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TO SECTORAL GROWTH IN AFRICA**

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# The Elasticity of Poverty with respect to Sectoral Growth in Africa

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## **Résumé**

Le continent africain a connu une croissance annuelle de plus de 4 pour cent en moyenne durant la dernière décennie. Toutefois, le lien entre ce fort taux de croissance et la réduction de la pauvreté ne semble ni évident ni simple. Cet article étudie l'élasticité de la pauvreté par rapport à la croissance du PIB au niveau sectoriel et prend en compte le fait que la croissance économique peut avoir un impact sur la pauvreté à la fois directement qu'indirectement, et ce à travers l'intensité sectorielle du travail. L'étude développe une méthodologie montrant la contribution de la croissance sectorielle sur la réduction de la pauvreté pays par pays en Afrique, afin de guider des recommandations de politique économique. Étant donné que la composition de la croissance est aussi importante que son niveau, il est crucial d'identifier les secteurs ayant le plus fort impact en matière de réduction de la pauvreté et d'en utiliser le potentiel. Cependant, si des secteurs avec un faible potentiel pro-pauvres croissent, comme le cas de la croissance poussée par les matières premières, des politiques redistributives s'avèrent alors nécessaires pour compenser le faible effet sur la pauvreté.

Mots-clés: élasticité de la pauvreté, croissance sectorielle, intensité du travail, croissance pro-pauvres.

Code JEL: O40, I32, J21.

## **Abstract**

The African continent has grown by more than 4 per cent yearly on average during the past decade. However, the link between this remarkable growth rate and poverty reduction is neither obvious nor simple. This paper focuses on the elasticity of poverty with respect to GDP growth at the sectoral level and takes into account the fact that economic growth may affect poverty directly as well as indirectly through sectoral labor share intensity. It develops a methodology that sheds light on the contribution of sectoral growth to poverty reduction country-by-country in Africa, guiding policy recommendations. As the composition of growth matters at least as much as its overall intensity, it is key to identify the sectors that have the strongest impact on poverty reduction and unleash their potential; if growth happens to concentrate in sectors with scarce pro-poor potential, like commodity-driven growth, redistributive strategies are necessary to compensate the weak effect on poverty.

Keywords: elasticity of poverty, sectoral growth, labor intensity, pro-poor growth.

JEL code: O40, I32, J21.

## **Non-technical summary**

The African continent has experienced an unprecedented cycle of sustained and prolonged economic growth, growing by more than 4 per cent yearly on average during the past decade. But was growth conducive to substantially reducing poverty in the world's poorest continent? Economic growth is a precondition for poverty reduction, but it is by no means sufficient. In particular, growth-elasticity to poverty is lower in Africa than in other regions of the world. Growth in most African countries for which data are available has at best triggered a less than proportional reduction in headcount poverty. However, the elasticity of poverty with respect to growth is strongly heterogeneous across the continent and some countries in the continent, such as Tunisia, Morocco or Ghana, have performed extremely well in capitalizing on growth to reduce poverty.

This paper contributes to the literature on the elasticity of poverty with respect to GDP, taking a country-specific approach. We sketch a simple theoretical framework where the elasticity of poverty with respect to growth is interpreted in terms of value added and labor share growth at the sectoral level. This provides the basis for a country-by-country interpretation of the elasticity of poverty with respect to growth that relies on the structure of the economy and its evolution.

The objective of our analysis is to get a country-specific measure of the elasticity of poverty with respect to growth, focusing on the economic structure characterizing each country and its evolution over time. Distributional characteristics are then taken into account through the labor shares employed in each sector, rather than through the inequality of income distribution.

The originality of the paper also resides in the data that allow the decomposition of the economic structure of the economy in six sectors (agriculture and fishing; services, transport, trade; manufacturing; mining and quarrying; construction and utilities; public administration and government services). On average over the last 30 years the service sector has represented the biggest share of GDP (transport and trade in particular), reflecting the importance of exports for many African economies. Agriculture is still the second most important sector for Africa on average, but the share of value added from agriculture over GDP has been recently decreasing. Structural adjustment programs reduced the importance of the public adminis-

tration over time as well. On the contrary, the importance of manufacturing and mining is increasing overtime.

The impact of economic growth on poverty reduction depends on the extent to which growth is inclusive and benefits the poor. While 42 per cent of the labor force works in the agricultural sector, only 18 per cent of the GDP is generated in that sector. In the services and manufacturing sector the share of value added represents about the double than the share of employed labor force. At the other end of the spectrum, only 1 per cent of the labor force works in the mining sector, although it represents 10 per cent of the GDP on average.

The analysis of the extent to which economic growth in Africa contributed to poverty reduction has important policy implications. First, the composition of growth is at least as important as its overall intensity. If growth is concentrated in sectors with scarce pro-poor potential, like commodity-driven growth, redistributive strategies are necessary to compensate the weak effect on poverty. Second, it is important to identify the sectors that have the strongest impact on poverty reduction and unleash their potential. In the short term agriculture is a natural candidate in many countries to implement pro-poor policies. For instance, helping small farmers to increase productivity by supporting the diffusion of modern and sustainable technologies could increase the income of workers in the agricultural sector. This could in turn stimulate demand for goods and services and the development of other sectors (*e.g.* manufacturing), and the creation of better jobs. Third, in the medium term industrial policies could contribute to economic diversification and sustainable structural change, by supporting the development of sectors characterized by high pro-poor potential, but which struggle to take off and represent tiny shares of the economy in African countries.

# 1 Introduction

Since 2000 Africa experienced an unprecedented cycle of sustained and prolonged economic growth, characterized by a conducive international economic environment, improved macroeconomic framework and policies, and rising financial flows. In particular, at the origins of this good performance was the sharp increase in prices for both soft and hard commodities, triggered mainly by increasing demand and high liquidity in the international financial markets. During the international economic crisis, the healthier macroeconomic framework built in the previous decade provided several countries with the fiscal space to implement an appropriate policy mix, thus limiting the contraction in GDP. However, the exogenous nature of possible shocks to its growth cycle and the uncertainty over the sustainability of its past drivers lifts the accent from macroeconomic stability and puts it back on economic development and poverty reduction.

Was growth in the past decade conducive to substantially reducing poverty in the world's poorest continent? Was growth in all economic sectors equally effective? The key message of this paper is that the sectoral composition of growth matters as much as its intensity. The distinction between growth intensity and composition is especially relevant when aggregate GDP growth is disconnected from household income evolution. The central argument in this paper is that growth in some sectors is little connected to household income and in particular does not affect the income of poor households. This is the reason why even attaining the overall growth target of 7 percent, established in the framework of the Millennium Development Goals (MDGs), may not be enough to halve poverty.

The commodity boom windfall at the origin of many instances of African growth has not been exploited to promote economic diversification. Indeed, in 2009, 80 per cent of African exports were still represented by commodities (especially oil and minerals). The African experience shows that, in the context of very low initial conditions in terms of per capita income, institution capacities, and social development, specialization in commodity exports is not conducive to poverty reduction, unless strong and effective redistribution policies are implemented.

The relationship between economic growth and poverty is complex and controversial. To what extent does growth reduce poverty? What are the drivers of the elasticity of poverty with respect to growth? Economic growth is a precondition for poverty reduction, but it is by no

means sufficient. The elasticity of poverty with respect to growth has been shown to depend on initial income levels (Bourguignon [2003]) and on inequality (Ravallion [1997]). In the light of this, it comes to no surprise that in Africa growth-elasticity to poverty is lower than in other regions of the world (Ravallion and Chen [2004]). However, while growth in most African countries for which data are available has at best triggered a less than proportional reduction in headcount poverty (Fosu [2009]), some countries in the continent, such as Tunisia, Morocco or Ghana, have performed extremely well in capitalizing on growth to reduce poverty.

The relationship between growth and poverty reduction has been largely studied in the economic literature based on different data and methodologies. Several indicators of monetary poverty (headcount and poverty gap index, etc) have been used in conjunction with microeconomic or macroeconomic measures of growth (based on household surveys or national accounts, respectively)<sup>1</sup>. As far as the methodology is concerned, it is possible to distinguish between two broad branches of research.

The first one focuses on the relationship between poverty, income growth and income distribution. This literature stresses the crucial role played by distributional factors in the elasticity of poverty with respect to growth, while the specification of the distributional term varies. Ravallion [1997] kick-starts this research branch, investigating the empirical relationship between poverty and growth through the role played by inequality and proxied by the Gini coefficient. Bourguignon [2003] adopts a more analytical approach and shows that, assuming a (log-normal) functional shape of the income distribution, a mechanical relationship exists between income growth and poverty, so that it is possible to characterize the entire distribution with only a scale and a distributional parameter.<sup>2</sup> Subsequent studies integrate Ravallion's and Bourguignon's specifications (Fosu [2009]). This 'micro' approach is particularly suitable when considering income growth reconstructed from household surveys.

A second branch of research takes into consideration distributional characteristics through factors more directly related to GDP than to income. This 'macro' approach argues that

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<sup>1</sup>See Ravallion [2001] for a comparison of advantages and disadvantages of microeconomic or macroeconomic measures of growth.

<sup>2</sup>Along the same lines, Misselhorn and Klasen [2006] examine the mathematical relationship between growth and distributional change on absolute changes in Foster-Greer-Thorbecke poverty measures assuming a log-normal income distribution. Bresson [2009] suggests that moving from the lognormal hypothesis to more flexible functional forms results in lower elasticities of poverty.



the structure of the economy is an important element in shaping the way economic growth affects poverty (Kakwani and Subbarao [1990], Gallup et al. [1998], Kakwani [2000], Khan [2001], Ravallion [2004], Ravallion and Chen [2004]). Loayza and Raddatz [2010] strengthen the argument developing a simple theoretical model linking GDP growth to poverty through a process of wage equalization across sectors.

This paper contributes to the literature of this latter research branch on the elasticity of poverty with respect to GDP, but taking a country-specific approach. Indeed, the objective of our analysis is not to provide insights on the general relationship between poverty and growth, but rather to get a country-specific measure of the elasticity of poverty with respect to growth. The key idea is to focus on the economic structure characterizing each country and its evolution over time. Distributional characteristics are then taken into account through the labor shares employed in each sector, rather than through the inequality of income distribution. The methodology developed in this paper allows evaluating country-by-country sectoral pro-poor growth<sup>3</sup>. Moreover, it also allows the projection of poverty evolution, based on estimates or forecasts of GDP composition and growth, and sectoral labor intensity.

The originality of the paper also resides in the data that allow the decomposition of the economic structure of the economy in six sectors (agriculture and fishing; services, transport, trade; manufacturing; mining and quarrying; construction and utilities; public administration and government services)<sup>4</sup> for a larger number of African countries with respect to previous studies. Indeed, we collected data on sectoral labor shares directly from the Statistical Offices of several African countries, increasing the information available through the International Labour Organization by 44 per cent.

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<sup>3</sup>Pro-poor growth can be intended as a relative or absolute concept. It has been defined in relative terms by Kakwani and Pernia [2000] and Kakwani et al. [2004] as characterized by a growth rate of income of the poor greater than the average income growth rate. On the other hand, Grosse et al. [2008] define growth as pro-poor if the poor enjoy greater absolute benefits than the non-poor. Ravallion and Chen [2003] define relative pro-poor growth as a growth for poor greater than the growth rate of the average population. They interpret instead strong absolute pro-poor growth as an income-gain of the poor greater than that of the average population and weak pro-poor growth as a growth rate of the poor greater than zero. Kakwani and Son [2008] develop a measure of growth rate, called poverty equivalent growth rate, which provides a conceptual framework for unifying alternative concepts of pro-poor growth. Bérenger and Bresson [2010] suggest a way of testing the pro-poor nature of growth for poverty measures based on both income and non-monetary characteristics that can be summed up using an ordinal index.

<sup>4</sup>Previous studies (for instance, Ravallion and Datt [1996]) usually focus only on the three main macro-sectors (primary, secondary, and tertiary). Loayza and Raddatz [2010] is the first paper accounting for six sectors of the economy (defined in a slightly different way with respect to this paper).

The paper is structured as follows. The data and some stylized facts on growth and poverty in Africa are described in section 2. Section 3 develops a simple theoretical framework illustrating how sectoral labor intensity determines the degree of inclusiveness of economic growth. It then assesses the elasticity of poverty with respect to growth in the African continent adopting a country-by-country approach. Section 4 concludes, drawing some policy implications.

## **2 Evidence on economic growth, poverty and the structure of African economies**

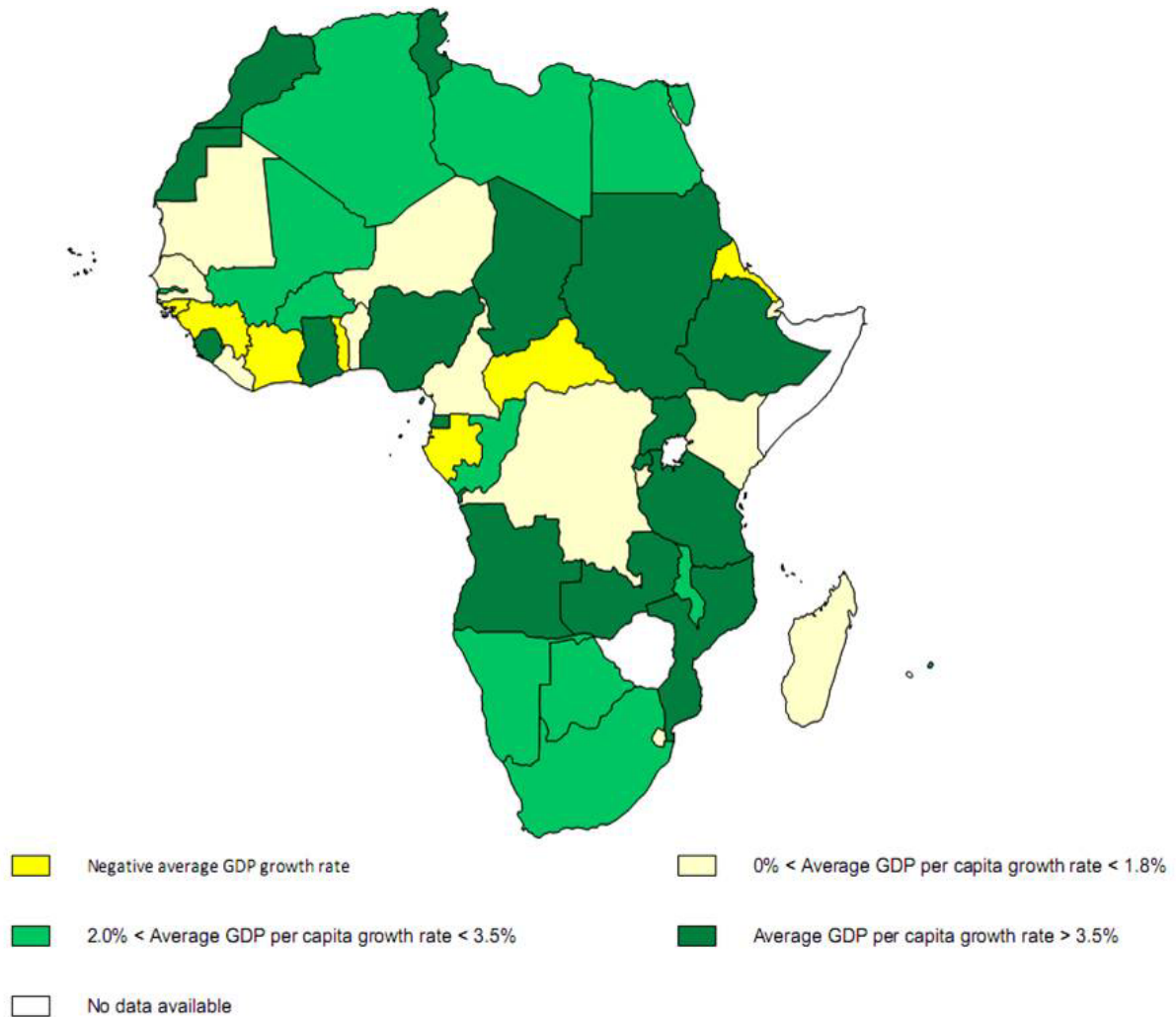
This paper focuses exclusively on the African continent, the poorest in the world, recognizing its specificities with respect to other regions. It relies on data on real GDP, value added of 6 sectors (agriculture and fishing; services, transport, trade; manufacturing; mining and quarrying; construction and utilities; public administration and government services), population, poverty measures (from the World Development Indicators of the World Bank), and labor shares by sectors (from the International Labour Organization). Notice that some information on the shares of labor force employed across the 6 above mentioned sectors is only available for 19 African countries, and in 9 cases only for one particular year. The total number of country-year observations is 62. We enriched this information by 44 per cent by collecting data on sectoral labor shares directly from Statistical Offices across the continent. Thanks to this procedure, we could add 5 new countries and complete the information for countries already included in the ILO dataset.<sup>5</sup>

We first describe the evolution of growth and poverty in Africa (section 2.1). Then, we analyze the composition of GDP in the continent and its evolution, the distribution of poverty according to the economic structure and the labor force employed by each sector (section 2.2).

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<sup>5</sup>ILO provided the information for: Algeria, Botswana, Egypt, Ethiopia, Gabon, Lesotho, Madagascar, Mali, Morocco, Mauritius, Namibia, São Tomé and Príncipe, Senegal, Sierra Leone, South Africa, Tanzania, Tunisia, Uganda, and Zimbabwe. National Statistical Offices allowed to extend the analysis to: Cameroon, Côte d'Ivoire, Gambia, Seychelles, and Zambia. They also provided additional information or observations for: Algeria, Egypt, Mali, Madagascar, Morocco, São Tomé and Príncipe, Tanzania, and Tunisia.

Figure 1: Average per capita real GDP growth (PPP) in African countries (1980-2008).



Cartographic source: Artique.

## 2.1 Growth and poverty in African countries

The average annual growth of per capita real GDP between 1980 and 2008 has been 2 per cent in Africa. After two decades of flat (if not negative) growth, between 2000 and 2008 Africa experienced an average sustained growth of 4 per cent, which is above that of Brazil each single year of the period.

A closer look shows many disparities across regions and countries (figure 1). Some countries recently experienced above average growth, mainly in East and North Africa, as well as in oil producing countries. Angola and Mozambique benefited from post-conflict economic catching up, while countries characterized by strong political instability grew less (Guinea-Bissau, Togo,

Côte d'Ivoire, Eritrea). Good agricultural policies and climate conditions favored some, like Rwanda, Uganda, Tanzania, Ethiopia and North Africa.

As far as monetary poverty is concerned, Africa is the region of the world with the highest and deepest incidence of poverty. The average headcount poverty rate, considering the 1.25 USD a day (PPP) poverty line, is 44.6 per cent. Monetary poverty is high even in countries that experienced high average annual per capita GDP growth in the preceding years, like Chad and Mozambique.

The relation between the rate of poverty reduction and GDP evolution is represented in figure 2.<sup>6</sup> The elasticity of poverty with respect to growth is on average negative, although in several cases poverty increased despite economic growth.<sup>7</sup> In Africa, poverty growth-elasticity is lower than in other regions of the world. Ravallion and Chen [2004] find that in 2001 the elasticity of the poverty gap with respect to mean income growth in Sub-Saharan Africa was only one third of the elasticity computed in South Asia. Even more alarmingly, they find that the elasticity decreased over time in absolute value in Sub-Saharan Africa, while it increased on average in developing countries.<sup>8</sup>

The elasticity of poverty with respect to growth is strongly heterogeneous across the continent. While some countries performed extremely well in capitalizing on growth to reduce poverty (*e.g.* Tunisia, Morocco, Ghana), in other African countries growth has at best triggered a less than proportional reduction in poverty. What is the explanation of this heterogeneity? The difference in the time frame of the available spells is part of the explanation. Institutional factors are also likely to play an important role. While North African countries were characterized by stable regimes, the civil war ravaged in Mozambique until the mid 90s. Botswana has been affected by South Africa's regime of apartheid and then by the insecurity that followed

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<sup>6</sup>Poverty growth refers to the headcount ratio with 1.25 USD a day (PPP) poverty line, except for Benin and the Republic of Congo where the national poverty line has been considered. GDP growth is computed as the average GDP growth over poverty spells.

<sup>7</sup>Fosu [2009] finds that the gap between the elasticity of poverty with respect to growth in Sub-Saharan Africa and the rest of the developing world varies with the considered poverty measure. In particular, the differential is the largest (2.6 times) when considering headcount poverty index, followed by the poverty gap and squared poverty gap index.

<sup>8</sup>Ravallion and Chen [2004] find that in 2001 the elasticity of the poverty gap with respect to growth in mean income was -1.3 in Sub-Saharan Africa, -1.8 in Latin America, -3.3 in East Asia, -3.9 in South Asia, -4.3 in Middle East and North Africa. In 1981 it was -1.4 in Sub-Saharan Africa. On average in developing countries it was -1.9 at the beginning of the 80s and it increased in absolute value to -2.5. Similarly, Besley and Burgess [2003] find that poverty is twice as responsive to economic growth in East Asia.



its collapse. In Côte d'Ivoire the civil war and political instability that started in 2002 were detrimental. However, the hypothesis underlying this paper identifies the economic structure and the drivers of growth in each country as important determinants of the elasticity of poverty with respect to growth.

## 2.2 The role of the structure of the economy

The majority of African economies are little diversified and decreasingly so.<sup>9</sup> In several countries one sector alone represents more than half of the GDP (Equatorial Guinea, Angola, Botswana, Central African Republic, Algeria, Kenya, Nigeria). The average weight of the biggest sector of the economy in Africa was 32 per cent of GDP in 2008, increasing slightly from 31 per cent in 1980. Often the biggest share of GDP is represented by services, and trade in particular, while in few other cases agriculture covers the biggest share. In 2008, for instance, agriculture represented more than 30 per cent of GDP in 7 countries (Central African Republic, Nigeria, Ethiopia, Democratic Republic of Congo, Malawi, Ghana, Kenya). There are several African countries whose economy is mainly based on natural resources (*e.g.* Botswana), while manufacturing never represents the most important sector.

To get a better understanding of the evolution of the structure of economies in Africa, we distinguish 6 sectors: agriculture and fishing; services, transport and trade; manufacturing; mining and quarrying; construction and utilities; and public administration and government services. Figure 3 represents the average evolution of the economic structure of the continent since 1980. On average over the last 30 years the service sector has represented the biggest share of GDP (transport and trade in particular), reflecting the importance of exports for many African economies. Agriculture is still the second most important sector for Africa on average, but the share of value added from agriculture over GDP has been recently decreasing. Structural adjustment programs reduced the importance of the public administration over time as well. On the contrary, the importance of manufacturing and mining is increasing overtime.

If we group countries based on leading sector (agriculture, services, and mining and quarrying),<sup>10</sup> we notice that countries based on services enjoyed the strongest GDP growth between

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<sup>9</sup>The diversification index computed in the framework of African Economic Outlook [2010] decreased from 10.8 in 1999 to 3.7 in 2008.

<sup>10</sup>The group of countries based on services includes: Cape Verde, Comoros, Djibouti, Mauritius, Morocco, and

Figure 3: Average sectoral contribution to GDP in Africa over time (1980-2008).

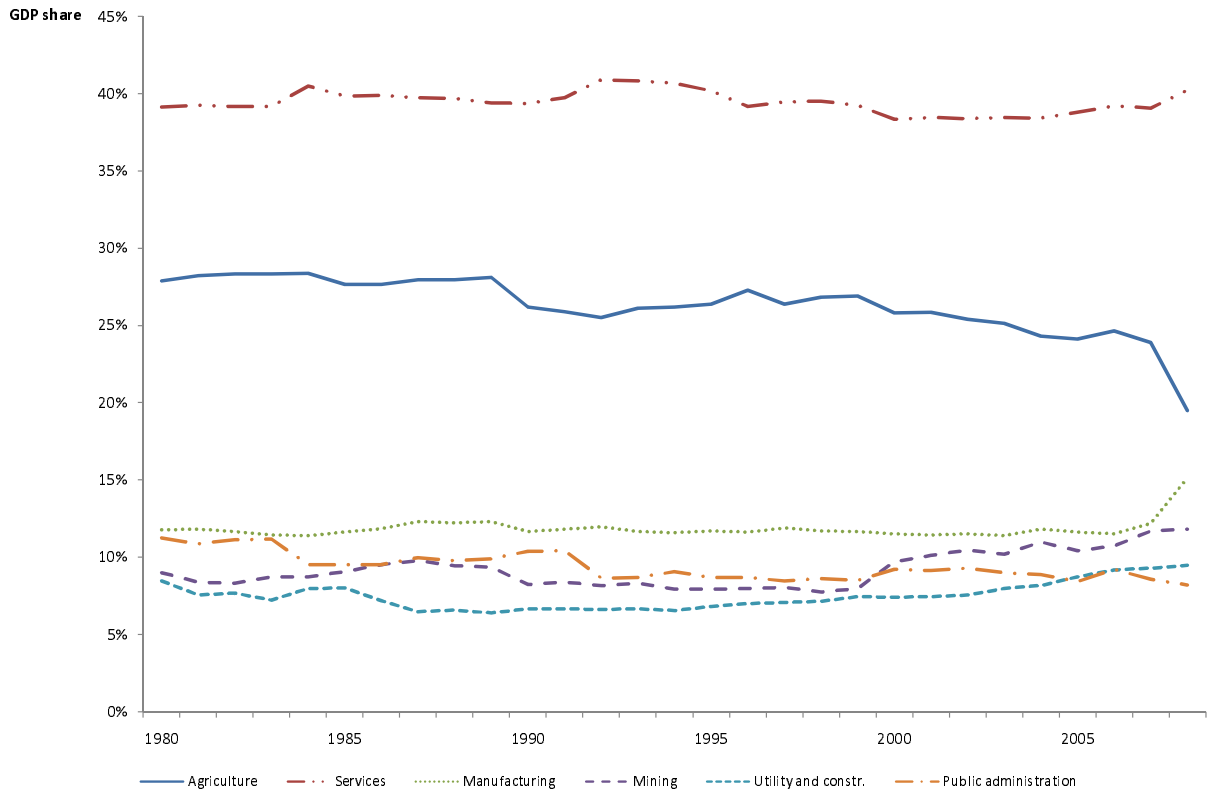
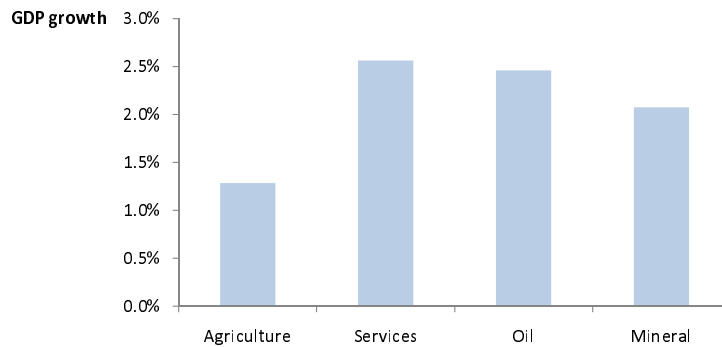


Figure 4: Average per capita real GDP growth (PPP) by dominant sector (1998-2008).



1998 and 2008, followed by those exporting oil and minerals (figure 4).

Interestingly, poverty is on average the highest among countries based on mineral extraction and agriculture,<sup>11</sup> followed by those relying on oil extraction.

Tunisia. The group of countries based on agriculture includes: Benin, Burkina Faso, Burundi, Central African Republic, Côte d'Ivoire, Ethiopia, Gambia, Ghana, Guinea Bissau, Kenya, Madagascar, Malawi, Mali, Rwanda, Senegal, Swaziland, Tanzania, Togo, and Uganda. The group of countries based on oil extraction includes: Algeria, Angola, Cameroon, Chad, Congo, Egypt, Gabon, and Nigeria. Finally, the group of countries based on mineral extraction includes: Botswana, Democratic Republic of Congo, Eritrea, Guinea, Lesotho, Liberia, Mauritania, Mozambique, Namibia, Niger, Sierra Leone, South Africa, and Zambia.

<sup>11</sup>Poverty headcount ratio with 1.25 USD a day (PPP) poverty line is on average above 50 per cent in countries

Table 1: OLS estimation on pooled sample.

	[I]	[II]
Per capita value added growth:		
agriculture and fishing	-1.103** (0.43)	-0.824* (0.44)
services	0.000** (0.00)	0.000** (0.00)
manufacturing	-0.354 (0.27)	-0.356 (0.25)
mining and quarrying	0.004 (0.08)	-0.020 (0.07)
construction and utilities	0.060 (0.23)	0.370 (0.26)
public administration	0.064 (0.20)	-0.022 (0.19)
Initial GDP sectoral share:		
agriculture and fishing	-6.153*** (1.50)	-5.777*** (1.41)
services	-3.917** (1.67)	-3.934** (1.55)
manufacturing	-8.904*** (2.14)	-9.318*** (1.99)
mining and quarrying	-5.878*** (1.85)	-5.509*** (1.72)
construction and utilities	-5.646** (2.59)	-3.102 (2.64)
Average GDP growth previous 10 years		-5.822* (3.41)
Intercept	5.064*** (1.49)	4.993*** (1.38)
N	57	55
$R^2$	0.450	0.537
Adj. $R^2$	0.315	0.405

Note: Robust Standard Errors in brackets, clustered by country. Significance levels: \*: 10% \*\*: 5% \*\*\*: 1%.

Although the number of observations is very limited to rely on econometric results, the estimated coefficients reported in table 1 suggest that the relation between the evolution of poverty and economic growth markedly varies with the type of sector. Column [I] in table 1 reports the estimated coefficients of a simple OLS regression where the growth rate of the poverty headcount ratio at 1.25\$ (PPP) a day (% of population) is regressed on per capita value added growth and spell initial GDP shares of the aforementioned six sectors of the economy (agriculture and fishing; services, transport and trade; manufacturing; mining and quarrying; construction and utilities; and public administration and government services). The sample consists of 78 pooled spells relative to the period 1980-2007. The main purpose of this econometric exercise is to assess whether the estimated coefficients relative to the growth of per capita value added in the different sectors vary, that is, whether the elasticity of poverty with respect to growth differs across sectors. Indeed, if this was not the case, the composition of growth would not matter for poverty reduction.

Value added growth in agriculture significantly correlates with a decrease in poverty: the  
based on mineral extraction and agriculture.



Table 2: Average labor intensity and value added across sectors.

	Agric.	Serv.	Manuf.	Mining	Constr.	Pub.adm.
Average labor share / total labor force (standard deviation)	42% (0.25)	26% (0.10)	9% (0.05)	1% (0.01)	7% (0.05)	15% (0.10)
Average value added / total GDP (standard deviation)	18% (0.13)	42% (0.13)	14% (0.08)	9% (0.15)	7% (0.05)	10% (0.06)

estimated elasticity in column [I] implies that, if agriculture grows at 1 per cent, poverty reduces *ceteris paribus* by 1.1 per cent on average in Africa. Even controlling for the average annual GDP growth of the 10 years before the considered spell (column [II]), the average elasticity of poverty with respect to growth in the agricultural sector is -0.8, by far the largest compared with the other sectors. The sector characterized by the strongest pro-poor connotation after agriculture is the manufacturing sector (although not significantly). Growth in the service sector appears on average neutral with respect to the evolution of poverty, while growth in mining, construction and public administration is on average accompanied by rising poverty (although not significantly). Table 1 shows at the same time that countries where agriculture, manufacturing, and mining represent a relatively large share of GDP are poorer on average than countries characterized by a relatively important weight of services and construction.

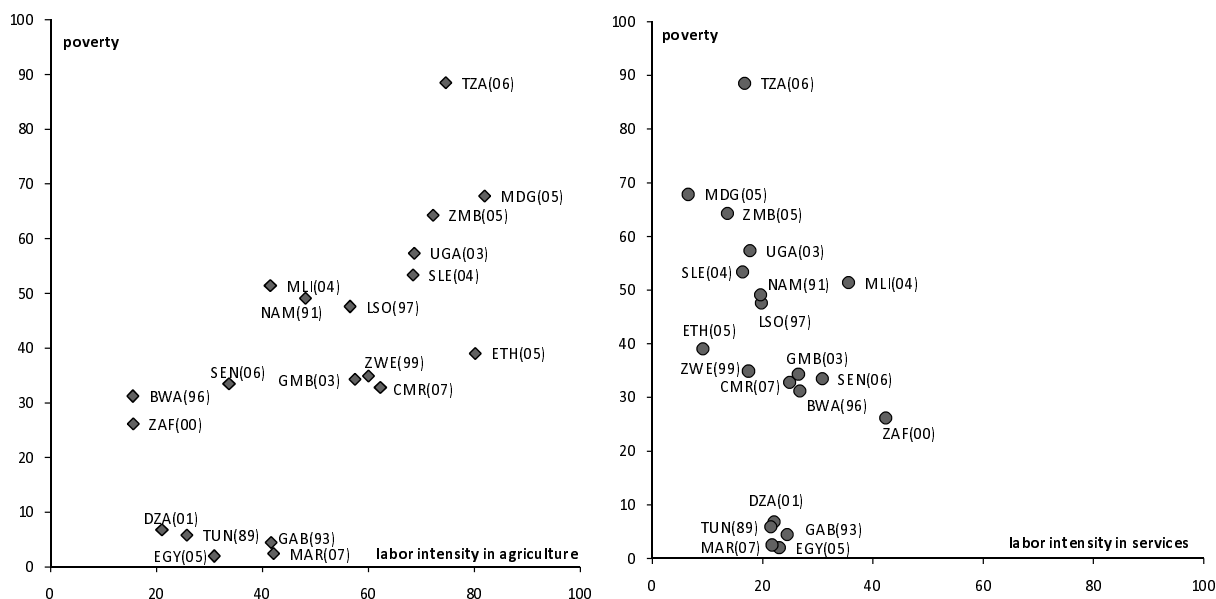
The impact of economic growth on poverty reduction depends on the extent to which growth is inclusive and benefits the poor, which has been shown to vary depending on the structure of the economy. This paper argues that the underlying mechanism is that growth in sectors where many poor people work is more likely to reduce poverty.<sup>12</sup> Unfortunately, the large majority of people in Africa do not work in the sectors that account for the largest value added.<sup>13</sup> Table 2 indeed shows that while 42 per cent of the labor force works in the agricultural sector, only 18 per cent of the GDP is generated in that sector. In the services and manufacturing sector the share of value added represents about the double than the share of employed labor force. At the other end of the spectrum, only 1 per cent of the labor force works in the mining sector, although it represents 10 per cent of the GDP on average.

Consistently, poverty tends to be more severe where agriculture employs larger shares of the

<sup>12</sup>Section 3.2 formally develops this intuition.

<sup>13</sup>For instance, in 2007 a UN report on ECOWAS poverty profiles found that more than half of the poor were living in households headed by a person occupied in agriculture, while often the group with the lowest headcount index was headed by a person employed in the public sector.

Figure 5: Poverty and sectoral labor shares between 1980 and 2008.



labor force and to decrease with the proportion of workers employed in sectors characterized by a more favorable ratio between value added and labor intensity, like services (figure 5)<sup>14</sup>.

The evidence presented so far on economic growth, poverty, and economic structure (in terms of both sectoral value added and labor shares) suggest that a relationship exist among these dimensions.<sup>15</sup> A simple framework that illustrates them is sketched in the following section (3.2).

### 3 The elasticity of poverty with respect to growth in 22 African countries

The objective of this paper is to assess the elasticity of poverty with respect to growth country-by-country in Africa. The country-by-country methodology developed in this section is a complementary exercise with respect to the standard econometric estimation of elasticities. The country-by-country approach has the main advantage of capturing the structural factors that vary across countries and sectors. However, it is important to bear in mind that the computed

<sup>14</sup>Poverty is measured as the headcount index with 1.25 USD a day (PPP) poverty line and refers to the period for which sectoral labor shares are available (reported in labels of figure 5).

<sup>15</sup>Fox and Gaal [2008] also conclude in ‘Working out of Poverty: Job creation and the quality of growth in Africa’ that recent high economic growth was associated with significant changes in the structure of output and employment.

elasticities are affected more severely by measurement errors than the average elasticities resulting from econometric estimations. The first step is the simple calculation of the observed elasticity (section 3.1). We then develop a simple framework to show that the elasticity of poverty with respect to sectoral growth depends on sectoral labor intensity growth and GDP composition (3.2). Finally, we assess the sectoral elasticities (section 3.3) and their components (section 3.4).

### 3.1 Observed elasticity of poverty with respect to growth

It is not possible to directly calculate the annual elasticity for each country in Africa over the last decade, because the availability of household surveys and therefore distributional data is scarce. The only possibility is to calculate the elasticity of poverty with respect to growth during the spell between available poverty measurement points.

By definition of elasticity, for each country  $j$ :  $\frac{\Delta P_j^t}{P_j^{t-1}} = \eta_j \Delta \frac{Y_j^t}{L_j^t} \frac{L_j^{t-1}}{Y_j^{t-1}}$ , where  $P_j$  is a poverty index (either monetary, like headcount, poverty gap, severity index, or non-monetary, like mortality under 5 years old),  $\eta_j$  is the elasticity of poverty with respect to growth, and  $\frac{Y_j}{L_j}$  is real GDP (constant USD) per capita<sup>16</sup> in country  $j$ . Therefore, it is possible to calculate the elasticity of poverty with respect to growth for each country  $j$  as:  $\eta_j = \frac{\Delta P_j^t}{P_j^{t-1}} \Delta \frac{L_j^t}{Y_j^t} \frac{Y_j^{t-1}}{L_j^{t-1}}$ .

Table 3 reports the observed elasticity of poverty with respect to growth for 22 countries. Elasticities below  $-1$  indicate a reduction of poverty more than proportional to growth. For instance, the average elasticity of poverty with respect to growth in Tunisia between 1985 and 2000 was  $-4.01$  and in Senegal between 1995 and 2005 it was  $-2.62$ , while growth was not accompanied by poverty reduction in Zambia between 1998 and 2003. Notice that the availability of data is very heterogeneous across Africa and spells have different durations in different periods and countries.

### 3.2 Sectoral value added and labor shares

The economy in each country  $j$  is composed by sectors ( $i = 1, \dots, n$ ), whose sectoral value added sum up to total GDP. We assume that there is no intermediate consumption, so that:

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<sup>16</sup>Notice that the paper simplifies demographic dynamics by assuming that the labor force corresponds to the population.

Table 3: Observed elasticity of poverty with respect to growth in 22 African countries.

<b>Country</b>	<b>Spell end</b>	<b>(yrs)</b>	<b>Poverty growth</b>	<b>GDP growth</b>	<b>Elasticity</b>
Botswana	1994	( 8 )	-0.12	0.48	-0.25
Burkina Faso	1998	( 4 )	-0.02	0.18	-0.09
Burkina Faso	2003	( 5 )	-0.19	0.16	-1.23
Cameroon	2001	( 5 )	-0.36	0.11	-3.45
Egypt	1996	( 5 )	-0.45	0.08	-5.42
Egypt	2000	( 4 )	-0.19	0.13	-1.39
Egypt	2005	( 5 )	0.00	0.09	0.00
Ethiopia	2000	( 5 )	-0.08	0.08	-1.00
Ethiopia	2005	( 5 )	-0.30	0.18	-1.65
Gambia	2003	( 5 )	-0.49	0.07	-7.37
Ghana	2006	( 8 )	-0.23	0.22	-1.04
Guinea	2003	( 9 )	0.91	0.15	6.07
Kenya	1997	( 3 )	-0.31	0.01	-27.04
Kenya	2005	( 8 )	0.01	0.02	0.32
Lesotho	1993	( 6 )	0.27	0.29	0.93
Lesotho	1995	( 2 )	-0.16	0.07	-2.30
Lesotho	2003	( 8 )	-0.09	0.10	-0.88
Madagascar	2001	( 2 )	-0.07	0.03	-2.23
Mali	2001	( 7 )	-0.29	0.15	-1.96
Mali	2006	( 5 )	-0.16	0.09	-1.81
Mauritania	1996	( 3 )	-0.45	0.03	-15.18
Mauritania	2000	( 4 )	-0.10	-0.05	1.80
Morocco	1991	( 6 )	-0.71	0.17	-4.10
Morocco	1999	( 8 )	1.76	0.02	108.16
Morocco	2001	( 2 )	-0.08	0.07	-1.14
Morocco	2007	( 6 )	-0.60	0.22	-2.75
Mozambique	2003	( 6 )	-0.08	0.34	-0.24
Senegal	2001	( 6 )	-0.18	0.07	-2.47
Senegal	2005	( 4 )	-0.24	0.09	-2.78
South Africa	1995	( 2 )	-0.12	0.02	-7.24
South Africa	2000	( 5 )	0.22	0.02	9.20
Swaziland	2001	( 6 )	-0.20	0.03	-6.09
Tanzania	2000	( 8 )	0.22	0.03	6.42
Tunisia	1990	( 5 )	-0.32	0.03	-10.64
Tunisia	1995	( 5 )	0.10	0.09	1.14
Tunisia	2000	( 5 )	-0.61	0.24	-2.55
Uganda	1992	( 3 )	0.02	0.03	0.61
Uganda	1996	( 4 )	-0.08	0.20	-0.41
Uganda	1999	( 3 )	-0.06	0.08	-0.73
Uganda	2002	( 3 )	-0.05	0.09	-0.57
Uganda	2005	( 3 )	-0.10	0.14	-0.72
Zambia	2003	( 5 )	0.17	0.09	1.79
Zambia	2004	( 1 )	0.00	0.04	-0.11

$$Y_j = \sum_i p_{i,j} Y_{i,j}.$$

In each sector the output  $Y_{i,j}$  results from a production function that exhibits constant return to scales of the production factors:  $Y_{i,j} = A_{i,j} L_{i,j}^{\alpha_{i,j}} K_{i,j}^{\beta_{i,j}}$ , where  $\alpha_{i,j} + \beta_{i,j} = 1$ ,  $K_{i,j}$  is the capital level, and  $A_{i,j}$  is the technological level, which is assumed to evolve exogenously. If the price of the good produced in sector  $i$  is  $p_{i,j}$ , the maximization of profit in each sector with respect to labor in perfect competition implies the following first order condition:

$$w_{i,j} = \alpha_{i,j} \frac{p_{i,j} Y_{i,j}}{L_{i,j}} \quad (1)$$

Condition (1) suggests that wages in a sector are related to the ratio between the value added in the sector ( $p_{i,j} Y_{i,j}$ ) and the labor force employed by the sector ( $L_{i,j}$ ). In particular, for a given labor force employed in sector  $i$ , the larger the value added in the sector, the higher the salary in the same sector. Conversely, for a given value added, the larger the labor force in sector  $i$ , the smaller the wages. Moreover, if the labor share of output ( $\alpha_{i,j}$ ) in one sector is smaller than in another one, *ceteris paribus* wages in the former are lower than in the latter.

According to the first order condition (1), the growth rate of wages in sector  $i$  is:

$$\frac{\Delta w_{i,j}^t}{w_{i,j}^{t-1}} = \left[ \frac{\Delta(p_{i,j}^t Y_{i,j}^t)}{p_{i,j}^{t-1} Y_{i,j}^{t-1}} - \frac{\Delta L_{i,j}^t}{L_{i,j}^{t-1}} \right] \frac{L_{i,j}^{t-1}}{L_{i,j}^t} \quad (2)$$

The evolution of wages in sector  $i$  thus depends positively on the evolution of the value added produced by the sector and negatively on the growth of the labor force employed in the sector.

If labor is perfectly mobile, in equilibrium wages equalize across sectors. Indeed, if one sectors grows more than the others, wages increase, attracting labor force employed in the other sectors. The reallocation of workers in turn decreases wages in the faster growing sector until the two effects compensate each other.

Notice however that, if labor markets are partially segmented, so that it takes some time for labor to move across sectors, an increase in the value added of one sector temporarily translates in higher wages. Over time workers may manage to overcome the barriers<sup>17</sup> and move to the growing sector, gradually leading to the equalization of wages across sectors. The reallocation

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<sup>17</sup>The nature of the barriers partially segmenting labor markets is potentially multidimensional, including geography, ethnicity, and skills.

of labor could potentially require quite a long time though. In the extreme case where labor does not reallocate across sectors, the evolution of wages in each sector only depends on the value added growth in that sector.

People living in poverty are assumed to work and to earn wages corresponding to the sector they work in. As labor income generally is the main source of income for the poor, the evolution of poverty is a decreasing function of the evolution of wages in the sectors composing the economy:  $\frac{\Delta P_j^t}{P_j^{t-1}} = -\varphi \frac{\Delta w_{i,j}^t}{w_{i,j}^{t-1}}$ .<sup>18</sup>

Therefore, poverty should reduce when sectoral value added increases, for a given labor intensity. If the labor force in the sector increases, then the gain of growth in that sector may be offset by labor reallocation over time.

### 3.3 Sectoral elasticity of poverty with respect to growth

While household surveys would allow the assessment of the true sectoral elasticity of poverty with respect to growth and detailed analyses of the profile of the poor across sectors, poverty measures are much more widely available at the country level. Those allow the calculation of a counterfactual elasticity for each sector  $i$  in each country  $j$ :  $\tilde{\eta}_{i,j} = \frac{\Delta P_j^t}{P_j^{t-1}} \frac{\Delta L_j^t}{\Delta p_{i,j}^t Y_{i,j}^t} \frac{p_{i,j}^{t-1} Y_{i,j}^{t-1}}{L_j^{t-1}}$ . The counterfactual sectoral elasticity  $\tilde{\eta}_{i,j}$  represents the elasticity of poverty with respect to growth that would characterize country  $j$  if the whole economy grew as sector  $i$ . Equivalently, the sectoral counterfactual elasticity represents the impact of growth on poverty if only the sector  $i$  composed the economy  $j$ . Notice that the counterfactual elasticity of a sector is a rather abstract measure and does not reflect the structure of the economy of a country.

In order to better understand the drivers of heterogeneous elasticities across sectors, each counterfactual sectoral elasticity  $\tilde{\eta}_{i,j}$  is normalized by the share that sector  $i$  represents in the overall GDP of country  $j$ . The normalized sectoral elasticity of poverty with respect to growth is:  $\eta_{i,j} = s_{i,j}^{t-1} \tilde{\eta}_{i,j}$ , where  $s_{i,j} = \frac{p_{i,j} Y_{i,j}}{Y_j}$  represents the share of sector  $i$  with respect to the overall GDP in country  $j$ . Therefore, the normalized sectoral elasticities scale the potential impact

<sup>18</sup>One way to see that poverty is a decreasing function of the evolution of wages in the sectors composing the economy is decomposing a Watts index of poverty. Indeed, the Watts index  $Watts_j = \frac{1}{L_j} \int_0^q \ln \frac{z}{y_{l,j}} dy_{l,j}$ , where  $z$  is the poverty line,  $q$  is the population living at or below the poverty line, and  $y_{l,j}$  is the income of household  $l$  in country  $j$ , can be decomposed by sectors as follows:  $Watts = \frac{1}{L_j} \left( L_{1,j} \int_0^{q_{1,j}} \ln \frac{z}{y_{l,1,j}} dy_{l,1,j} + L_{2,j} \int_0^{q_{2,j}} \ln \frac{z}{y_{l,2,j}} dy_{l,2,j} + \dots \right)$ . Therefore, the evolution of poverty can be written as decreases in sectoral wage growth:  $\frac{d(Watts)}{dt} = -\frac{L_{1,j}}{L_j} \int_0^{q_{1,j}} d(\ln y_{l,1,j}) dy_{l,1,j} - \frac{L_{2,j}}{L_j} \int_0^{q_{2,j}} d(\ln y_{l,2,j}) dy_{l,2,j}$ .

of growth on poverty of the different sectors in the economy on their relative importance. It should be noted that the normalized sectoral elasticities do not mirror all the effects from the development of a given sector on poverty. However, decomposing the overall elasticity of poverty with respect to growth into sectoral elasticities allows singling out the sectors where growth has a stronger pro-poor potential. Moreover, it also allows the comparison of the pro-poor potential of the same sector in different countries. Table 4 reports the normalized sectoral elasticity of poverty with respect to growth for the 22 countries for which sectoral value added is available.

In order to see the pro-poor potential of the different sectors, table 5 reports some summary statistics for the normalized sectoral elasticities presented in Table 4. The first panel shows that the agricultural sector is characterized by the largest mean and median elasticity of poverty with respect to growth in absolute value, followed by the services sector.<sup>19</sup> However, it is important to notice that the standard deviation of the elasticity relative to agriculture is quite high, reflecting a strong heterogeneity across countries.

The second panel of table 5 presents some summary statistics for the normalized sectoral elasticities grouping African countries into four regions<sup>20</sup>. In Northern Africa the highest median elasticity of poverty concerns growth in the agricultural sector, followed by that in services. While this fact is in line with the average results for Africa as a whole (first panel), it is remarkable that the size of these elasticity is about the double that of the continental median, reflecting the very good record of this region in poverty reduction. Moreover, in Northern Africa growth in the manufacturing and public administration sectors also impressively contributed to poverty reduction. Indeed, the median elasticity of poverty to growth in these two sectors is about ten times the median in the continent as a whole. In Eastern Africa the two sectors with the highest pro-poor potential are by far agriculture and services. In the case of the first sector, it is important to notice that the mean elasticity is much larger in absolute value than the median one and the standard deviation is extremely high. This is due to the very large absolute value of

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<sup>19</sup>Agriculture is always characterized by the largest elasticity also when considering separately three groups of countries, based on the dominant sector of their economy (see grouping of figure 4). The elasticity of the services sector is particularly large in absolute value for the group of countries for which it is the main sector of the economy.

<sup>20</sup>The countries present in table 4 are grouped as follows: Morocco, Tunisia, and Egypt as Northern Africa; Ethiopia, Kenya, Tanzania, Mozambique, Madagascar, Zambia, and Uganda as Eastern Africa; South Africa, Lesotho, and Swaziland as Southern Africa; and Cameroon, Mauritania, Senegal, Mali, Burkina Faso, Guinea, Gambia, and Ghana as Western Africa.

Table 4: Normalized sectoral elasticity of poverty with respect to growth.

Country	Spell end (yrs)	Normalized sectoral elasticity					
		agric.	serv.	manuf.	mining	constr.	pub.adm.
Botswana	1994 ( 8 )	-0.02	-0.01	-0.01	-2.17	-0.01	-0.02
Burkina Faso	1998 ( 4 )	-0.03	-0.03	-0.01	0.00	0.06	0.00
Burkina Faso	2003 ( 5 )	-0.57	-1.22	-0.13	0.00	-0.01	-0.04
Cameroon	2001 ( 5 )	-0.34	3.26	-0.13	1.97	-0.04	0.54
Egypt	1996 ( 5 )	-1.82	-0.39	-0.87	1.41	-0.07	0.14
Egypt	2000 ( 4 )	-0.51	-0.22	-0.11	0.09	-0.06	0.01
Ethiopia	2000 ( 5 )	-33.04	-0.19	-0.09	-0.04	-0.04	0.00
Ethiopia	2005 ( 5 )	-1.22	-0.29	-0.14	-0.01	-0.04	0.08
Gambia	2003 ( 5 )	-1.10	-10.88	-0.55	0.00	0.00	-1.81
Ghana	2006 ( 8 )	-1.55	-0.22	0.15	-0.04	-0.04	-0.04
Guinea	2003 ( 9 )	0.89	4.27	0.25	0.68	0.23	-0.48
Kenya	1997 ( 3 )	0.83	-1.61	9.77	0.04	-0.89	0.00
Kenya	2005 ( 8 )	0.01	-0.07	-0.01	0.00	0.00	0.00
Lesotho	1993 ( 6 )	0.39	0.67	0.05	0.00	0.04	0.11
Lesotho	1995 ( 2 )	-0.06	0.17	-0.03	0.00	-0.05	-0.01
Lesotho	2003 ( 8 )	0.10	0.10	-0.01	0.00	0.07	-0.05
Madagascar	2001 ( 2 )	1.82	-0.67	-0.11	0.00	-0.01	0.10
Mali	2001 ( 7 )	-6.39	-0.51	0.06	0.00	-0.02	0.50
Mali	2006 ( 5 )	-1.17	-0.25	-0.03	0.14	-0.06	-0.25
Mauritania	1996 ( 3 )	-5.13	-1.26	0.64	-15.74	-0.15	3.02
Mauritania	2000 ( 4 )	0.11	-0.08	-0.04	0.16	-0.01	-0.14
Morocco	1991 ( 6 )	-0.31	-2.96	-1.09	0.10	-0.66	-0.32
Morocco	1999 ( 8 )	-1.42	4.68	4.47	0.27	0.68	1.04
Morocco	2001 ( 2 )	-0.58	-0.35	-0.26	-0.07	-0.07	-0.50
Morocco	2007 ( 6 )	-1.33	-0.96	-0.76	-0.05	-0.14	-0.42
Mozambique	2003 ( 6 )	0.58	-0.23	-0.01	0.00	0.00	-0.01
Senegal	2001 ( 6 )	1.15	-0.66	-0.56	0.10	-0.03	0.19
Senegal	2005 ( 4 )	1.03	-0.79	1.78	0.03	-0.04	-1.24
South Africa	1995 ( 2 )	0.02	-0.96	-0.47	0.17	-0.24	0.92
South Africa	2000 ( 5 )	0.04	0.86	10.46	-0.16	-0.26	-0.37
Swaziland	2001 ( 6 )	-0.40	-1.92	-7.93	0.00	-0.03	-12.17
Tanzania	2000 ( 8 )	-3.56	0.31	-0.67	0.00	-0.12	-0.62
Tunisia	1990 ( 5 )	-3.87	-7.28	0.49	0.03	0.00	-1.21
Tunisia	1995 ( 5 )	-0.09	0.34	0.09	-0.03	0.44	0.06
Tunisia	2000 ( 5 )	-0.18	-1.33	-0.48	-0.02	-0.40	-0.22
Uganda	1992 ( 3 )	-0.15	0.08	0.00	0.00	0.04	0.01
Uganda	1996 ( 4 )	-0.58	-0.15	-0.01	0.00	-0.02	-0.02
Uganda	1999 ( 3 )	0.92	-0.23	-0.01	0.00	-0.07	-0.04
Uganda	2002 ( 3 )	-0.43	-0.17	-0.08	0.00	-0.06	-0.03
Uganda	2005 ( 3 )	0.44	-0.19	-0.06	0.00	-0.05	-0.03
Zambia	2003 ( 5 )	-18.49	0.70	0.15	-0.19	0.04	0.05
Zambia	2004 ( 1 )	-0.04	-0.05	-0.02	0.00	0.00	0.03



Table 5: Summary statistics of normalized sectoral elasticity of poverty with respect to growth.

	agric.	serv.	manuf.	mining	constr.	pub.adm.
mean	-1.81	-0.49	0.33	-0.32	-0.05	-0.33
quartile 1	-1.21	-0.76	-0.14	-0.01	-0.07	-0.27
median	-0.25	-0.22	-0.03	0.00	-0.04	-0.02
quartile 3	0.09	0.06	0.06	0.04	0.00	0.07
SD	5.87	2.41	2.67	2.49	0.23	2.05
<b>By African region:</b>						
<b>North</b>						
mean	-1.12	-0.94	0.16	0.19	-0.03	-0.16
median	-0.58	-0.39	-0.26	0.03	-0.07	-0.22
SD	1.20	3.14	1.69	0.47	0.40	0.60
<b>East</b>						
mean	-3.78	-0.20	0.62	-0.01	-0.09	-0.04
median	-0.10	-0.18	-0.02	0.00	-0.03	-0.01
SD	9.82	0.51	2.64	0.05	0.24	0.19
<b>South</b>						
mean	0.02	-0.18	0.35	0.00	-0.08	-1.93
median	0.03	0.14	-0.02	0.00	-0.04	-0.03
SD	0.26	1.06	5.86	0.10	0.14	5.04
<b>West</b>						
mean	-1.09	-0.70	0.12	-1.06	-0.01	0.02
median	-0.46	-0.38	-0.02	0.02	-0.03	-0.04
SD	2.36	3.64	0.61	4.66	0.09	1.16

agriculture elasticities in Zambia and even more in Ethiopia. Southern Africa is characterized by rather small elasticities of poverty with respect to growth in all sectors. However, the role played by the manufacturing and public administration sectors is very heterogeneous, largely due to the case of Swaziland. Sectoral elasticities of poverty to growth in Western Africa are relatively similar to the ones characterizing the continent as a whole. Indeed, agriculture and services are the sectors with the highest pro-poor potential, while median elasticities are close to zero for the other four sectors. Finally, notice that the elasticity of poverty with respect to growth in the mining sector is close to zero in all African regions.<sup>21</sup>.

<sup>21</sup>Christiaensen et al. [2011] find similar results based on an econometric approach.

### 3.4 Direct and indirect components of sectoral elasticity of poverty with respect to growth

The framework sketched in section 3.2 shows that the elasticity of poverty with respect to sectoral growth depends on sectoral labor intensity growth and GDP composition.<sup>22</sup> If over time the labor force in one sector increases, then the gain may be offset by labor reallocation over time. Based on the evolution of wage described by expression (2), the elasticity of poverty with respect to growth in the overall economy is expected to be a function of the dynamics of labor, so that the normalized sectoral elasticity ( $\eta_{i,j}$ ) depends on the sectoral labor growth  $\left(\frac{\Delta l_{i,j}^t}{l_{i,j}^{t-1}}\right)$  and on the sectoral shares over GDP ( $s_{i,j}^{t-1}$ ), where  $t - 1$  indicates the beginning of the considered spell. In order to gain insights on sectoral elasticities and to be able to compare the role that the composition of GDP and the labor intensity play in different economies, we use the following *ad hoc* interpretation, where sectoral elasticity depends on the growth of the labor intensity and the GDP share that a sector represents in the overall economy of each country:

$$\eta_{i,j} = \underbrace{\mu_j s_{i,j}^{t-1}}_{direct} + \underbrace{\nu_{i,j} s_{i,j}^{t-1} \frac{\Delta l_{i,j}^t}{l_{i,j}^{t-1}}}_{indirect\ component} \quad (3)$$

where  $\mu_j$  is constant at the country level, while the coefficient  $\nu_{i,j} < 0$  varies across both sectors and countries. The first term of expression (3) represents the direct effect of sectoral growth. Its weight on poverty reduction depends on the share of the sectoral value added with respect to overall GDP. The second term represents instead the effect of labor reallocation. Indeed, when a sector experiences sustained growth workers may reallocate from other sectors to the expanding one if there are no barriers. Notice that the term for the labor reallocation effect corresponds to the Syrquin effect<sup>23</sup> for one sector (Syrquin [1986]).

<sup>22</sup>This paper links differences in the elasticity of poverty with respect to growth across sectors simply to labor reallocations. However, of course other conditions are crucial as well. In particular, it has been shown that the elasticity of poverty with respect to growth depends on initial income levels (Bourguignon [2003]), inequality (Ravallion [1997]), namely asset inequality (Gallup et al. [1998], (Christiaensen et al. [2011]), access to markets for the poor and, in general, all the factors affecting the translation of growth into increases in the income of the poor. Moreover, the interaction of macroeconomic policies and the circumstances of each country plays a crucial role. If poverty is mainly urban, high food prices are likely to be detrimental, while if the poor are net producers of food, poverty may decline (Khan [2001]).

<sup>23</sup>Syrquin [1986] develops an index of the labor reallocation effect on the aggregate productivity that is equal to  $\sum_{i=1}^n s_i^{t-1} \frac{\Delta l_{i,j}^t}{l_{i,j}^{t-1}}$ .

Expression (3) suggests that, if the labor share is constant in sector  $i$  over the considered period, growth in sector  $i$  decreases poverty proportionally to its GDP share. The larger the share represented by the value added of a sector over GDP, the larger the potential pro-poor impact of that sector. If the labor share of sector  $i$  increases, then labor reallocation constitutes a potential additional and indirect channel of transmission between growth and poverty, whose impact depends again on the sectoral value added with respect to overall GDP.

Based on expression (3) it is possible to recover the structural parameter  $\mu_j$  for each country and  $\nu_{i,j}$  for each sector and country in the following way. If the labor share does not change in a sector over the considered period, then only the elasticity component driven by the direct effect of growth is active, so that it is possible to recover the country parameter  $\mu_j$ .<sup>24</sup> Once recovered the parameter  $\mu_j$ , the sectoral parameters  $\nu_{i,j}$  can be easily computed. However, in practice it is of course possible that no sector is characterized by a stable labor share over the spell. Therefore, we approximate the parameter  $\mu_j$  based on the counterfactual elasticity of the sector for which the labor share variation is the closest to 0.<sup>25</sup> Then, the direct effect (that is, imagining no labor reallocation) is  $\mu_j$  times the sectoral share, *i.e.* the normalized sectoral elasticity. The parameter  $\nu_{i,j}$  is then recovered by difference and the indirect effect consists of the latter times the sectoral value added share times the growth of sectoral labor share. Notice

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<sup>24</sup>Notice that once computed the sectoral and country parameters, it is possible to estimate the evolution of poverty. Indeed, extrapolating sectoral labor shares and relying on estimates of the sectoral share in the overall GDP, we could estimate the potential sectoral elasticity for subsequent periods for which poverty measures are not available, based on expression (3). Furthermore, it is possible to recover the overall elasticity of poverty with respect to growth for each country  $j$  based on sectoral elasticities, weighted for the sectoral contribution to growth:  $\eta_j = \sum_{i=1}^n (c_{i,j} \tilde{\eta}_{i,j})$ , where  $c_{i,j}$  is the contribution of sector  $i$  to the overall growth in country  $j$ . It corresponds to the share of sector  $i$ 's value added over total GDP in country  $j$  times the ratio between the growth rate in sector  $i$  and the overall growth rate of the economy  $j$ :  $c_{i,j} = s_{i,j} \frac{\Delta(p_{i,j}^t Y_{i,j}^t)}{p_{i,j}^{t-1} Y_{i,j}^{t-1}} \frac{Y_j^{t-1}}{\Delta Y_j^t}$ . Therefore, it is possible to estimate the evolution of poverty as:  $\frac{\Delta P_j^t}{P_j^{t-1}} = \sum_{i=1}^n (c_{i,j} \tilde{\eta}_{i,j}) \frac{\Delta Y_j^t}{Y_j^{t-1}}$ . While this approach takes into account the structural characteristics of the economy country-by-country, its limitations should be borne in mind. Indeed, in practice due to scarcity of data the parameters are sometimes recovered on the basis of a single observed time spell for a specific country and thus are especially sensitive to measurement errors. Moreover, the relationship between growth and poverty has been shown to be highly non-linear (Kakwani [1993], Bourguignon [2003]). Therefore, the methodology is more reliable as a descriptive tool to characterize past patterns of sectoral growth and poverty reduction than to estimate poverty evolution.

<sup>25</sup>The identifying assumption that the sector with the labor share growth closest to 0 serves as reference sector (with imputed null growth of the labor share) is aimed at minimizing the impact of the hypothesis necessary to solve the system. Notice that it implies that the reference sector changes across observations. To test the sensitivity of this identifying assumption, we computed the structural parameters that result from choosing the sectors with the second smallest labor share growth as the reference sectors in cases for which the smallest change in the labor force in a sector is the same order of magnitude as the change in the labor force in another sector and conclude that it does not have a strong impact on the results (available upon request).

that when the labor shares are not available (*e.g.* Mozambique), we can assess only the direct effect, this time at the sectoral level. In this case the sectoral  $\mu_{i,j}$  is equal to the counterfactual sectoral elasticity ( $\tilde{\eta}_{i,j}$ ) and the structural parameters  $\nu_{i,j}$  cannot be recovered.

The first part of table 6 reports the country parameters  $\mu_j$  and the sectoral and country specific parameters  $\nu_{i,j}$  computed for all countries for which the information about labor intensity is available. Otherwise, the sectoral and country specific parameter  $\mu_{i,j}$  is reported in the second part of the table. At the country level, for instance, in Ethiopia between 1995 and 2005 the average direct component of the elasticity of poverty with respect to growth was  $-31$ , so that the conditions were especially favorable to poverty reduction. The indirect component of the sectoral elasticity of poverty with respect to growth of the service sector played instead a crucial role in Tunisia between 1985 and 2000; the increasing sectoral value added produced has indeed benefited the increasing labor force in the sector.

## 4 Conclusions and policy implications

The objective of this paper is to shed lights on the elasticity of poverty with respect to growth in Africa and on its heterogeneity across the continent. It does not to provide insights on the general relationship between poverty and growth, but rather looks at the elasticity of poverty in each country to understand which sectors have a greater pro-poor potential and guide policy making.

To do so, this paper investigates the link between growth and poverty reduction at the macro level, relying on sectoral data on value added and labor shares at a subtler level of disaggregation than existing analyses. We find descriptive evidence that the sectoral composition and characteristics of growth are crucial for poverty reduction. We sketch a simple theoretical framework where the elasticity of poverty with respect to growth is interpreted in terms of value added and labor share growth at the sectoral level. This provides the basis for a country-by-country interpretation of the elasticity of poverty with respect to growth that relies on the structure of the economy and its evolution.

This paper shares a similar spirit with Loayza and Raddatz [2010], but adopts a complementary approach. The country-by-country methodology illustrated in this paper can be indeed

Table 6: Structural parameters.

Country	Spell		$\mu_j$	$\nu_{i,j}$					
	end	(yrs)		agric.	serv.	manuf.	mining	constr.	pub.adm.
Botswana	1994	( 8 )	-0.07	0.62	.	-0.23	-3.24	-0.07	-0.10
Egypt	1996	( 5 )	13.69	-0.34	48.71	61.54	.	36.52	46.32
Egypt	2000	( 4 )	-0.92	34.97	4.64	-1.79	-6.14	.	12.25
Ethiopia	2000	( 5 )	-61.31	.	27.50	25.93	28.89	24.89	26.76
Ethiopia	2005	( 5 )	-2.32	-0.13	-2.01	0.52	.	-2.64	-4.83
Lesotho	1993	( 6 )	0.54	-2.28	-1.33	.	-3.84	0.51	-1.32
Lesotho	1995	( 2 )	-0.29	0.11	-1.69	.	-0.01	0.04	-0.46
Lesotho	2003	( 8 )	0.32	0.04	-0.06	0.33	0.10	.	0.61
Madagascar	2001	( 2 )	1.73	76.18	35.20	11.06	-3.33	8.55	.
Mali	2001	( 7 )	0.65	38.51	6.20	.	2.18	2.35	-14.31
Mali	2006	( 5 )	-0.70	-1.14	0.36	.	-5.68	0.29	6.85
Morocco	1991	( 6 )	-1.51	.	-146.14	109.87	-124.06	170.13	-62.55
Morocco	1999	( 8 )	11.81	-1.40	.	-26.41	-0.13	4.47	-0.68
Morocco	2001	( 2 )	-3.36	.	33.99	-21.71	-7.47	49.70	-23.91
Morocco	2007	( 6 )	-2.00	110.47	-4.16	415.75	.	1.32	-117.71
South Africa	1995	( 2 )	1.75	5.34	-16.03	-2.97	.	-126.88	27.95
South Africa	2000	( 5 )	-1.75	-4.91	7.39	37.92	.	-25.30	-1.13
Tanzania	2000	( 8 )	-7.42	.	36.66	-3.04	6.55	4.81	-1.77
Tunisia	1990	( 5 )	2.54	199.98	-116.18	0.00	49.04	.	-111.83
Tunisia	1995	( 5 )	3.80	51.95	-62.05	651.19	79.06	.	-41.63
Tunisia	2000	( 5 )	-3.70	-22.08	22.90	-194.90	-11.77	.	15.72
Zambia	2003	( 5 )	0.72	-1899.39	12.05	-1.88	6.08	0.57	.
Country	Spell		$\mu_{i,j}$	$\mu_{i,j}$					
	end	(yrs)		agric.	serv.	manuf.	mining	constr.	pub.adm.
Burkina Faso	1998	( 4 )		-0.08	-0.08	-0.09	0.12	0.90	-0.04
Burkina Faso	2003	( 5 )		-1.72	-3.00	-0.98	-0.43	-0.25	-0.56
Cameroon	2001	( 5 )		-1.67	7.97	-0.78	15.83	-1.32	7.97
Gambia	2003	( 5 )		-3.84	-22.05	-3.95	0.00	0.00	-22.05
Ghana	2006	( 8 )		-4.30	-0.64	1.65	-0.65	-0.43	-0.64
Guinea	2003	( 9 )		4.40	9.90	6.21	4.16	2.44	-7.17
Kenya	1997	( 3 )		2.67	-3.25	75.92	6.96	-15.71	0.00
Kenya	2005	( 8 )		0.03	-0.13	-0.08	0.09	0.09	0.00
Mauritania	1996	( 3 )		-12.83	-5.86	7.74	-108.94	-3.64	26.38
Mauritania	2000	( 4 )		0.27	-0.36	-0.48	1.13	-0.29	-1.33
Mozambique	2003	( 6 )		1.72	-0.47	-0.05	-0.04	-0.04	-0.15
Senegal	2001	( 6 )		5.50	-1.38	-3.41	7.54	-0.58	2.26
Senegal	2005	( 4 )		5.49	-1.57	11.04	2.56	-0.70	-17.08
Swaziland	2001	( 6 )		-3.64	-6.94	-19.66	1.06	-0.60	-76.40
Uganda	1992	( 3 )		-0.38	0.22	0.10	0.01	0.38	0.22
Uganda	1996	( 4 )		-1.56	-0.37	-0.15	-0.17	-0.18	-0.37
Uganda	1999	( 3 )		2.81	-0.58	-0.16	-0.06	-0.52	-0.58
Uganda	2002	( 3 )		-1.45	-0.43	-0.99	-0.23	-0.42	-0.43
Uganda	2005	( 3 )		1.54	-0.46	-0.83	-0.25	-0.36	-0.46

seen as complementary to the standard econometric estimation of elasticities. The former relies on volatile data that are subject to measurement errors, but captures the structural factors that vary across countries and sectors, while the latter provides only with average relations. With respect to Loayza and Raddatz [2010], this paper focuses only on African countries, exploiting a uniquely rich data set.

Our methodology can be applied to different measures of monetary poverty.<sup>26</sup> Moreover, a straightforward application of the developed methodology assessing the country-by-country relation between poverty reduction and economic growth consists in extending it to other indicators of poverty and in particular non-monetary measures, like infant mortality, malnutrition, or life expectancy at birth.

The analysis of the extent to which economic growth in Africa contributed to poverty reduction has important policy implications. First, the composition of growth is at least as important as its overall intensity. If growth is concentrated in sectors with scarce pro-poor potential, like commodity-driven growth, redistributive strategies are necessary to compensate the weak effect on poverty. Second, it is important to identify the sectors that have the strongest impact on poverty reduction and unleash their potential. In the short term agriculture is a natural candidate in many countries to implement pro-poor policies. For instance, helping small farmers to increase productivity by supporting the diffusion of modern and sustainable technologies could increase the income of workers in the agricultural sector. This could stimulate demand for goods and services and the development of other sectors (*e.g.* manufacturing), and the creation of better jobs. Third, in the medium term industrial policies could contribute to economic diversification and sustainable structural change, by supporting the development of sectors characterized by high pro-poor potential, but which struggle to take off and represent tiny shares of the economy in African countries.

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<sup>26</sup>We applied the same methodology using the poverty gap and results (available upon request) are similar to the ones based on headcount poverty.

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