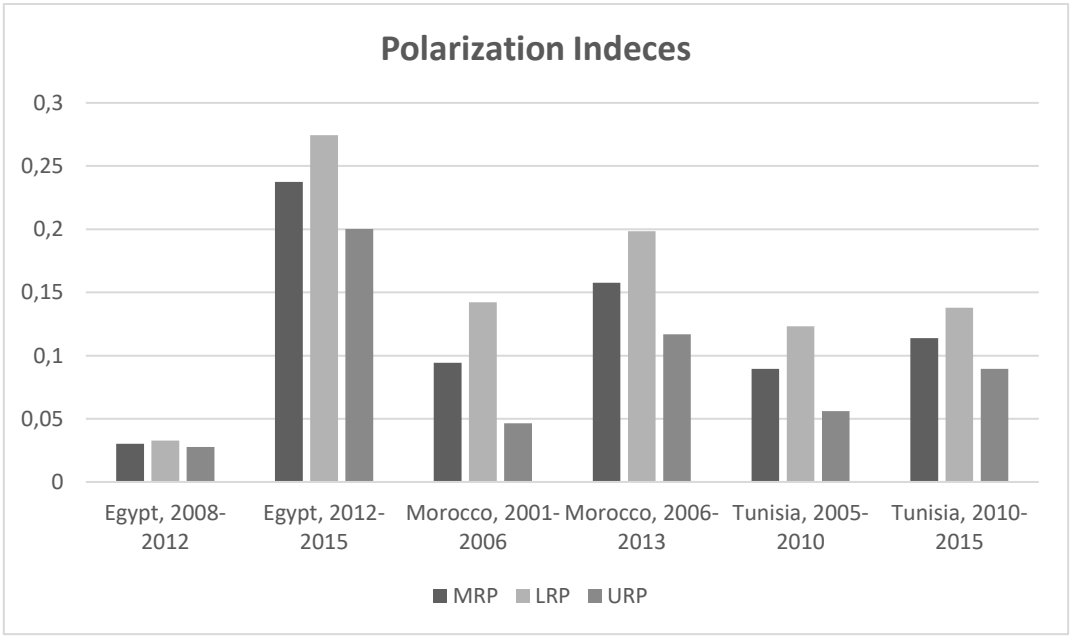


Figure 4.6: Polarization indexes, by subperiods

4.5 Summary and conclusions

The last decade has seen the countries of North Africa be protagonists of a period of political instability with protests and violent internal conflicts known as the Arab Spring. These events brought changes in the countries and areas. The reasons for this epochal change are different, and the economic literature tries to provide an answer, including Alvaredo et al. (2018), Devarajan and Ianchovinchina (2017), Hassine (2015), Halsny and Verme (2013), and Lakner et al. (2016).

These works have led to different conclusions about the relationships between the country's economic situation, especially inequalities, and the Arab Spring protests: some authors claim that the inequality in MENA countries is low and did not influence the riots, while other authors show the high level of inequality and how this can be one of the causes of the Arab Spring.

The chapter develops in two steps. Firstly, a methodology that estimates the consumption distribution of Tunisia in 2015 from grouped data is implemented. For this purpose, a parametric imputation method is adopted.

Secondly, to observe the changes in the distribution of household consumption, the method of "relative distribution", used in previous chapters for Sub-Saharan African countries, is implemented

The results show that Egypt, Morocco and Tunisia in the last two decades experienced an increase in household consumption with an average increase of 60%. In the same period, the standard inequality indices, like Gini index and Theil index, remain substantially stable and thus harder to interpret. The same trend is observable for the polarization indices, Forster-Wolfson index and Duclos-Esteban-Ray index, that remain stable along the analyzed period.

Interesting are the results of the relative distribution method. The graphs show that the three countries experienced a distributional change of lower polarization, similar to that observed for Sub-Saharan African countries in the first chapter. We also observe an upgrading in the distribution that is the fattening of the upper tail of the distribution (upper polarization), but not commensurate to the lower polarization. The increase of polarization, specifically the "downgrading" with the increase of lower polarization, is confirmed by the polarization indices that are significantly positive.

This trend is visible in the subperiods for each country: The only exception is for Egypt, which registers a substantially stable situation in the period 2008-2012 while the polarization is marked in the period 2012-2015, with a significant increase in the upper tail.

For Morocco and Tunisia, the evolution of the phenomena is quite similar: both countries experienced an increase in polarization for the sub-periods 2001-2006 and 2006-2013, for Morocco, and between 2005-2010 and 2010-2015 for Tunisia. For both countries, the increase of polarization is guided by the lower polarization.

Chapter 5

Conclusions

This thesis is a contribution to the debate on inequality emerging in the last years. The interest is centered on the distribution of consumption in Sub-Saharan Africa in the first part and on the countries of North Africa in the second.

In the second chapter, we consider changes in the distribution in 24 Sub-Saharan African countries and the impact of inequality on the reduction of poverty. In the second part, the covariates that influence the changes of the re-distribution of households into the lower and upper tails of the distribution are observed.

In the third chapter, we ignored national boundaries and provided new estimates on the evolution of polarization in Sub-Saharan Africa over the period 1997 to 2012. The underlying methodology involved constructing a distribution of consumption expenditures among individuals by combining household survey data from as many African countries as possible. Polarization was subsequently measured on this Sub-Saharan-Africa-wide distribution of consumption expenditures using (bi-)polarization indexes and the relative distribution method.

The fourth chapter investigated the situation in three MENA countries (Egypt, Morocco and Tunisia) and the distribution of household consumption from the polarization point of view, differently from the previous studies on the region. The scope of the chapter is to clarify the contrasting previous results and investigate the link between polarization and conflict.

The first two chapters can be a contribution to the debate (*inter alia* Fosu, 2018; Rodrick, 2018) on rethinking the "African growth miracle", pinpointing the negative side effects in terms of inequality and polarization. Interestingly, the polarization results match particularly well with recent analyses of the structural transformation in Sub-Saharan Africa (World Bank, 2018). Both shed light on the poor performance of the bottom 30-40 percent of the Sub-Saharan African population trapped in a spiral of low activity rates, limited productivity, and income often dependent on subsistence agriculture. The same group is the one losing ground compared to the rest of the population according to our analysis. Not everybody in Sub-Saharan Africa, however, is performing badly, and a sub-regional analysis clearly indicates clusters of countries that share similar performances. This process, however, did not start until the late 1990s; there

are several structural factors that explain it, but certainly, the last two decades of growth has accentuated it.

Polarization seems to be highly associated with the sluggish performance of the middle class in the last two decades. Differently from the rest of the developing world, the Sub-Saharan African middle class's[37] share over total population has not substantially varied since 1990, remaining at around 14 percent (African Development Bank, 2011a). Other proxies for "interconnectedness" confirm this lack of socio-economic integration in the region. For example, internal tariffs fell much slower than in other regions, meaning the free mobility of goods and people is far from being achieved (United Nations Economic Commission for Africa, 2010; World Bank, 2011), and it is difficult for countries in the region to reach a political consensus on a common economic agenda.

Polarization, a small middle class, and lack of cohesion also are on par with widespread conflicts. In the same two decades of growing polarization, we also observe a strong prevalence of non-state conflicts (Allansson et al., 2017): 33 out of 60 non-state conflicts in 2016 took place in Africa. It is worth noting, however, that while there is a renewed interest on this topic (*inter alia* Esteban and Ray, 2011; Abu-Bader and Ianchovichina, 2018), to our knowledge no specific study focuses on the conflict-polarization nexus in Sub-Saharan Africa or in MENA countries.

The fourth chapter contributes to the debate about the "Arab Spring" and the possible connection with the different conditions of the population of the involved countries. In the economic literature, different positions about this question are present. More interesting is the potential connection of polarization, the lack of a strong middle class, and the "Arab Spring". Different studies such as Alvaredo et al. (2018) and Lakner et al. (2016) contribute to the debate that the high inequality in the MENA countries can be one of the causes of the violent conflicts in the last years. Observing the polarization, we can conclude that before and during the period of the "Arab Spring" there is not a strong middle class in these countries, and this can be linked to the increase in tensions and riots (Esteban and Ray, 2011).

Finally, this work offers an interesting hunch to policy-makers looking at Sub-Saharan Africa and MENA countries. The method used to measure polarization, the so-called relative distribution method, facilitates grasping the very nature of the polarization phenomenon, which

[37] Here, we refer to what the African Development Bank (2011a) defines as a "stable middle class".

is a dynamic process (Anderson, 2015). The dynamics clearly identified a point in the growth pattern that is inherently polarizing, and the only reduction in polarization occurs when there is little growth, another condition that is not particularly appealing. The role of politics is, therefore, to encourage growth but also to render it more inclusive, as it seems there is no automatic trickle-down. Furthermore, recent country studies on the drivers of polarization (Bertoni et al., 2016; Clementi et al., 2017, 2018b) indicate that this has accumulated over many years, driven by covariates that tend to change slowly in time, such as human capital, demography, and basic infrastructure. This calls for urgent policy intervention since the result of corrective policies will not appear for several years.

Appendix A

A.1 Panel-based decomposition of poverty changes: estimation framework and results

Here we present the basic econometric framework and estimation results underlying the poverty change decomposition based on panel data analysis introduced in Section 2.2 and discussed in Section 4.2 of the main text.

The econometric model may be specified as (e.g. Kalwija and Verschoor, 2007; Fosu, 2015, 2017a, 2017b, 2018):

$$\begin{aligned}\Delta\ln P_{it} = {} & \beta_1 + [\beta_2 + \beta_3 \ln G_{it-1} + \beta_4 \ln(z/\bar{y}_{it-1})]\Delta\ln\bar{y}_{it} \\ & + [\beta_5 + \beta_6 \ln G_{it-1} + \beta_7 \ln(z/\bar{y}_{it-1})]\Delta\ln G_{it} \\ & + \beta_8 \ln G_{it-1} + \beta_9 \ln(z/\bar{y}_{it-1}) + \eta_{it},\end{aligned} \qquad \text{(A.1)}$$

where i is a country index, $t-1$ is the year-observation before time t, $\Delta\ln P_{it} = \ln P_{it} - \ln P_{it-1}$ is growth in the poverty index (headcount ratio or poverty gap), $\Delta\ln\bar{y}_{it} = \ln\bar{y}_{it} - \ln\bar{y}_{it-1}$ is average household consumption growth, $\Delta\ln G_{it} = \ln G_{it} - \ln G_{it-1}$ is the growth in Gini coefficient, $\ln G_{it}$ is the logarithm of initial Gini coefficient, $\ln(z/\bar{y}_{it-1})$ is the ratio of the poverty line z to mean household consumption (expressed in natural logarithm) taken as proxy for the initial density of consumption near the poverty line, and β_j $(j = 1,2,\dots,9)$ are the coefficients to be estimated—with β_1 capturing a common linear time trend. The error term is denoted by η_{it}.

Following Fosu (2015, 2017a, 2017b, 2018), the anticipated signs of the coefficients are as follows: $\beta_2 < 0$, for an increase in income growth should reduce growth in the poverty index, *ceteris paribus*; $\beta_3 > 0$, as a higher level of initial inequality would decrease the rate at which consumption growth acceleration is transformed into poverty reduction; $\beta_4 > 0$, consistent with the hypothesis that a larger level of initial consumption (relative to the poverty line) would have associated with it a higher growth elasticity; $\beta_5 > 0$, for a worsening income distribution is expected to increase poverty, *ceteris paribus*; $\beta_6 < 0$, given the diminishing poverty-increasing

effect of rising inequality; $\beta_7 < 0$, as in a relatively low-income economy (high $z/\bar{y}_{it-1}$) improving income distribution (by lowering $\Delta \ln G_{it}$) might worsen poverty by increasing the likelihood of more people falling into poverty; $\beta_8, \beta_9 > 0$, for rising initial inequality or increasing the poverty line relative to the initial level of consumption should, *ceteris paribus*, exacerbate poverty.

Using parameter estimates from Equation (A.1), the growth elasticity of poverty is computed as:

$$\varepsilon_{\bar{y}_{it}} = \hat{\beta}_2 + \hat{\beta}_3 \ln G_{it-1} + \hat{\beta}_4 \ln(z/\bar{y}_{it-1}), \qquad \text{(A.2)}$$

Given the above-expected signs of the regression coefficients, $\varepsilon_{\bar{y}_{it}}$ is generally anticipated to be negative, and its magnitude (in absolute terms) would be larger as initial inequality is lower and consumption relative to the poverty line is higher (low $z/\bar{y}_{it-1}$). The elasticity of poverty to redistribution is given by:

$$\varepsilon_{G_{it}} = \hat{\beta}_5 + \hat{\beta}_6 \ln G_{it-1} + \hat{\beta}_7 \ln(z/\bar{y}_{it-1}). \qquad \text{(A.3)}$$

Given the expected signs, $\varepsilon_{G_{it}}$ is generally anticipated to be positive, and its magnitude would be smaller as initial inequality is higher and consumption relative to the poverty line is lower (high $z/\bar{y}_{it-1}$).[38]

Equation (A.1) is first estimated using the headcount ratio, mean consumption and the Gini coefficient calculated from the country-level data described in Section 3.[39] The sample comprises 48 panel observations, involving 24 countries over 1992-2014. Because of the potentially endogenous nature of income and inequality, the estimator employed is the two-step

[38] Perverse signs of the elasticities are nevertheless likely to occur (e.g. Fosu, 2015, 2017a, 2018). For instance, in a highly unequal (high G_{it-1}) and low-income (high $z/\bar{y}_{it-1}$) economy, the magnitude of the combined positive-signed β_3 and β_4 could actually overwhelm the magnitude of the negative-signed β_2, thus rendering E_G positive. Similarly, in such an economy, E_R could be negative.

[39] As already highlighted in footnote 17 of the main text, computation of the poverty indices makes use of the USD 1.9 international poverty line for all countries except Ghana and Nigeria, for which we use the national poverty line converted to 2011 PPP dollars.

Generalized Methods of Moments (GMM) estimator and all regressors involving $\Delta\ln\bar{y}_{it}$ are considered endogenous and are instrumented.[40] The estimated equation is given by:

$$\begin{aligned}\Delta\ln\widehat{HCR}_{it} = {} & \underset{(2.07)}{1.45} - \underset{(-4.76)}{11.08}\,\Delta\ln\bar{y}_{it} + \underset{(4.23)}{2.69}\,\Delta\ln\bar{y}_{it}\times\ln G_{it-1} + \underset{(9.06)}{1.01}\,\Delta\ln\bar{y}_{it}\times\ln(z/\bar{y}_{it-1}) \\ & + \underset{(0.79)}{2.91}\,\Delta\ln G_{it} - \underset{(-0.65)}{0.63}\,\Delta\ln G_{it}\times\ln G_{it-1} - \underset{(-3.97)}{1.82}\,\Delta\ln G_{it}\times\ln(z/\bar{y}_{it-1}) \\ & - \underset{(-2.09)}{0.40}\,\ln G_{it-1} - \underset{(-1.67)}{0.10}\,\ln(z/\bar{y}_{it-1}).\end{aligned} \quad \text{(A.4}$$

The figures in parentheses are t-ratios; the p-value for the Hansen J-statistic is 0.14, suggesting that the model is correctly specified.[41] Therefore, the elasticity of poverty headcount to growth and redistribution are estimated as:

$$\varepsilon^{HCR}_{\bar{y}_{it}} = -11.08 + 2.69\ln G_{it-1} + 1.01\ln(z/\bar{y}_{it-1}), \quad \text{(A.5)}$$

$$\varepsilon^{HCR}_{G_{it}} = 2.91 - 0.63\ln G_{it-1} - 1.82\ln(z/\bar{y}_{it-1}). \quad \text{(A.6)}$$

Using the poverty gap, Equation (A.1) is estimated as:

$$\begin{aligned}\Delta\ln\widehat{PG}_{it} = {} & \underset{(1.78)}{1.74} - \underset{(-4.06)}{12.48}\,\Delta\ln\bar{y}_{it} + \underset{(3.56)}{2.99}\,\Delta\ln\bar{y}_{it}\times\ln G_{it-1} + \underset{(14.99)}{1.12}\,\Delta\ln\bar{y}_{it}\times\ln(z/\bar{y}_{it-1}) \\ & - \underset{(-1.58)}{7.44}\,\Delta\ln G_{it} + \underset{(1.85)}{2.30}\,\Delta\ln G_{it}\times\ln G_{it-1} - \underset{(-6.90)}{3.31}\,\Delta\ln G_{it}\times\ln(z/\bar{y}_{it-1}) \\ & - \underset{(-1.81)}{0.48}\,\ln G_{it-1} - \underset{(-3.97)}{0.24}\,\ln(z/\bar{y}_{it-1}),\end{aligned} \quad \text{(A.7)}$$

[40] As in Kalwija and Verschoor (2007) and Fosu (2015, 2017a, 2017b, 2018), we use as instruments, in addition to lagged values of mean consumption and Gini, the change in GDP per capita ($\Delta\ln\text{GDP}pc_{it}$) from the national accounts corrected for PPP—as is $\bar{y}_{it}$ itself. Several interaction terms between this instrument and the initial consumption distribution as well as dummy variables for sub-regions (Western Africa, Eastern Africa, Middle Africa, and Southern Africa) are also included. An additional instrument we use is the change in the logarithm of the size of the population ($\Delta\ln\text{POP}_{it}$). For GDP and population statistics, the source is the World Development Indicators database of the World Bank (https://data.worldbank.org/products/wdi) last accessed on June 25, 2018.

[41] The Hansen J-statistic is an over-identification test statistic to validate the set of instruments which is also considered to be a general model-specification test (e.g. Bound et al., 1995).

with a p-value for the Hansen J-statistic of approximately 0.33. From the results of this model, the poverty gap responsiveness to consumption growth is obtained as:

$$\varepsilon_{\bar{y}_{it}}^{PG} = -12.48 + 2.99\ln G_{it-1} + 1.12\ln(z/\bar{y}_{it-1}), \qquad \text{(A.8)}$$

while the elasticity to redistribution is given by:

$$\varepsilon_{G_{it}}^{PG} = -7.44 + 2.30\ln G_{it-1} - 3.31\ln(z/\bar{y}_{it-1}). \qquad \text{(A.9)}$$

The elasticity values (A.5), (A.6), (A.8) and (A.9) for the 24 SSA countries in the sample are displayed in Table A.2.

Table A.1: Growth and inequality elasticities by SSA country (headcount ratio and poverty gap measure).

Country	Headcount ratio		Poverty gap	
	Growth elasticity	Inequality elasticity	Growth elasticity	Inequality elasticity
Botswana	-1.34	2.97	-1.66	7.03
Burkina Faso	-0.39	0.15	-0.61	1.03
Cameroon	-1.84	2.05	-2.22	3.89
Chad	-1.21	0.68	-1.53	1.22
Democratic Rep. of the Congo	-0.07	**-1.13**	-0.27	**-1.89**
Ethiopia	-2.04	0.97	-2.44	0.76
Ghana	-1.53	1.01	-1.88	1.61
Ivory Coast	-1.83	1.96	-2.21	3.66
Madagascar	-0.71	0.51	-0.97	1.51
Malawi	-1.08	0.45	-1.38	0.80
Mauritania	-2.09	2.19	-2.50	3.88
Mauritius	-3.23	3.86	-3.76	6.61
Mozambique	-0.07	**-0.12**	-0.26	0.78
Namibia	-1.22	2.66	-1.53	6.40
Nigeria	-1.73	1.13	-2.10	1.65
Rwanda	-0.56	0.34	-0.80	1.27
Senegal	-1.68	1.47	-2.05	2.59
Sierra Leone	-1.33	0.94	-1.66	1.71
South Africa	-1.42	3.12	-1.75	7.32
Swaziland	-1.04	1.58	-1.33	3.84

Tanzania	-0.89	**-0.17**	-1.17	**-0.56**
Togo	-1.28	1.05	-1.60	2.09
Uganda	-1.03	0.90	-1.33	2.04
Zambia	-1.22	1.59	-1.54	3.59

Notes: all computations make use of the USD 1.9 international poverty line for all countries except Ghana and Nigeria, for which we use the national poverty line converted to 2011 PPP dollars. Values in bold are perverse and admissible, as discussed in the text, and generally result from cases where the poverty line exceeds considerably mean consumption.

There is considerable cross-country variation of these values. The income elasticity for both the headcount and the poverty gap ranges, in absolute value, from near zero in Mozambique to more than 3 in the Mauritius. The inequality elasticity of the poverty headcount ranges from –1.13 in the Democratic Republic of the Congo to 3.86 in the Mauritius, whereas for the poverty gap the range goes from -1.89 in the Democratic Republic of the Congo to 7.32 in South Africa.[42] These elasticities are used to decompose poverty changes into growth and redistribution using Equation (9) of Section 2.2. The decomposition results for the 24 SSA countries are presented and discussed in Section 4.2.

A.2 Polarization and relative distribution results

Figure A.1 presents the overall distribution and decomposition into location and shape for three countries.

For most countries, in the left side panel, it is possible to observe a shift of households in the highest deciles of distribution, confirming the increase in consumption seen in chapter 2. Representing exceptions, Cameroon, Ivory Coast, Madagascar, Malawi, Togo and Zambia, show a concentration of the household in the first deciles of the distribution.

The central panel of Figure A.1 shows the location effect. The effect of the median shift for the countries in which an increase in consumption is observed in the overall results was quite large. This alone would have moved them out of the lowest deciles of the reference distribution and placed them in any of the remaining deciles. For the other countries, only in Cameroon, Madagascar and Zambia is a marked decrease of mean consumption observable, with a shift of the household in the first decile and the increase in the lower tail of the

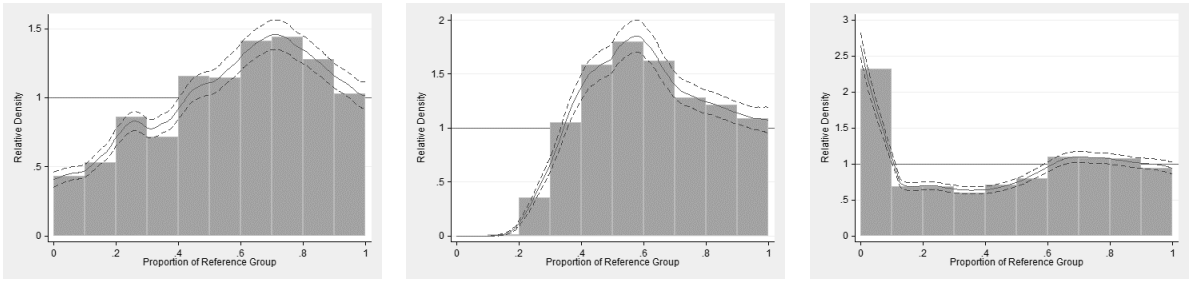
[42] As discussed before, negative inequality elasticity values are indeed admissible. In very low-income countries, inequality-reducing redistribution might actually increase the poverty rate, as many more may be rendered poor following the redistribution.

distribution. For the Ivory Coast, Malawi and Togo, the effect is neutral and does not lead to significant changes in the mean consumption.

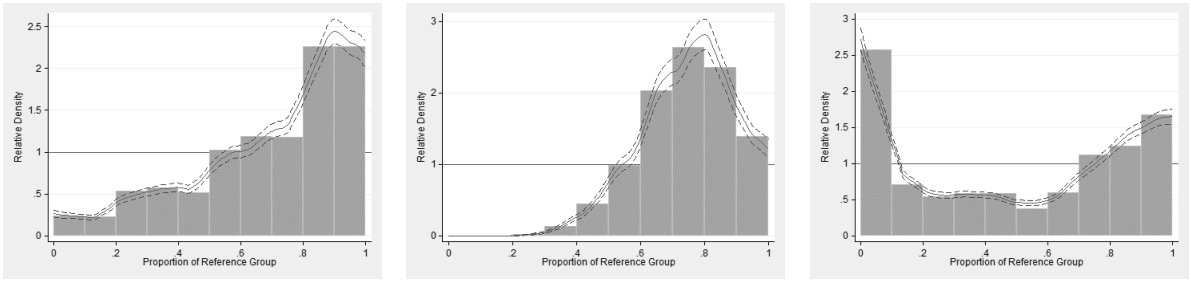
For the shape effect, in the left side of Figure A.1, in 16 countries, it is possible to observe a significant increase in polarization that is predominantly driven by a downgrading of the consumption distribution, the only notable exception being Nigeria, where upgrading and downgrading are almost equivalent (see Clementi et al., 2017). The significant exception regards the cases of Madagascar and Zambia, where the polarization decreased during the period.

(a) Relative density (*b) Location effect* (*c) Shape effect*

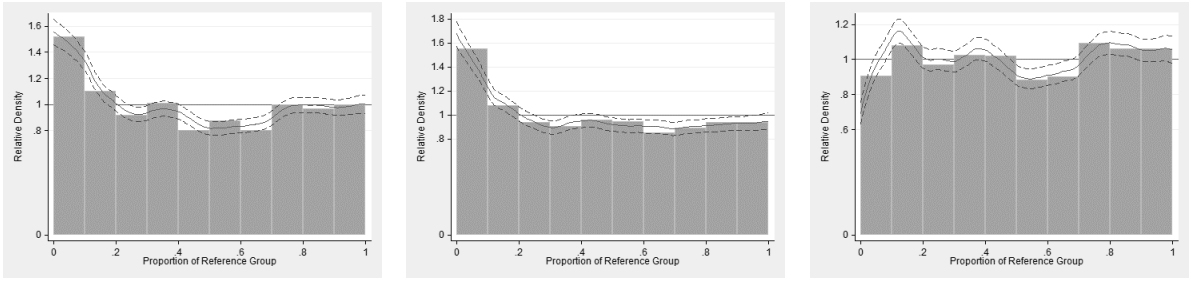
Botswana



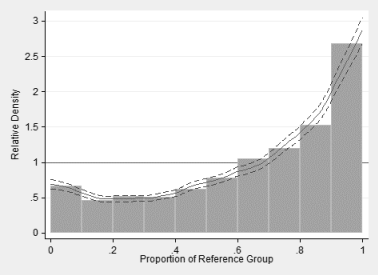
Burkina Faso

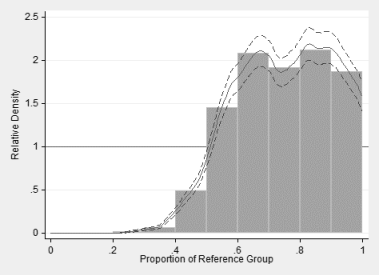


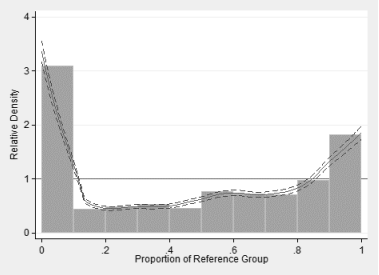
Cameroon



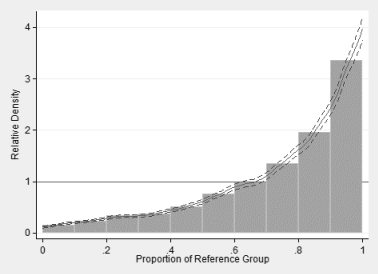
Chad

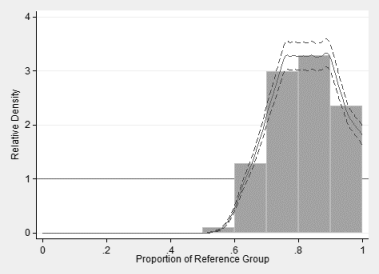


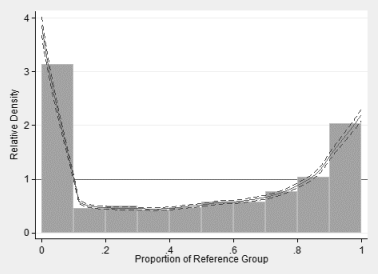




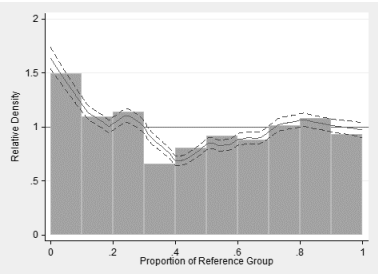
Dem. Rep. of Congo

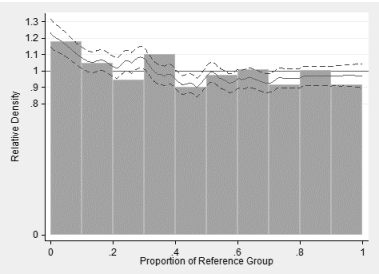


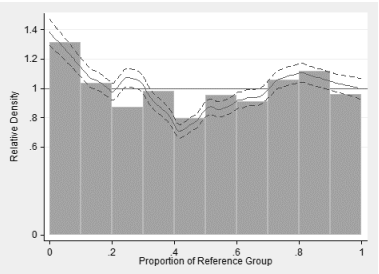




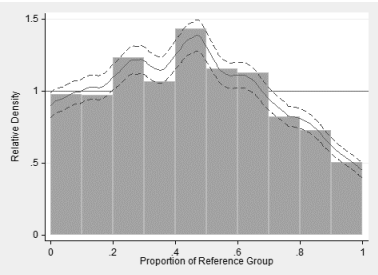
Ivory Coast

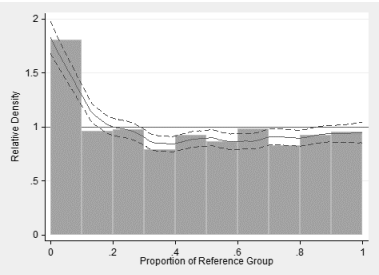


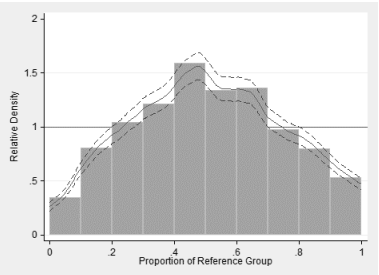




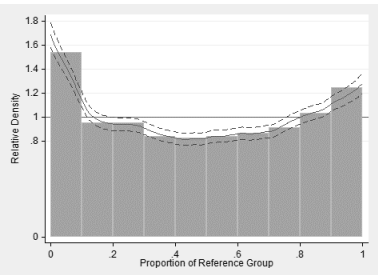
Madagascar

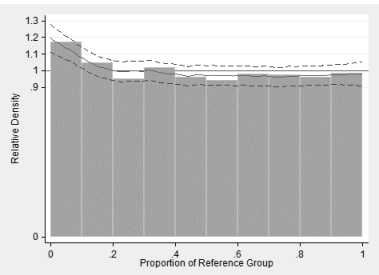


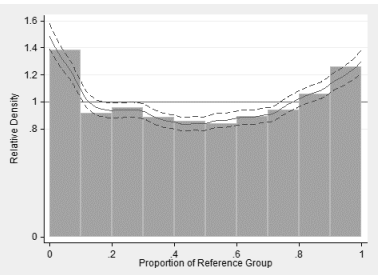




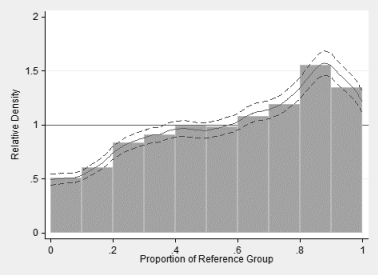
Malawi

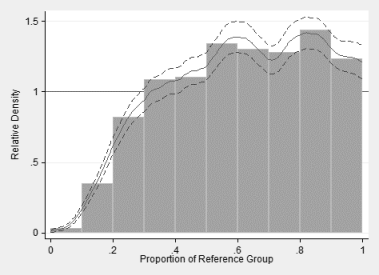


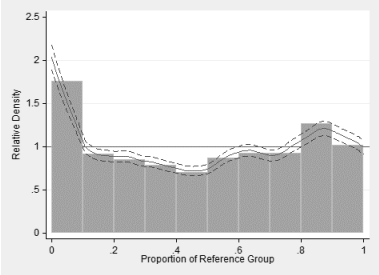




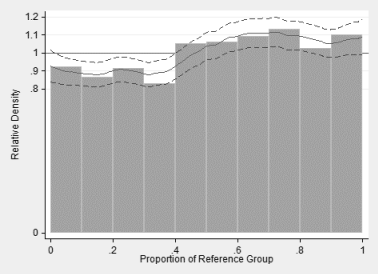
Mauritania

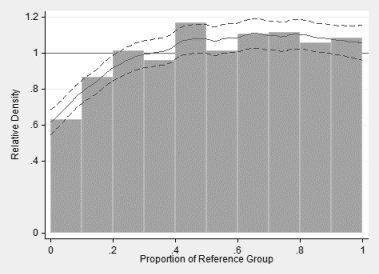


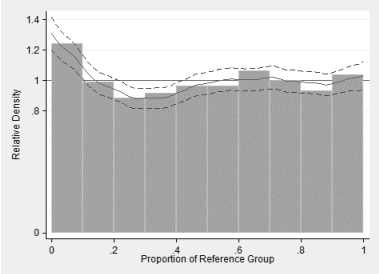




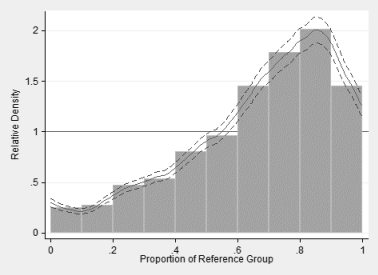
Mauritius

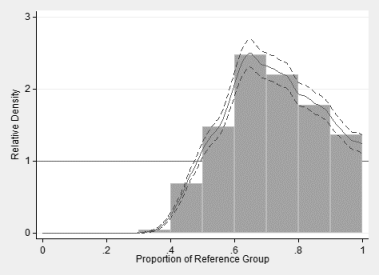


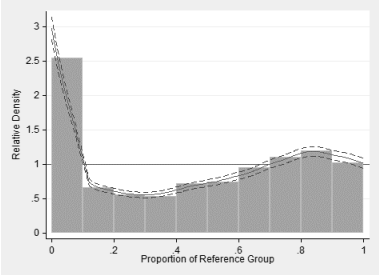




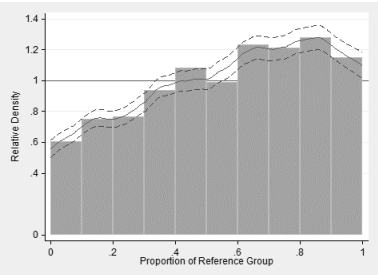
Mozambico

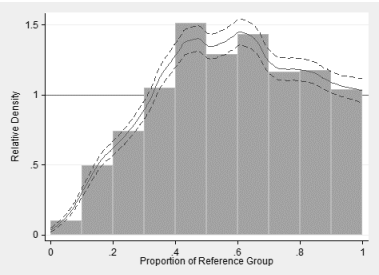


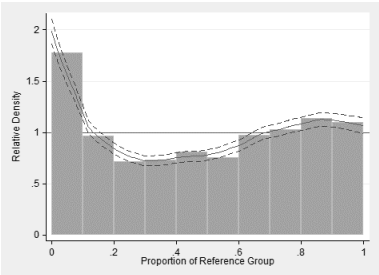




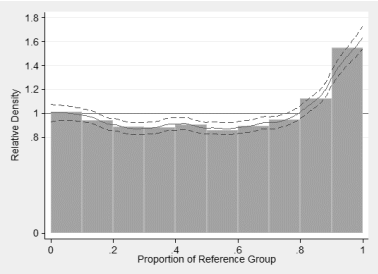
Namibia

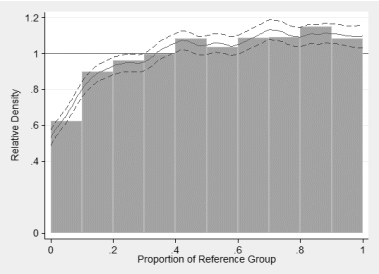


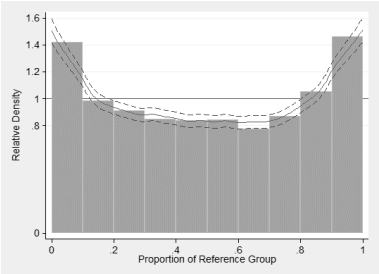




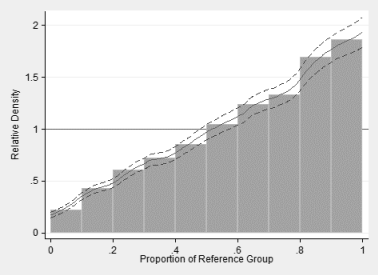
Nigeria

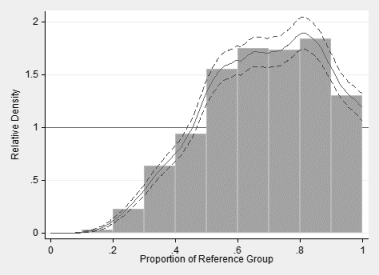


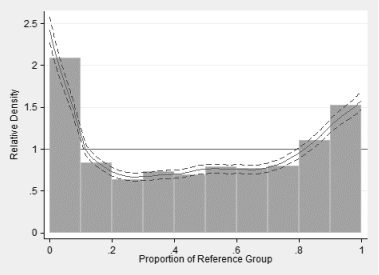




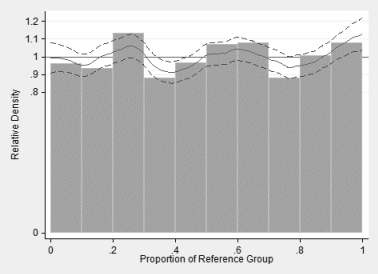
Rwanda

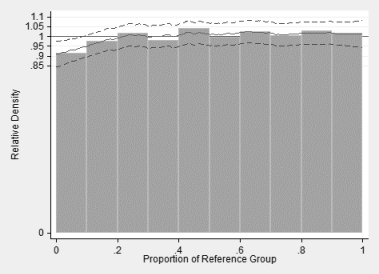


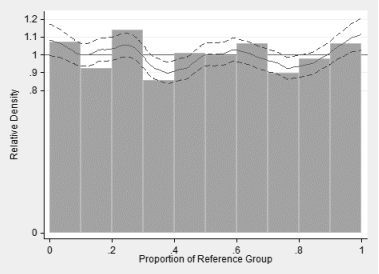




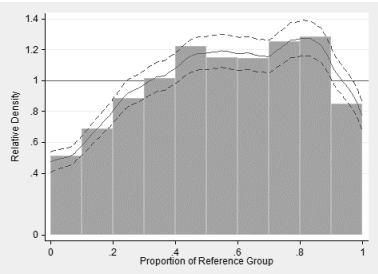
Senegal

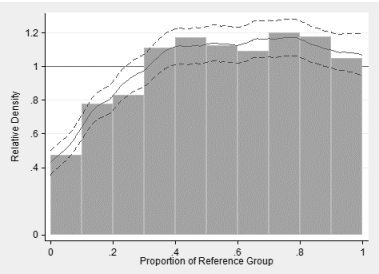


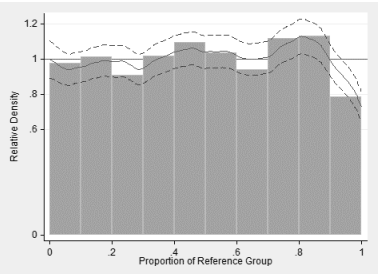




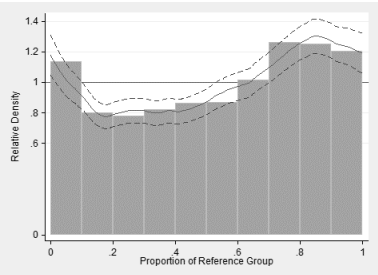
Sierra Leone

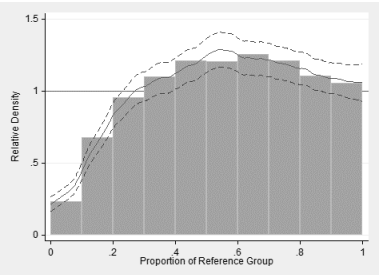


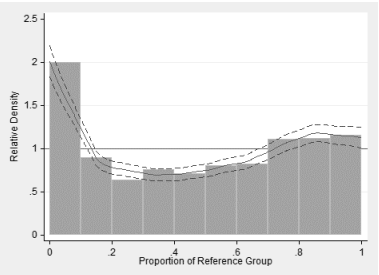




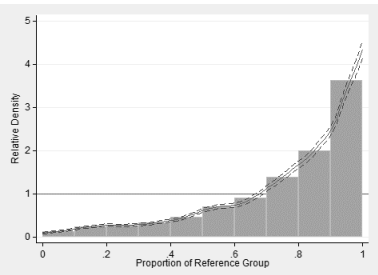
Swaziland

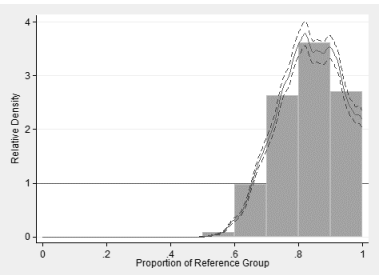


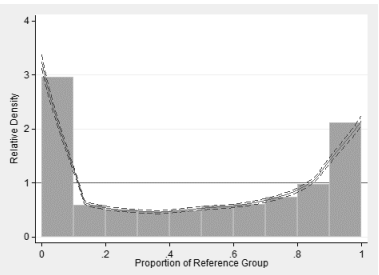




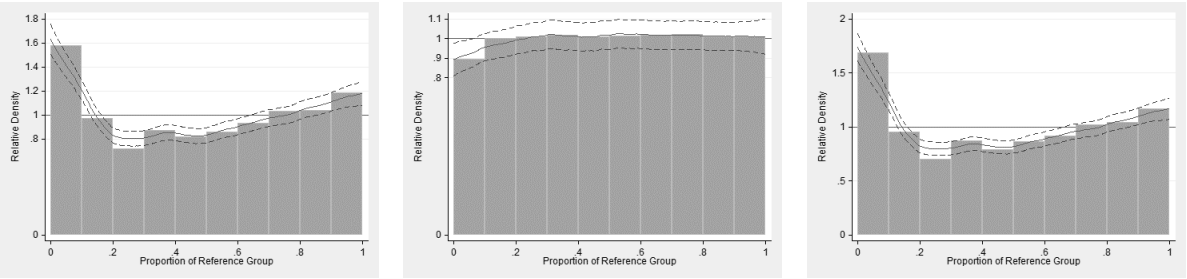
Tanzania



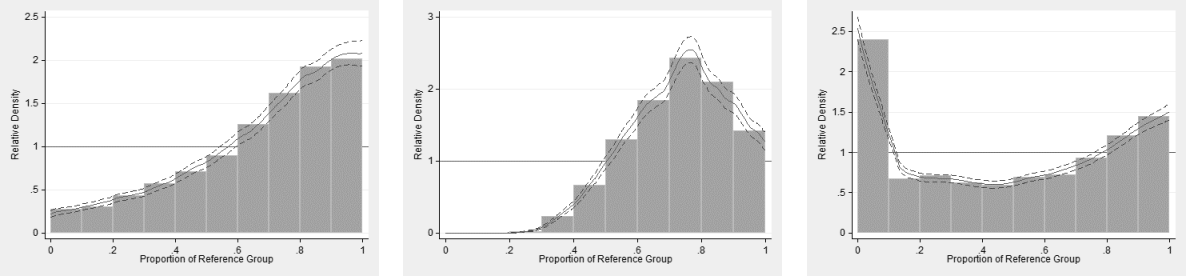




Togo



Uganda



Zambia

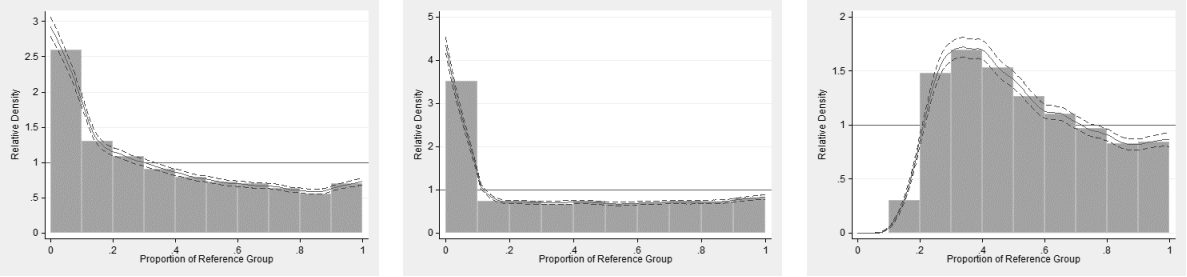


Figure A.1 – Relative distirbution plots

A.4 Oaxaca-Blinder decomposition results: the influence of covariates

In this section, we present the tables of the results of the decomposition of the shape effect of the relative distribution method for selected covariates, summarizing the results of the figures in Chapter 2.

Burkina Faso

Covariates	Deciles			
	10th	20th	80th	90th
Household	-17.74	-3.51	42.45	132.34
Education	-0.66	-0.42	-11.95	-65.23
Employment	-24.53	-13.92	-72.03	-183.57
Infrastructures	0.23	-0.08	12.90	69.14
Spatial	18.99	19.07	74.58	109.48
Interaction	5.55	-0.24	-13.83	-71.99
Constant	81.77	83.05	234.54	257.66

Table A.2 – Oaxaca-Blinder decomposition results, Burkina Faso

Cameroon

Covariates	Deciles			
	10th	20th	80th	90th
Household	-162.46	-98.25	114.61	83.59
Education	136.61	147.68	144.33	169.98
Employment	-115.72	-166.25	-152.90	-160.14
Infrastructures	10.48	11.83	89.67	132.61
Spatial	-19.18	-48.53	186.85	156.43
Interaction	29.95	39.10	-37.34	77.67
Constant	332.98	357.35	472.81	659.30

Table A.3 – Oaxaca-Blinder decomposition results, Cameroon

Ivory Coast

Covariates	Deciles			
	10th	20th	80th	90th
Household	-539.33	-662.52	-1669.41	-3015.66
Education	38.16	36.15	108.54	288.76
Employment	38.85	90.86	176.67	412.67
Infrastructures	225.55	363..91	1882.04	1667.74
Spatial	62.19	63.27	82.32	127.78
Interaction	71.50	17.79	-675.35	-60.48
Constant	329.58	477.47	1344.49	2345.14

Table A.4 – Oaxaca-Blinder decomposition results, Ivory Coast

Ghana

Covariates	Deciles			
	10th	20th	80th	90th
Household	-30.80	-95.51	-327.45	-345.76
Education	23.06	42.28	87.21	57.61
Employment	18.96	15.20	56.02	130.06
Infrastructures	-12.45	-11.98	37.48	167.64
Spatial	11.18	10.25	-13.91	-66.65
Interaction	41.08	53.85	239.09	181.67
Constant	43.99	131.99	545.60	756.83

Table A.5 – Oaxaca-Blinder decomposition results, Ghana

Guinea

Covariates	Deciles			
	10th	20th	80th	90th
Household	-12.37	26.92	-131.21	-224.05
Education	1.49	-7.57	-11.22	-54.99
Employment	29.80	38.29	4.04	-82.25
Infrastructures	-1.98	-0.50	68.33	124.83
Spatial	-13.97	-46.50	-141.29	-52.74
Interaction	20.00	26.29	1.53	-72.58
Constant	143.12	154.20	469.41	583.70

Table A.6 – Oaxaca-Blinder decomposition results, Guinea

Mauritania

Covariates	Deciles			
	10th	20th	80th	90th
Household	-402.26	-405.89	-405.89	-1574.90
Education	7.00	17.64	59.23	-183.05
Employment	50.60	59.23	57.30	-183.05
Infrastructures				
Spatial	41.71	43.29	45.13	-204.09
Interaction	79.11	73.92	70.10	52.98
Constant	569.78	647.75	681.65	2909.98

Table A.7 – Oaxaca-Blinder decomposition results, Mauritania

Mozambique

Covariates	Deciles			
	10th	20th	80th	90th
Household	44.36	22.77	-26.08	-64.48
Education	14.34	18.96	60.43	125.17
Employment	66.54	50.35	55.81	-6.89
Infrastructures	1.36	2.19	5.39	-11.32
Spatial	24.30	36.78	72.88	125.41
Interaction	-2.61	-9.22	-142.32	-295.52
Constant	-61.87	-8.42	315.73	521.44

Table A.8 – Oaxaca-Blinder decomposition results, Mozambique

Niger

Covariates	Deciles			
	10th	20th	80th	90th
Household	46.84	68.66	-96.24	52.19
Education	-2.56	-4.38	40.29	77.48
Employment	-8.87	18.64	-620.29	-423.89
Infrastructures	-1.25	-0.59	-20.20	-37.15
Spatial	37.65	48.92	36.68	97.94
Interaction	1.40	-3.92	-29.88	-16.48
Constant	110.76	67.01	1064.01	687.51

Table A.9 – Oaxaca-Blinder decomposition results, Niger

Nigeria

Covariates	Deciles			
	10th	20th	80th	90th
Household	71.47	75.19	198.16	340.88
Education	86.51	126.11	297.45	506.90
Employment	39.00	49.08	99.51	230.85
Infrastructures	113.03	206.13	845.95	1427.16
Spatial	-4.69	2.11	-43.46	-146.43
Interaction	-116.54	.193.37	-502.15	-749.56
Constant	-189.63	-257.51	-645.69	-1233.12

Table A.10 – Oaxaca-Blinder decomposition results, Nigeria

Democratic Republic of Congo

Covariates	Deciles			
	10th	20th	80th	90th
Household	-205.32	-252.22	-791.70	-1062.54
Education	60.22	45.21	80.81	116.91
Employment	-6.88	45.15	-109.09	-346.06
Infrastructures	-0.94	1.80	42.32	94.91
Spatial	18.48	15.40	-34.79	89.94
Interaction	26.05	30.90	73.58	75.36
Constant	367.22	459.00	1565.68	2200.19

Table A.11 – Oaxaca-Blinder decomposition results, Democratic Republic of Congo

Rwanda

Covariates	Deciles			
	10th	20th	80th	90th
Household	1.14	22.07	46.10	248.64
Education	-20.06	-49.91	-61.96	-30.29
Employment	-27.88	-8.56	144.51	552.22
Infrastructures	-1.33	-2.70	7.76	75.61
Spatial	8.15	12.67	-8.43	-76.38
Interaction	28.10	16.40	-210.47	-661.49
Constant	-50.94	-80.64	-231.02	-543.46

Table A.12 – Oaxaca-Blinder decomposition results, Rwanda

Senegal				
Covariates	Deciles			
	10th	20th	80th	90th
Household	183.79	61.43	-466.09	-462.99
Education	1.97	10.68	9.13	23.12
Employment	58.26	55.48	-90.33	-77.48
Infrastructures	18.23	14.95	-137.86	-316.11
Spatial	-29.41	-30.85	-397.48	-412.79
Interaction	-37.14	-46.59	-116.12	-66.44
Constant	4.65	220.68	1581.99	1648.94

Table A.13 – Oaxaca-Blinder decomposition results, Senegal

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