Africa's Quiet Revolution [*]

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Abstract: This paper documents patterns of structural change in Sub-Saharan Africa between 1960 and 2010. After years of decline, the decade 2000-2010 was marked by growth enhancing structural change. However, the most important contribution to growth during the period 2000-2010 was within sector labor productivity growth in agriculture. Using data from the demographic and health surveys, we confirm a large decline in the share of the population engaged in agriculture over this same period. Also using data from the demographic and health surveys, we show significant heterogeneity in changes in occupational shares across countries but also across sub-groups within countries. In particular, we find that the share of rural youth engaged in agriculture declined by 10 percentage points while the share of rural youth in school increased by 12 percentage points. The changes in schooling are positively correlated with the quality of governance and commodity prices.

1. Introduction

It is well documented that structural change – that is, the reallocation of economic activity away from the least productive sectors of the economy towards more productive ones – is a fundamental driver of economic development (Duarte and Restuccia, 2010; Herrendorf et al., 2014). In particular, the movement of labour out of less productive semi-subsistence agriculture and into the more productive sectors of manufacturing or services, in both urban and rural areas, is needed to sustain increases in overall productivity and living standards and to drive poverty reduction. This is true both from a theoretical standpoint and as seen from actual experiences of countries throughout stages of their development.[1] In other words, countries that pull themselves out of poverty also exhibit positive structural change.[2]

Until very recently, African countries have largely been absent from empirical analyses in this literature, and thus there is little evidence on how structural change has played out in African countries since the achievement of independence half a century ago. A major reason for this absence relates to data: economic data to undertake such analysis have for most African countries been unreliable or non-existent. Importantly, then, data issues still constrain the analysis of structural change in Africa. Recent attempts to shed new light on growth using alternative sources of data (Young, 2012; de Vries et al., 2013) are welcome, but much more could be done. These issues are important enough to warrant a separate section in this paper.

A deeper reason for the lack of research on structural change in Africa is poverty itself. Until recently, few African countries have enjoyed the sustained economic growth needed to trace out the patterns of structural transformation achieved in earlier decades elsewhere. The start of the 21st century saw the dawn of a new era in this regard, with African economies growing as fast or faster than the rest of the world. Examining the recent process of structural change in Africa, and how it has interacted with economic growth, could yield enormous benefits. For one, the theory and stylised facts of structural change enable several predictions about the allocation of the factors of production for countries at different stages of development; as Sub-Saharan Africa is now by far the poorest region of the world, including African countries in this could enrich current understandings

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[1] See Herrendorf et al. (2014) for an overview of and many references on this subject.
[2] The converse is not true, however: countries with structural change do *not* also necessarily achieve poverty reduction. Structural change into protected or subsidised sectors comes at the expense of other activities, and is therefore not associated with sustained growth out of poverty for the population as a whole. Structural change is effective at reducing poverty only when people move from lower- into higher-productivity activities.

of the mechanisms that drive structural change. Perhaps more importantly, and most pertinent to this paper, is that such an analysis could offer insights regarding the continent's recent economic performance – both its prolonged period of weak economic growth since the 1970s and the period of stronger growth over the past decade.

We begin our analysis by asking whether it is reasonable to compare structural change in Africa with that in other regions during the same time period. Average incomes in Africa are significantly lower than in East Asia, Latin America and all other regions and, if countries at different stages of development tend to exhibit different patterns of structural change, the differences between Africa and other developing regions may be a result of their different stages of development. Motivated by this possibility, we explore how *levels* of employment shares across sectors in African countries compare with those in other countries, controlling for levels of income. We find that African countries appear to fit seamlessly into the pattern observed in other countries. In other words, given current levels of income per capita in Africa, the share of the labour force in agriculture, manufacturing and industry is roughly what we would expect.

Our analysis also reveals that African countries stand to benefit the most from structural transformation, and have begun to reap these gains. Indeed, McMillan and Rodrik (2011) find a significantly positive correlation between a country's level of development and its' sectoral variation in productivity levels; in other words, the poorer a country is, the wider the gap between its most productive and least productive sectors. There is thus potential for enormous economic gain in African countries from reallocating activity from low- to high-productivity sectors. For reasons not well understood, this potential was not realised over much of the period between 1960 and 2010. However, more recent work demonstrates that structural change in Africa has begun to contribute to the continent's growth (de Vries et al., 2013; McMillan, et al., 2013). And in this paper, we show that country averages mask significant heterogeneity in the experience with structural change both among rural and urban populations as well as among youth and the older population.

The reasons for the turnaround are unclear, but a number of recent events could have made it possible. For example, several African countries were still consolidating structural adjustment well into the late 1990s (Thurlow and Wobst, 2004). And by 2000, a number of countries were well positioned to take advantage of the commodity price boom that began in that year and that persists to this day. Indicators of governance for many countries in Africa began to pick up in the early

1990s, and continued to rise between 2000 and 2010. Meanwhile, the incidence of civil conflict fell over this same period. African countries have witnessed commodity booms before, but it may be that improvements in governance and also in external factors have come together in a way that benefits more people than it has in the past.

To explore this possibility, we use information on occupation, gender, age, employment status and location from Demographic and Health Surveys (DHSs). DHSs are conducted by Macro International Inc., Calverton, Maryland (usually in cooperation with local authorities and funded by the US Agency for International Development, USAID). They are nationally representative surveys designed to collect detailed information on child mortality, health and fertility, as well as on households' durables and on dwelling quality. They are also designed to collect information on education, employment status and occupation of women and men between the ages of 15 and 49 years. Importantly, the design and coding of variables (especially on type of occupation, educational achievements, households assets and dwelling characteristics) are generally comparable across countries and over time. Finally, the sample includes considerable regional variation: 90 surveys are available for 31 African countries and 92 surveys for 37 non-African countries. Established in 1984, more than 200 standard DHSs from around 70 countries were conducted between 1985 and 2012. For most countries, more than one survey (up to seven) is available. The average sample size is between 5,000 and 30,000 households.

Using the DHSs and focusing exclusively on Sub-Saharan Africa, we find that - for a much larger sample of countries than previously used - the average continent-wide shifts in occupational structures broadly mimic results reported by McMillan, Rodrik and Verduzco (2013) and de Vries et al (2013) who used a combination of household surveys, census data and labour force surveys. In particular, the share of the labor force working in agriculture has declined significantly while the share of the labor force working in professional jobs, unskilled manual jobs and services has increased. We also find a substantial increase in labour force participation that is more pronounced for women. Not surprisingly, there is significant heterogeneity in changes in employment shares across countries, genders, locations and age groups. Finally, occupational status and education are highly correlated; the least educated workers are in agriculture while the most educated workers are in professional jobs.

Probably the most important changes we uncovered are those taking place among rural youth. Over a 10-year period, young rural males are almost 10 percentage points less likely to report that they work in agriculture and 12 percentage points more likely to report that they are in school. The results for females are similar, although not as large. These results are notable for at least three reasons. First, these changes are taking place at a time when commodity prices are at an all-time high. The rise in commodity prices could have just as well led to a reduction in the share of the young remaining in school because of the increased opportunity cost of schooling (Edmonds and Pavcnik, 2005). Second, evidence from the United States suggests that technological innovation in agriculture is more likely with an educated population (Rogers, 1962). And third, recent evidence suggests that educated youth are more likely to engage in the agricultural policymaking process (Mapila, 2014).

The rest of this paper is organised as follows. In Section 2, we place our discussion of structural change in historical context and characterise its' nature in Africa over the period 1960-2010. We show that countries in Africa are where we would expect them to be, given their current levels of income. We also present evidence that structural change contributed positively to economic growth in Africa between 1960 and 1975, negatively to economic growth between 1975 and 2000 and then positively to economic growth between 2000 and 2010. In Section 3, we discuss the 'data problem' and describe our empirical approach to understanding structural change in Africa. Section 4 explores potential explanations for the patterns we observe in Africa from 1992 to 2012. Section 5 concludes by interpreting the results in a broader context and highlighting directions for future research.

2. Background: structural change in Africa and elsewhere

Traditionally, the concept of structural change has been framed in terms of reallocation of economic activity between three broad sectors – agriculture, manufacturing and services – which accompanies and facilitates the process of economic growth. In the early stages of economic development, people devote a disproportionate share of their abundant labour and scarce capital to agriculture and other 'traditional' activity, since they have no other way to feed themselves and meet basic needs. As these resource-poor rural people accumulate capital, diminishing returns on limited agricultural land lead them to invest an increasing share of their capital and labour in other activities. Increases in national income and purchasing power also help pull workers and their savings out of

agriculture into more 'modern' skill- and capital-intensive sectors like manufacturing and services. These more dynamic sectors – particularly manufacturing, but also services such as financial intermediation, wholesale and retail distribution, education and health care – can grow much more rapidly than agriculture because they are not constrained by the available farmland, and also because they face more elastic demand.

The process of structural change is integral to the ability of developing countries to pull themselves out of poverty, and early development economists such as Lewis (1955) recognised it as such. Lewis and others observed the historical reallocation of workers from traditional agriculture towards 'modern' industry in Europe, North America and East Asia, and predicted that other regions would follow the same development process. Duarte and Restuccia (2010) find that structural change did indeed play a substantial role in the productivity catch-up of developing countries in their sample – relative to the US – over the period 1950-2006. As predicted, the gains are particularly dramatic in sectors with international trade.

Duarte and Restuccia (2010) find that productivity differences in agriculture and industry between rich and developing countries have narrowed substantially, whereas productivity in services has remained significantly lower in developing countries relative to rich countries. Thus, developing countries with the most rapid growth rates have typically reallocated the most labour into high-productivity manufacturing, allowing aggregate productivity to catch up.[3] The authors conclude that rising productivity in industry, combined with structural change out of agriculture and into industry, explains 50% of the catch-up in aggregate productivities among developing countries over their sample period of 1950-2006. Notably, this sample does not include any African countries.

More recent work by Rodrik (2012) underscores the importance of this type of structural change. Using a large panel of countries, he finds that, since 1960, formal sector manufacturing has exhibited *unconditional* convergence in labour productivity regardless of country- or regional-level factors. This finding is important because it suggests that the destination sector in which less developed countries eventually catch up with the productivity levels of developed countries is manufacturing.

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[3] Conversely, where the manufacturing sector stagnates and structural transformation involves primarily reallocation of workers into lower-productivity sectors, aggregate productivity is slower, especially among developing countries whose productivity in services remains low – relative both to agriculture in other countries and to other sectors within the country.

Some stylised facts of the pattern of structural change over the course of development have emerged from this literature. As countries grow, the share of economic activity in agriculture monotonically decreases, and the share in services monotonically increases. The share of activity in manufacturing follows an inverted U-shape, increasing during low stages of development as capital is accumulated, then decreasing in high stages of development where higher incomes drive demand for services and labour costs make manufacturing difficult. Herrendorf et al. (2014) document this pattern for a panel of mostly developed countries over the past two centuries, and Duarte and Restuccia (2010) note a similar process of structural change among 29 countries over the period 1956-2004.

With this insight in mind, we turn to an exploration of the evolution of the distribution of employment between sectors across levels of income experienced in Africa, and how this compares with the patterns seen historically in other regions over the course of their development. Using the patterns seen in other regions historically as a baseline, we will be able to gauge the extent to which structural change in Africa compares with what we would 'expect' based on its income levels. To this end, we started by aggregating the nine sectors in the database used by McMillan and Rodrik (2011) into 'agriculture', 'industry' and 'services', by adding manufacturing, mining, construction and public utilities to make 'industry'; adding wholesale and retail trade, transport and communication, finance and business services and finally community, social, personal and government services to create 'services'; and leaving 'agriculture' as-is.[4] To this sample, we add an additional 10 countries for which we were able to obtain data on employment shares for these three sectors[5]. Our measure of 'development' is log gross domestic product (GDP) per capita in international dollars from Maddison (2010).

Figure 1.a plots employment shares in agriculture, industry and services, respectively, on the y-axis and log GDP per capita on the x-axis for the 19 African countries in our sample for the years 1990 and 2005. The share of employment in agriculture decreases, and that in services increases, monotonically with income; the share in manufacturing also monotonically increases. In other words, recent patterns of structural change in Africa fit into the stylised facts of other regions' historical development. Note that industry does not follow the inverted-U shape documented in

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[4] This aggregation is consistent with that used in Duarte and Restuccia (2010), who also use the Groningen Growth and Development Centre (GGDC) database (along with other sources) to construct their dataset.
[5] Data for this exercise are based on household and labour force surveys and were obtained from Alun Thomas at the International Monetary Fund (IMF).

Herrendorf et al. (2014) and Duarte and Restuccia (2010), but this is because each country's GDP per capita is below the threshold at which the rate of change of industry's employment share changes from positive to negative.[6]

Although Figure 1.a suggests the patterns of employment allocation between agriculture, industry and services are qualitatively similar to the stylised facts based on the experience of other regions, it may be that they differ quantitatively. For instance, although Figure 1.a confirms that the agricultural employment share and services employment share in Africa decrease and increase, respectively, with level of income, it could be that the *level* of agricultural or services employment in Africa is higher than that in other regions (the latter being argued in Badiane, 2011), perhaps because of resource endowments or productivity levels. To investigate this question, we obtained data used in Duarte and Restuccia (2010) that show shares of hours worked in the three broad sectors for a panel of 29 countries (none of which are in Africa) from 1950 to 2006.[7/8] Again, we obtained GDP per capita for these countries from Maddison (2010). By directly comparing the relationship between income levels and distribution of employment in Africa in recent years with that in other regions over the past several decades, we can obtain an idea of whether the process of structural change in Africa is playing out differently than we would expect given current levels of income.

Figure 1.b plots employment shares in agriculture, industry and services, respectively, on the y-axis and log GDP per capita on the x-axis simultaneously for our sample of African countries and for those in Duarte and Restuccia (2010). Each country in our sample again has two data points (1990 and 2005), and each country in the Duarte and Restuccia (2010) sample has all available data points. Two things are immediately evident from Figure 1.b. First, per capita incomes in recent years in most African countries in our sample are lower than those seen in most of the world since 1950. Second, distributions of employment among the African countries fit almost seamlessly into those seen over the past six decades in other regions. In other words, controlling for income, the quantitative patterns of structural change in Africa are roughly what we would expect based on what has transpired elsewhere.

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[6] Herrendorf et al. (2014) note that this peak in industry's employment share occurs at a log GDP per capita of about 9. Mauritius, whose GDP per capita is the highest in our sample and was about 9 in 1990, fits into this peak: its log GDP per capita increased to roughly 9.5 in 2005 and its share of employment in industry decreased.

[7] Data were downloaded from Margarida Duarte's website on 24 July 2012.

[8] Note that the Duarte and Restuccia (2010) data measure share of hours worked, whereas our data measure share of total employment.

Thus, our preliminary analysis reveals that, when we compare *levels* of employment in Africa with those in other regions across levels of development, the pattern among our sample of African countries appears to fit seamlessly into that experienced by other regions. It also reveals that (i) the countries in Africa remain the poorest in the world and (ii) the scope for growth-enhancing structural change in Africa is significant. With this in mind, we turn now to a description of the patterns of structural change across Africa.

Figure 2 presents the contribution of structural change to Africa's growth for the period 1960 to 2010, based on de Vries et al. (2013). It uses a new dataset compiled by the Groningen Growth and Development Center (GGDC) for Africa that includes data on value added and employment for 12 African countries for 9 sectors and broken out by gender. The results for the period 2000 to 2010 are similar to those presented in McMillan et al. (2013). The main difference between the two sets of results is that de Vries et al. (2013) decompose the structural change term into two components: static and dynamic. Thus, overall growth is decomposed into three terms: within-sector productivity growth, a static reallocation effect and a dynamic reallocation effect. Within-sector productivity growth is a familiar term that measures changes in value added per worker for a given sector and time period. The static reallocation effect measures the change in overall value added per worker that arises as workers move from sectors with below- (above-) average productivity levels to sectors with above- (below-) average productivity levels. It is positive when workers move from relatively low-productivity sectors to relatively high-productivity sectors, and negative when the reverse occurs. It does not take into account the possibility that worker flows will have an impact on sectoral productivity growth rates. The dynamic reallocation effect, also known as the cross term or interaction term (Timmer, 2000; van Ark, 1996), represents the joint effect of changes in employment shares and sectoral productivity. It is positive (negative) if workers are moving to sectors that are experiencing positive (negative) productivity growth. Hence, de Vries et al. have decomposed the structural change term used by McMillan and Rodrik (2011) and McMillan et al. (2013) into two terms: whether workers move to above-average productivity *level* sectors (static reallocation effect) and whether productivity *growth* is higher in sectors that expand in terms of employment shares (dynamic reallocation effect).

Figure 2 makes it clear that the period 1975-1990 was a period of economic decline for most African countries; within-sector productivity growth was negative and the combined static and dynamic reallocation effects contributed slightly positively to economic growth. The net result is that

growth in economy-wide value added per worked was negative during the period 1975-1990. This is in stark contrast with the period 1960-1975 and the period 2000-2010. Like McMillan et al. (2013), de Vries et al. (2013) find that, *overall*, structural change contributed positively to Africa's growth during the period 2000-2010. Figure 2 also shows that within-sector productivity growth during Africa's most recent decade in history was greater than within-sector productivity growth during the period 1960-1975. This is good news for Africa given recent concerns over developing countries' ability to follow the path of Asia, where structural change was a key driver of economic growth.

Also encouraging is the fact that within-sector productivity growth has been steadily increasing since 1975, and that its contribution to overall growth doubled between 1990-2000 and 2000-2010. Moreover, Table 1 shows that the bulk of within-sector productivity growth has come from increases in output per worker in agriculture. Overall, the combined static and dynamic effects of structural change remain muted, indicating an as-yet unexploited source of potential growth for the countries of Africa. However, it is worth emphasising that the static reallocation effects of structural change are likely to have had a significant positive effect on the wellbeing of individuals across Africa. As both McMillan and Rodrik (2011) and de Vries et al. (2013) note, the majority of labour reallocation in recent years has been characterised by a movement of labour out of agriculture and into services. On average, output per worker in services is more than double output per worker in agriculture. The implication is that, as workers move from agriculture to services, consumption levels also rise. Indeed, in a background paper for the World Development Report 2013, McMillan and Verduzco (2012) show that, for a handful of countries, the correlation between value added per worker and consumption per worker across sectors is 0.85.

To better understand the implications and sustainability of Africa's recent growth episode, we take a two-pronged approach. We start by digging into the robustness of the changes in employment shares using data from the DHSs, which enable us to examine changes in occupational shares by country and disaggregated by age, gender and location. This is preceded by a brief discussion of some of the issues surrounding data quality in Africa. In Section 4, we follow up with an examination of plausible explanations for observed changes in employment shares.

3. The data problem

Sectoral employment shares for Africa are difficult to come by, even at the most aggregate of levels. For example, the World Bank's World Development Indicators report employment shares in

agriculture for only six Sub-Saharan African countries. The scarcity of this type of data is one of the things that prompted researchers at the GGDC to construct a new database for 12 African countries that includes value added and employment shares for 12 African countries for 9 sectors and broken down by gender for the period 1960-2010.

The reasons for the lack of reliable data are unclear. Some scholars have argued that the poor quality of African statistics is related to the weak capacity to collect, manage and disseminate data; inadequate funding of statistical offices; diffuse responsibilities on who is collecting what; and fragmentation in surveys and gathering exercises (Devarajan, 2013) (Jerven, 2013). Young (2012) has argued that many African countries do not have a well-established statistical system, not even reporting national accounts data on a consistent basis. He therefore explores alternative sources of information on national income using DHS data.

However, as noted by researchers at the GGDC, many African countries have a considerable history of collecting national accounts data and conducting labour force and household surveys. To construct their database, the researchers at the GGDC take an in-depth country-by-country approach to using procedures that aim to ensure internal, inter-temporal and international consistency. Moreover, the DHS data can be used to calculate employment shares for at least 24 African countries so it is unclear why the World Development Indicators contain practically no information on employment shares for African countries.

As de Vries et al note, the quality of African statitics varies considerably over time. Broadly speaking, statistical quality has been through three major waves (Lehohla, 2008). During the first wave, roughly the 1960s to the 1970s, many African statistical offices developed national accounts based on the UN system of national accounts. During Africa's period of economic decline, the quality of African statistics also deteriorated. This is not only due to a lack of resources but also to an increase in informal activities which made it more difficult to track economic activity. More recently, there has been a revival in the quality of statistics for Africa, with various statistical offices implementing surveys and censuses to obtain a more accurate measure of economic activities within their national borders.

As pointed out by de Vries et al (2013), academic debates over the quality of African statistics has also been sporadic. The Review of Income and Wealth first published an issue on national accounts data in 1962. This was followed by discussions from Bondestam (1973) and

Blades (1980). As Africa's economies declined, so too did the interest in Africa's statistics. Around 2000, when statistics begand to improve, there was a revival in attention by researchers. For example, a recent special issue in the *Review of Income and Wealth*, contains articles on the quality of Africa socioeconomic data (Volume 59 Issue 2, 2013).

To investigate the robustness of the changes in employment shares reported in McMillan and Rodrik (2011) and de Vries et al (2013) we use information from the DHSs to study changes in employment shares. Although the DHSs are not naturally designed as labour force surveys, they provide comprehensive information on employment status and occupation characteristics of women and men aged between 15 and 49 (sometimes between 15 and 59). Information on men is not provided for all DHS countries and survey rounds. In total, our sample contains information on about 750,000 women and 250,000 men aged between 15 and 59 years.Because the samples are nationally representative, they include employment in both formal and informal sectors. This paper makes no attempt to distinguish between the two, and notes only that they are both included.

An advantage of the DHS in analysing determinants and trends of occupation types across countries and over time is that the design and coding of variables (especially on type of occupation, educational achievements, households assets and dwelling characteristics) are generally comparable across countries and survey rounds. At the household level, the DHS provides information on household socioeconomic characteristics, household structure and family composition, enabling analysis of the distribution and determinants of occupation types by socioeconomic characteristics and of changes in the distribution over time. Note that this does not mean there are not 'recode' errors in the original DHS files. In a much-expanded version of this paper (forthcoming), we provide detailed information about data errors we uncovered and measures we took to correct them.

A second and important advantage of the DHS data is that it in addition to an individual's occupation, the data contains information on the individual's gender, age, educational status and location. Thus, for example, it allows us to examine changes in occupational status for rural and urban youth separately and for men and women separately.

A disadvantage of DHS data is that household income and expenditures are not included, but available information on household assets can be used to construct an asset index to proxy for individual or household welfare. Additionally, measures of nutrition, health and education can be combined with information on assets to gain a more complete measure of wellbeing.

For the purposes of this paper, we restrict our sample to African countries for which at least two DHSs are available, allowing us to analyse trends over time. The list of countries is reported in Table A.1. The large coverage of countries and survey years provides us with a sample size of 24 African countries, capturing the period between 1993 and 2011. In Table A.2, we compare the countries in our sample to excluded countries to assess whether our sample is somehow biased towards, for example, countries not in conflict. We find that our sample of African countries covers 77 percent of the population in Sub-Saharan Africa. When we compare average infant mortality rates, education levels and incidence of conflict we find no statistical difference between the countries in our sample and the rest of Sub-Saharan Africa. However, the countries in our sample have an average level of GDP per capita which is significantly lower than the excluded countries and a slightly higher share of the labor force engaged in agriculture. These latter differences are not surprising given that the DHS are funded by the United States Agency for International Development and thus the mandate is to focus on the poorest countries in the world.

To assign individuals to occupational categories, we rely on the question about occupation for women and men. The DHS provides a grouped occupation variable that relies on the question that asks what the respondent mainly does for work.[9] The respondent's response is grouped into one of nine categories: not working; professional/technical/managerial; clerical; sales; agricultural – self employed; agricultural – employee; household and domestic services; skilled manual; and unskilled manual. We further combine the groups of clerical, sales and services into one group. As an additional category, we combine women and men from agricultural self-employment and agricultural employees into an overall group of agricultural occupation. Finally, we include a category 'in school', both to account for difference between the young and old and to establish trends in schooling over time. Thus, we are left with six 'occupational' categories for adults: agriculture; services; skilled manual labour; unskilled manual labour; professional; and not working. For youth – those aged 16-24 years – we add the category 'in school' to make it seven 'occupational' categories in total.

The first thing we note is the enormous cross-country heterogeneity in employment shares. For example, in the year 2000, the share of the working population engaged in agriculture in Rwanda was 84%; in that same year in Namibia it was only 11%. Reporting a continent-wide average is problematic because not all countries are surveyed in the same year. Similarly, there is quite a bit of heterogeneity in changes in employment shares over time across countries. For example, although *on*

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[9] Variable v717: What is your occupation, that is, what kind of work do you mainly do?

average the share of the population working in agriculture fell by around 6 percentage points over the decade 2000 to 2010, in Madagascar it increased by 12 percentage points between 1997 and 2009 whereas in Mozambique it fell by almost 16 percentage points between 1997 and 2011.

Likewise, there is significant heterogeneity across gender, age groups and location. For example, in Ethiopia in 2000, the share of all working women who reported that they worked in agriculture was 54%; the share of working men was 72%. Additionally, between 2000 and 2011, the share of women in Ethiopia who reported that they worked in agriculture fell by 17 percentage points; the share of men fell by only 7 percentage points. Not surprisingly, rural inhabitants are much more likely to report that they work in agriculture and youth are less likely to do so. These last two facts are true for all countries in the sample and for all years.

With these caveats in mind, it is nevertheless instructive to report the continent-wide trends. Part of the reason for doing this is so that we can compare the DHS results to the results in McMillan and Rodrik (2011), McMillan et al. (2013) and de Vries et al. (2013). A deeper reason for doing this is that we would like to know whether *on average* countries in Africa are exhibiting patterns similar to those found in other regions or whether Africa seems to be transforming differently from other regions of the world. To obtain a continent-wide average for changes in employment shares, we use the following strategy. For each country and occupation, we run the following regression:

$$occupation_{it} = \propto_0 + \propto_t Year(t) + \epsilon_{it}. \quad (1)$$

Occupation is a binary variable that takes on values of 1 or 0 depending on the individual respondent's occupation. Dummies for all survey years except the initial survey year are included in the regression, allowing us to interpret the coefficient on the constant term as the share of the population engaged in occupation x at beginning of the sample period. The coefficients on the year dummies are interpreted as the change in the share of the population working in occupation i relative to the base year. Thus, for example, if the first survey was run in 2000, the second in 2005 and the final in 2012, the regression will include dummies for 2005 and 2012; then the coefficient on the 2012 year dummy tells us how much lower (higher) is the share of the population working in occupation x in 2012 relative to 2000.

In Figure 3, we report an unweighted average of the coefficients on the final year dummy for all countries in our sample across all occupations broken out by gender. Since gaps between survey

years vary, we first annualise the change by dividing the coefficient by the number of years between the first and the last survey and then multiply this number by 10 to get an idea of the changes that took place during the decade 2000-2010. The red bars indicate changes for females and the blue bars changes for males; grey bars are for the entire population and are skewed towards the results for females, since overall there are many more females than males in the sample.

The results for males are more or less consistent with what others have written about changes in employment shares in Africa. The share of the male labour force reporting that they work in agriculture fell by an average of 6 percentage points, while the share of the male labour force working in services, professional jobs and unskilled manual jobs each rose by almost 2 percentage points. For women, the occupational shifts are less pronounced and entail a 2-percentage-point decline in the share of the population reporting that they work in agriculture and an equivalent increase in the share of the population reporting that they work in professional jobs. We also learn something new from Figure 3: labour force participation has increased by a little over 6 percentage points for women and 4 percentage points for men.

In the interest of space, we cannot reproduce here all of the many results we uncovered using the DHS data. However, one is too important to overlook. In particular, we show in Figure 4 the striking changes that are taking place among rural youth. Over a 10-year period, males are almost 10 percentage points less likely to report that they work in agriculture and 12 percentage points more likely to report that they are in school. The results for females are similar, although not as large. These results are striking because this is taking place at a time when commodity prices are at an all-time high. The rise in commodity prices could have just as well led to a reduction in the share of the young remaining in school because of the increased opportunity cost of schooling.

In summary, using an alternative source of information – the DHS – we have shown for a much larger sample of countries that continent-wide shifts in occupational structures broadly mimic results found using household surveys, census data and labour force surveys. We have also shown substantial increases in labour force participation and rural schooling not previously documented. Finally, we have documented a substantial degree of heterogeneity in changes in employment shares across countries, genders, locations and age groups. In the next section, we exploit this heterogeneity to better understand the relationship between commodity prices, governance and changes in employment shares across Africa.

4. Toward an understanding of changes in occupational shares: 1993-2012

All of the previous results point to a decline in the share of the population engaged in agriculture across Africa over the past two decades. This decline has been much more dramatic in some countries. It has on average been matched by an increase in the share of the population working in services, professional jobs and unskilled manual labour. It has also been accompanied by a significant increase in the share of rural youth staying in school and an increase in labour force participation. It has not been accompanied by an increase in the share of employment in formal sector manufacturing. Nevertheless, as noted previously, these structural changes have brought about significant increases in living standards for those able to move out of agriculture.

Figure 2 summarises the changes by decade and naturally leads one to ask the following distinct but related questions: why do things seem to be turning around and how sustainable is this recent growth episode in Africa? Put differently, how might one go about explaining the stark differences between Africa's economic performance from 1975 to 1990 and its more recent performance (2000 to 2010)? Without a better understanding of what is driving Africa's recent performance, it is impossible to know whether or not the recent growth is sustainable.

The most obvious reason for the turnaround is the spike in agricultural commodity prices. Figure 5 shows the trend between 1960 and 2010 in country-specific indicators of commodity price shocks. To obtain these indices, we follow Henderson et al. (2013). These indices summarise the individual commodity price environment each country faces by appropriately weighting the different prices of commodities each country exports. The intuition behind this is that a country's geographic characteristics determine the long-term export bundles each country exports. In turn, the commodity price environment each country faces depends on the individual prices of each country's export bundle. We first calculated country-specific price indices using all 37 agricultural and non-agricultural commodities used by Henderson et al. Using a similar methodology, we calculated two other indices: one for agricultural commodities and one for non-agricultural commodities. Clearly, the commodity price increases between 2000 and 2010 are the largest and most prolonged in Africa's recent history.

There is, though, another plausible explanation for the turnaround. There are strong indications that governments in Africa are becoming more 'developmental'. Two good examples of this are the Comprehensive Agriculture Development Programme (CAADP) and the adoption of

the Land Governance Assessment Framework (LGAF). CAADP is an Africa-led and Africa-owned agenda that serves to provide a common framework for policy and partnership renewal in the agriculture sector. Its primary objectives are to increase investment in agriculture and improve agriculture policy and strategy design and implementation. Through these outcomes, CAADP is supposed to help meet the goals of higher growth, poverty reduction and food and nutrition security. Specific benchmarks for participating countries are to allocate at least 10% of the national budget to agriculture and to achieve an annual agricultural growth rate of 6%.

A number of African countries are also participating in LGAF, which is jointly managed by the World Bank and the International Food Policy Research Institute (IFPRI). LGAF is designed to bring stakeholders together in country to take stock of existing land tenure practices, to identify areas for interventions that will improve tenure security and to monitor progress over time. The renewed interest in land tenure issues stems in part from increased foreign investment in land in Sub-Saharan Africa. As a result of this interest, many governments are also grappling with how best to screen commercial investments in land and how to engage local communities in the process. Important outstanding issues typically include (i) providing clarity on property rights, (ii) valuation of land and (iii) analysis of the economic and social costs and benefits of such projects.

Using the Polity IV database, we confirm a general trend towards improved governance across Africa. Figure 6 plots the population weighted average Polity IV score for 46 countries in Sub-Saharan Africa between 1960 and 2011.[10] To determine whether the particular Polity IV is driven by changes in the composition of the sample – depending on which countries have data for a particular year – we note that the scores for most countries appear in the dataset around the 1960s and 1970s and, as soon as a country shows up in the data, all observations for subsequent years are non-missing. Hence, the sample of countries for a particular year can change only if a new country is added to the dataset, possibly because that country gained independence in that year. Of the 46 Sub-Saharan Africa countries in the Polity IV dataset, 23 countries have data starting in 1960. An additional 9 have data starting between 1961 and 1965; 11 have data starting between 1966 and 1975; and 3 start having data from 1990.

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[10] Polity IV has a particular coding for certain variables. These special codes can take values such as -66, -77 or -88. In order to obtain scores that were not affected by these coding issues, we ignored these values when calculating the average scores.

To account for these changes in the composition of the sample as new countries appear, we divided the countries into four main cohorts. The first cohort includes only those countries with data starting in 1960; the second all countries with data from 1965 on; the third countries with data from 1975; and the last all countries with data from 1990 on. We show the trends of the weighted average for each cohort in solid, bright lines. Red corresponds to the 1960 cohort, yellow to the 1965 cohort, green to the 1975 cohort and blue to the 1990 cohort. As can be seen, the lines for each cohort follow each other very closely; hence, the addition of new countries to the sample has virtually no effect in the trends of the average scores.[11]

Finally, the poor performance of Africa during the period 1975-1990 is not all that surprising, as it coincides with the period of structural adjustment in many African countries. Post-independence, many countries in Africa maintained and expanded the large parastatal sector that had its roots in the colonial period. Most of these large firms proved to be economically and socially unsustainable, leading to more than a decade-long process of structural adjustment, which started in the early 1980s and lasted well into the 1990s. The consequences of these structural adjustment programmes included large layoffs, which in some countries resulted in an anomalous urban to rural migration. Thurlow and Wobst (2004) provide a vivid account of this sort of thing in Zambia. They show that the period of structural adjustment there was marked by a significant decline in the share of the labour force employed in the formal sector and a movement of labour out of industry and back to agriculture. Much of this was precipitated by the privatisation of state-owned factories. Finally, they show that, between 1999 and 2001, things were beginning to turn around. They attribute this to a more stable macro and political environment, in which the government was able to mitigate the effects of Zambia's copper exports on the exchange rate and domestic prices.

The story in Mozambique is not so different. After a prolonged period of civil war, Mozambique entered into its first structural adjustment programme with the World Bank in 1987 (McMillan et al., 2003). The first period of reform lasted until 1990. A second, more aggressive, period of reform began in the early 1990s. One of the casualties of this reform was state-owned enterprises. For example, by the end of 1994, all of the formerly state-owned cashew-processing

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[11] These trends could also be influenced by a single or a few large countries. To check this, we took subsamples of each cohort and included the average scores for these subsamples in the figures. For each cohort, we took subsamples at random: 10 random draws of 50% of the cohort sample and another 10 random draws of 25% of the cohort samples. If a single country is driving the trends, then the trends of the random subsamples should differ considerably from that of the cohort's full sample. Again, the full sample and the subsamples across cohorts broadly follow the same trends.

factories had been privatised, releasing thousands of workers, who typically returned to agriculture because little else was available. It is only in recent years that the cashew-processing sector in Mozambique has begun to hire new workers. However, the scale of the sector is still much smaller than it was under state ownership.

To assess the possibility that changes in commodity prices and governance could be driving recent changes in occupational shares across Africa, we combine our country-specific measures of commodity prices and governance with DHS data on occupational shares. The purpose of this exercise is not to draw causal inference but rather to describe patterns in the data that can help us think more carefully about structural change in Africa. For example, if we find a correlation between our measures of governance and changes in employment shares, then it may be worth thinking more carefully about how to identify this relationship in a more convincing way and in a manner that gets at the underlying mechanisms at work.

In Table 2, we report the results of running a regression of an individual's occupational choice on education levels, gender, location, country-specific agricultural commodity prices, a country-specific measure of governance and a country-specific measure of the incidence of conflict. All specifications include a common time trend and country fixed effects to control for international business sector fluctuations and time-invariant country characteristics such as geographical characteristics and colonial history. The results reveal a number of stylised facts. First, education levels and occupational status are highly correlated and seemingly linear. That is, higher levels of education are more strongly associated with a decreased likelihood of working in agriculture. Second, women are less likely than men to report that they are working. Third, urban youth are more likely to report that they are not working than rural youth. And finally, young females are less likely than their male counterparts to be in school. Although not shown on a country-by-country basis, these results hold when the regressions are run on a country-by-country basis.

Turning now to the correlations between commodity prices, governance and employment shares, some suggestive patterns emerge. First, the rise in commodity prices is associated with an increase in labour force participation, a reduction in the share of youth in agriculture and an increase in the share of youth in school. For youth, the rise in commodity prices is associated with a significant reduction in the likelihood of working in agriculture. The rise in commodity prices is also associated with an increased likelihood of working in services. Similarly, improvements in

governance are associated with an increase in labour force participation and an increase in the likelihood that youth are in school. A direct comparison of the magnitudes of the coefficients is not possible because commodity prices and governance are measured in different units.

To compare the relative importance of governance and commodity prices, we can multiply the estimated coefficient by the actual average change in the explanatory variable across the sample period. For example, the magnitude of the actual impact of commodity prices on the likelihood of labour force participation for the older population is equal to the estimated coefficient of -0.043 times the average change in commodity prices over the sample period of 0.661, or around 3 percentage points. One of the most striking results (not reported in Table 2) is our finding that, together, the increase in the quality of governance and the rise in commodity prices are associated with a 10-percentage-point increase in the likelihood that rural youth are enrolled in school. Of the 10-percentage-point increase, 6 percentage points are attributable to the rise in commodity prices and 4 to the increase in the quality of governance. Both the magnitude and significance of this latter result warrant further investigation, given the importance of human capital in the process of structural change.

5. Moving forward: Africa's quiet revolution

Africa's current growth has sparked a heated debate over its sources and sustainability. Some argue that growth across the continent is fundamentally a result of rising commodity prices, and that, if these prices were to collapse, so too would Africa's growth rates. Others lament the so-called 'de-industrialisation' of Africa. They worry that, without a vibrant manufacturing sector, unemployment will remain high and the economies of Africa will not catch up to the more advanced countries of the world. Finally, some warn that youth unemployment could lead to an 'Arab Spring'. Taken together, one could conclude that recent success will be short-lived.

This paper has argued that these observations miss some important changes across the continent – what I will refer to as Africa's 'quiet revolution' – that lead us to be cautiously optimistic about the sustainability of Africa's economic progress. This quiet revolution includes a substantial decline in the share of the labour force engaged in agriculture, an unprecedented increase in the numbers of rural children in secondary school, significant improvements in governance and a rise in in agriculture. For now, the revolution remains quiet, because the synergies between these various developments are only just starting to be realised.

Moving out of agriculture has been associated with increased living standards for millions of people (McMillan and Rodrik, 2011; McMillan and Verduzco, 2012). This is because agriculture in Africa has been dominated by subsistence farmers and very low labour productivity. We have shown in this paper that moving out of agriculture has also been accompanied by a 10-percentage-point increase in the likelihood that the rural young stay in school. While education does not guarantee structural change, no country has been able to sustain economic growth without investments in human capital. Finally, although not traditionally accounted for in the structural change literature, the increase in labour force participation is a kind of structural change that is growth enhancing.

We have also shown that the decline in the share of the labour force engaged in agriculture has coincided with an increase in value added per worker in agriculture in several African countries. Our results are consistent with work by Keith Fuglie and Nicholas Rada (2013) at the US Department of Agriculture, who report that, for the first time in decades, total factor productivity growth in Africa is rising. Progress is slow, at roughly 1% per year, but in previous decades total factor productivity growth in agriculture was negative in most African countries.

It is probably no accident that these structural changes have coincided with an overall increase in the quality of governance in Africa. A number of political scientists have found that rural people in Africa vote more often than their urban counterparts, and overwhelmingly for the incumbent, whereas urban residents tend to be much more supportive of the opposition. As education and living standards in rural areas improve, it will become increasingly difficult for incumbents to buy these votes. In an empirical investigation into this issue, Bates and Block (2013) find that increased political competition across Africa is a strong empirical predictor of the rise in total factor productivity growth in agriculture. According to them, the emergence of electoral competition has altered political incentives, resulting in both sectoral and macroeconomic policy reforms that benefit farmers.

The reason this is so important is that, paradoxically, it is very likely that hope for the 'modernisation' of Africa that will bring formal sector jobs needed to sustain productivity growth lies in the agriculture sector. Consider some of the recent investments in labour-intensive manufacturing. The Chinese, Indians and Europeans are all investing in Ethiopia's leather sector. Indians and Europeans are investing in fruit processing in Ghana. The Americans and the Swiss are investing in cashew processing in Mozambique. While access to relatively cheap labour is an

attraction, it is not the primary reason for these investments. Rather, it is access to high-quality raw materials.

For example, a recent survey of foreign investors in leather processing and manufacturing by Brautigam et al. (2013) finds that the single most important reason for investment in Ethiopia's leather sector is the country's potential to produce some of the highest-quality leather in the world. This potential has not yet been realised because of the disorganised nature of the livestock industry, and because of traditional practices that make many of the hides unsuitable raw materials. The result is that many firms now import up to two-thirds of the hides they then turn into shoes, gloves and bags for export.

The lesson is clear: additional investments in the livestock sector have the potential to create more formal jobs in the leather industry while at the same time bettering the lives of the rural poor. And the good news is that these sorts of investments could happen relatively quickly, leading to more of the kind of structural change that we would like to see take place in Africa.

As we have discussed, changes are taking place that could lead to faster agricultural productivity growth in the future. But a great deal more could be done to transform the agricultural sector more quickly. With a little bit of luck and more pressure from an increasingly educated population, policies that promote faster productivity growth in agriculture could be the key to the modernisation of Africa, leading to more rapid structural changes that brings better jobs and higher labour productivity growth.

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Figure 1.a: Employment Shares by Broad Economic Sectors

Figure 1.b: Employment Shares by Broad Economic Sectors, Africa.

Source: Own calculations using that from Maddison (2010), Duarte and Restuccia (2010), WDI (2012), and McMillan, Rodrik, and Verduzco (2013)

Notes:

1. Africa data measures sectoral shares based on number of workers employed by sector, whereas Duarte and Restuccia (2010) use shares based on total hours worked by sector.

2. Duarte and Restuccia (2010) data covers 29 countries (excluding Africa) from 1950-2006

3. African countries included: Angola, Botswana, Cameroon, Ethiopia, Ghana, Kenya, Malawi, Mali, Mauritius, Mozambique, Nigeria, Rwanda, Senegal, Tanzania, Uganda, Zambia, Egypt, Morocco, and South Africa.

4. There are two data points for each African country: one for 1990 and one for 2005.

Source: Own calculations using that from Maddison (2010), Duarte and Restuccia (2010), WDI (2012), and McMillan, Rodrik, and Verduzco (2013)

Notes:

1. Africa data measures sectoral shares based on number of workers employed by sector.

2. African countries included: Angola, Botswana, Cameroon, Ethiopia, Ghana, Kenya, Malawi, Mali, Mauritius, Mozambique, Nigeria, Rwanda, Senegal, Tanzania, Uganda, Zambia, Algeria, Egypt, Morocco, and South Africa.

3. There are two data points for each African country: one for 1990 and one for 2005.

Figure 2: Labor Productivity Growth Decomposition

Sub-Saharan Africa

Average annual labour productivity growth
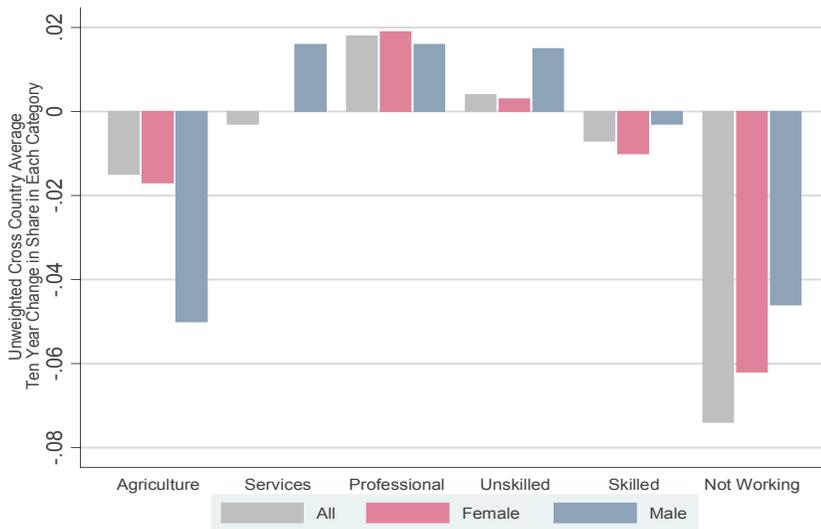
Legend:
- Within
- Between - static
- Between - dynamic
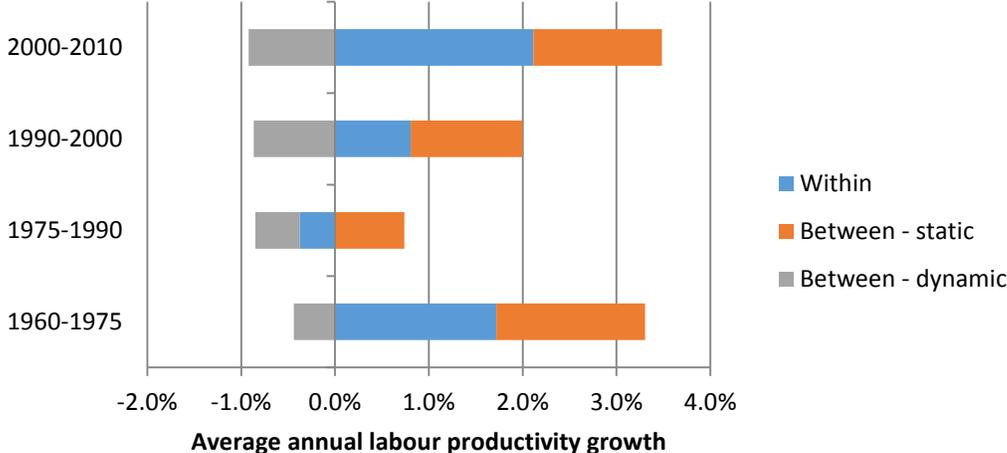
Source: de Vries, G. J., M. P. Timmer, K. de Vries (2013), "Structural Transformation in Africa: Static Gains, Dynamic Losses" GGDC Research Memorandum #136

Note: Includes all African countries in the GGDC's Africa Sector Database.

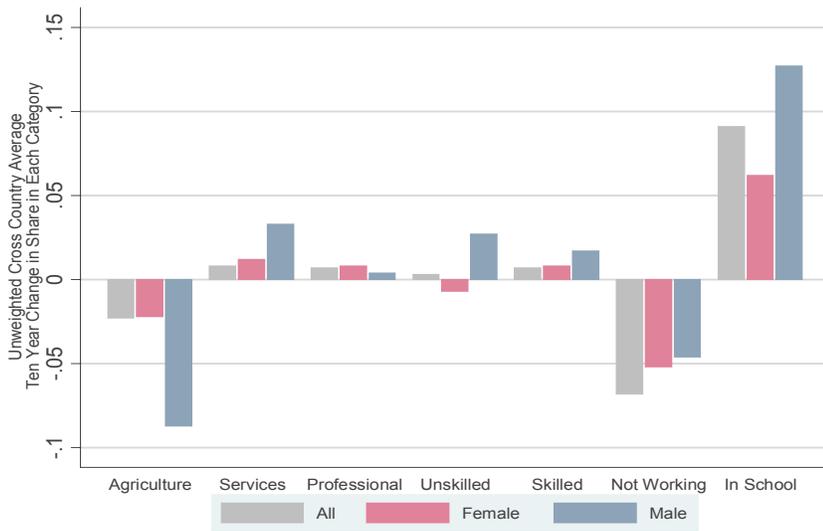**Figure 3: Change in Occupational Structure Using DHS Data**

Source: Author's calculation using DHS data.

Notes:

1. Average 10-year changes are computed as a simple unweighted mean of country specific 10-year changes. Country specific 10-year changes correspond to the coefficient on the final year dummy of a country specific regression of occupation on time dummies with the first year excluded; these changes were then annualized and multiplied times ten to get the predicted 10-year change.

2. Countries in sample include: Benin, Burkina Faso, Chad, Cote d'Ivoire, Cameroon, Ethiopia, Gabon, Ghana, Guinea, Kenya, Lesotho, Madagascar, Mali, Mozambique, Malawi, Namibia, Niger, Nigeria, Rwanda, Senegal, Tanzania, Uganda, Zambia, Zimbabwe.

**Figure 4: Occupational Changes Rural Youth 2000 to 2010**

Source: Author's calculation using DHS data.

Notes:

1. Average predicted 10-year changes are computed as a simple unweighted mean of country specific 10-year changes. Country specific 10-year changes correspond to the coefficient on the final year dummy of a country specific regression of occupation on time dummies with the first year excluded; these changes were then annualized and multiplied times ten to get the predicted 10-year change.

2. Countries in sample include: Benin, Burkina Faso, Chad, Cote d'Ivoire, Cameroon, Ethiopia, Gabon, Ghana, Guinea, Kenya, Lesotho, Madagascar, Mali, Mozambique, Malawi, Namibia, Niger, Nigeria, Rwanda, Senegal, Tanzania, Uganda, Zambia, Zimbabwe.

3. Sample includes only young individuals (aged 16 to 24) from rural areas.

Figure 5: Commodity Price Indices by Country
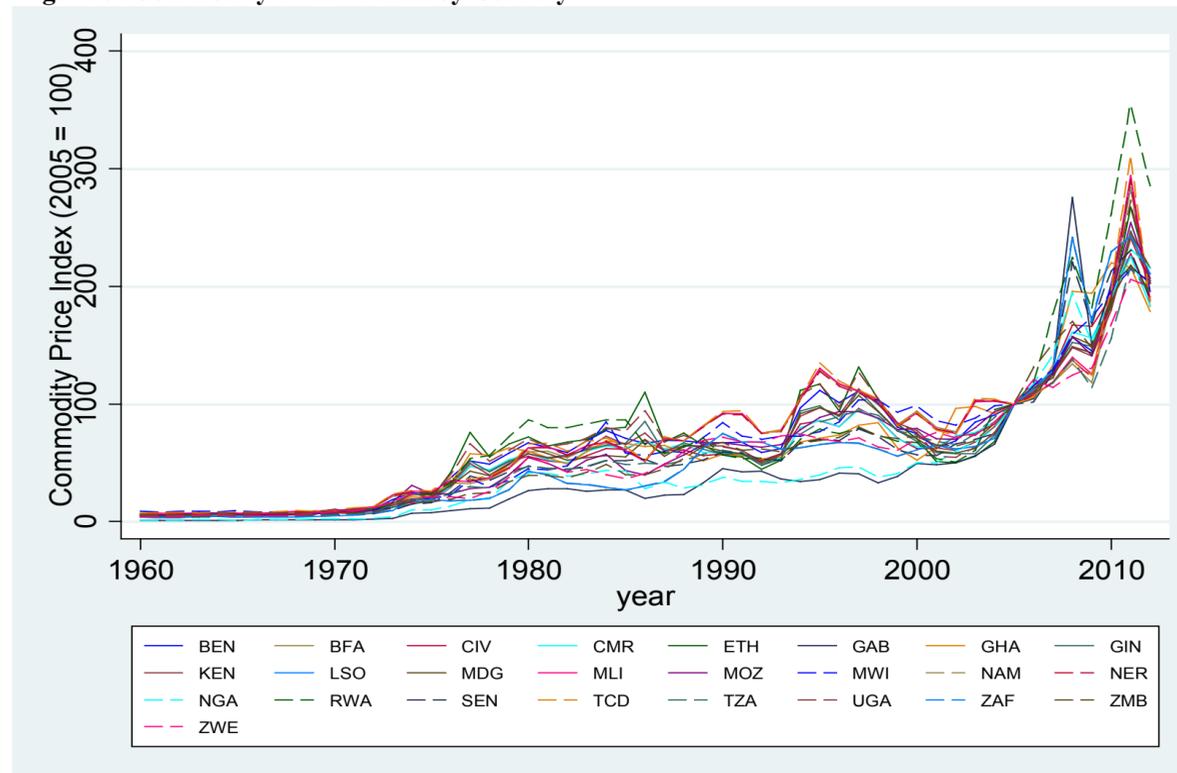
Source: Authors' calculations following Henderson, Roberts and Storeygard (2013) using data from several sources. Commodity prices come from UNCTAD except for maize, natural gas, rubber, silver, tea, tobacco, logs, and sawnwood wich come from The World Bank's Pink Sheet dataset (Sept. 2013 update). Export shares were calculated from Freenstra (2005) data. Consumer price index for the US comes from US Bureau of Labor Statistics and GDP data in current dollars comes from the Penn World Tables version 7.

Notes:

Included commodities are: Aluminium, bananas, beef, cattle hides, coconut oil, cocoa beans, coffee, copper, copra, cotton, crude petroleum, cottonseed oil, groundnut oil, iron ore, jute, lead, linseed oil, manganese ore, pepper, palm oil, rice, sisal, sunflower, soybeans, sugar, soybean oil, tin, wheat, zinc, maize, natural gas, rubber, silver, tea, tobacco, logs, sawnwood.

Figure 6: Average polity2 score for Sub-Saharan Africa
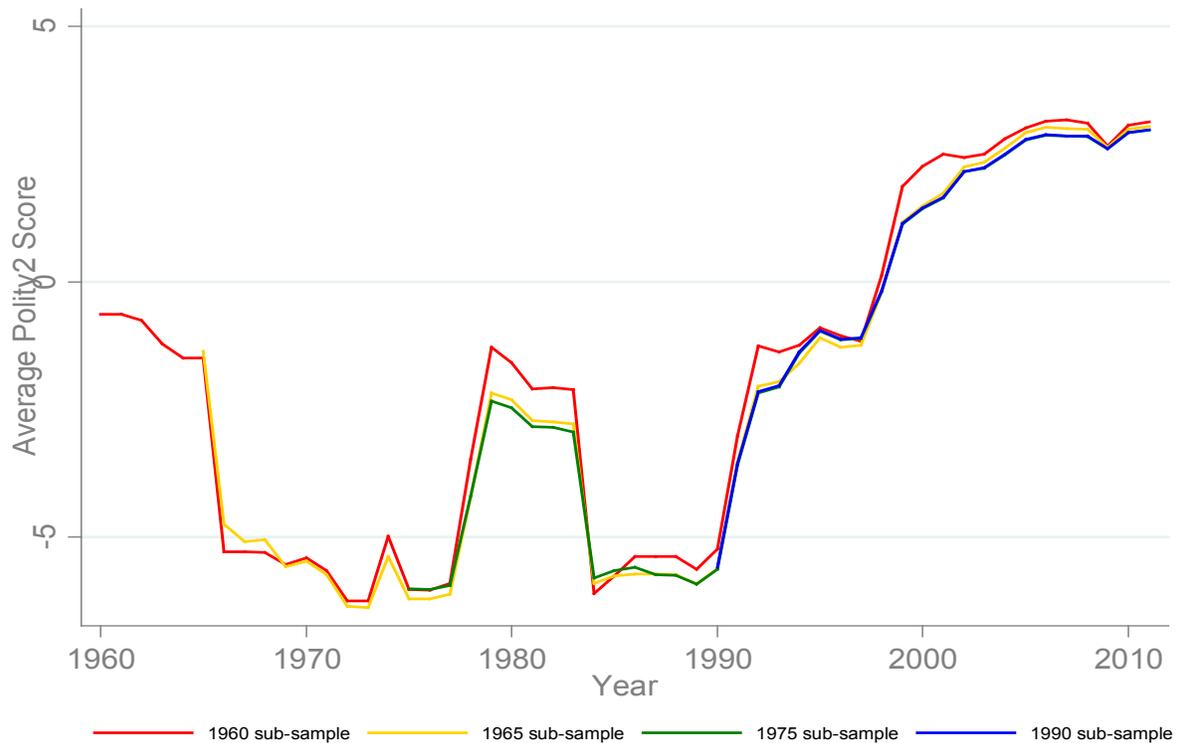
Source: Author's calculations using data from the Polity IV Project and The World Bank's WDI dataset.

Notes:

1. Graph shows a weighted average of the polity2 score (weighted by population) in the Polity IV dataset. The polity2 score is the revised combined polity score which, is the result of substracting the "autoc" score from the "democ" score. It scores how democratic or autocratic a regime is and ranges from -10 (strongly autocratic) to +10 (strongly democratic).

2. Solid bright lines are population-weighted averages of the individual country scores for each cohort: the 1960 cohort (red), 1965 cohort (yellow), 1975 cohort (green), and the 1990 cohort (blue).

3. Countries included are: Benin, Burkina Faso, Cameroon, Central African Republic, Chad, Congo Brazzaville, Congo Kinshasa, Ethiopia, Gabon, Ghana, Guinea, Ivory Coast, Liberia, Madagascar, Mali, Mauritania, Niger, Nigeria, Senegal, Somalia, South Africa, Sudan, Togo, Rwanda, Sierra Leone, Tanzania, Burundi, Uganda, Kenya, Malawi, Zambia, Gambia, Botswana, Lesotho, Equatorial Guinea, Mauritius, Swaziland, Zimbabwe, Guinea-Bissau, Angola, Cape Verde, Comoros, Mozambique, Namibia, Eritrea, and South Sudan.

Figure 7: Armed Conflict in Sub-Saharan Africa, 1960-2008

Source: Straus (2012)

Table 1: Sectoral contribution to within-sector component and changes in employment shares

	Contribution to within-component		Change in employment share	
	1990 to 2000	2000 to 2010	1990 to 2000	2000 to 2010
Agriculture (agr)	0.49	0.72	-2.19	-9.82
Mining (min)	0.19	0.18	-0.53	-0.19
Manufacturing (man)	0.11	0.13	-1.46	0.60
Utilities (pu)	0.11	0.11	-0.06	0.08
Construction (con)	-0.06	0.32	0.27	0.98
Trade services (wrt)	-0.22	-0.05	0.93	5.46
Transport services (tsc)	0.10	0.23	0.29	0.83
Business services (fire)	-0.03	0.05	0.61	0.77
Government and Personal services (cspsgs)	-0.05	0.38	2.13	1.31
Total Economy (sum)	0.63	2.10		

Notes:

1. Contributions to within-component of productivity growth are based on unweighted average of productivity decomposition for all African countries in the GGDC's Africa Sector Database.

2. Numbers in table represent percentage points.

3. Changes in employment shares based on average (weighted) Africa-wide changes.

Table 2: Occupational Regressions, Full Sample

	Panel A: Old population (age 25+)						Panel B: Young population (age 16 to 24)						
	All agricultural workers	Professional workers	Clerical, sales, and services workers	Unskilled workers	Skilled workers	Not working	All agricultural workers	Professional workers	Clerical, sales, and services workers	Unskilled workers	Skilled workers	Not working	In school
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Female	-0.0889***	-0.0120***	0.178***	-0.0177***	-0.0613***	0.207***	-0.0890***	-0.00567***	0.168***	-0.0401***	-0.0514***	0.209***	-0.0778***
	(0.00130)	(0.000720)	(0.00124)	(0.000678)	(0.00101)	(0.000928)	(0.00228)	(0.000870)	(0.00208)	(0.00139)	(0.00174)	(0.00196)	(0.00157)
Urban	-0.444***	0.0182***	0.282***	0.0457***	0.0773***	0.0299***	-0.486***	0.0105***	0.276***	0.0610***	0.0798***	0.103***	0.00765***
	(0.00140)	(0.000793)	(0.00152)	(0.000799)	(0.00109)	(0.00117)	(0.00223)	(0.000925)	(0.00250)	(0.00148)	(0.00182)	(0.00201)	(0.00139)
Incomplete primary	-0.0581***	0.00216***	0.0315***	0.00406***	0.0168***	-0.0315***	-0.0621***	0.000857	0.0293***	0.00441***	0.0254***	-0.0259***	0.294***
	(0.00164)	(0.000569)	(0.00153)	(0.000779)	(0.00108)	(0.00138)	(0.00264)	(0.000650)	(0.00254)	(0.00131)	(0.00179)	(0.00241)	(0.00161)
Complete primary	-0.130***	0.0193***	0.0614***	0.00785***	0.0366***	-0.0352***	-0.118***	0.00682***	0.0474***	0.0119***	0.0507***	-0.0241***	0.225***
	(0.00219)	(0.000880)	(0.00207)	(0.00117)	(0.00155)	(0.00177)	(0.00345)	(0.000976)	(0.00327)	(0.00200)	(0.00247)	(0.00312)	(0.00213)
Incomplete secondary	-0.251***	0.0938***	0.0980***	0.00620***	0.0511***	-0.0377***	-0.209***	0.0404***	0.0949***	0.0185***	0.0712***	0.0110***	0.606***
	(0.00206)	(0.00135)	(0.00217)	(0.00109)	(0.00161)	(0.00172)	(0.00358)	(0.00161)	(0.00373)	(0.00207)	(0.00283)	(0.00320)	(0.00191)
Complete secondary	-0.316***	0.233***	0.106***	-0.0270***	0.0122***	-0.0756***	-0.254***	0.169***	0.132***	-0.0257***	0.0181***	0.0359***	0.236***
	(0.00286)	(0.00306)	(0.00363)	(0.00148)	(0.00252)	(0.00264)	(0.00548)	(0.00492)	(0.00658)	(0.00303)	(0.00460)	(0.00525)	(0.00369)
Higher	-0.367***	0.555***	-0.0717***	-0.0415***	-0.0613***	-0.0740***	-0.307***	0.417***	-0.0157	-0.0386***	-0.0190***	-0.0456***	0.596***
	(0.00254)	(0.00354)	(0.00350)	(0.00131)	(0.00204)	(0.00269)	(0.00750)	(0.0113)	(0.0112)	(0.00470)	(0.00663)	(0.00922)	(0.00607)
Log of Agric. Commodity price index	0.00348	-0.00942***	0.0207***	0.00934***	-0.00791*	-0.0428***	-0.0257***	-0.00900**	0.0889***	-0.000974	-0.0317***	-0.0780***	0.0160**
	(0.00586)	(0.00300)	(0.00561)	(0.00308)	(0.00414)	(0.00510)	(0.00970)	(0.00355)	(0.00909)	(0.00527)	(0.00677)	(0.00877)	(0.00658)
Revised Combined Polity Score	0.000735**	0.00202***	0.00148***	-0.00379***	-0.000718***	-0.00442***	0.000166	0.00109***	0.00371***	-0.00369***	-0.000705*	-0.00101**	0.00591***
	(0.000335)	(0.000167)	(0.000330)	(0.000209)	(0.000249)	(0.000278)	(0.000552)	(0.000194)	(0.000531)	(0.000354)	(0.000399)	(0.000445)	(0.000306)
Country experienced any kind of conflict	0.0289***	0.0122***	0.00731***	-0.0179***	-0.0238***	0.0228***	0.0537***	0.00865***	-0.00190	-0.0293***	-0.0457***	0.0550***	0.0408***
	(0.00251)	(0.00137)	(0.00260)	(0.00131)	(0.00178)	(0.00215)	(0.00403)	(0.00151)	(0.00414)	(0.00235)	(0.00306)	(0.00371)	(0.00261)
Constant	0.637***	0.112***	-0.127***	0.0921***	0.113***	0.145***	0.864***	-0.00532	-0.227***	0.000365	0.236***	0.370***	-0.0964***
	(0.0468)	(0.0250)	(0.0449)	(0.0254)	(0.0332)	(0.0185)	(0.0359)	(0.0135)	(0.0336)	(0.0193)	(0.0265)	(0.0603)	(0.0242)
Observations	488,206	488,206	488,206	488,206	488,206	613,781	183,584	183,584	183,584	183,584	183,584	284,198	380,486
R-squared	0.352	0.265	0.202	0.061	0.051	0.126	0.336	0.139	0.201	0.065	0.062	0.122	0.281

*** p<0.01, ** p<0.05, * p<0.1

Notes:

1. Robust standard errors in parentheses

2. Female = 1 if person is a woman; Urban = 1 if person lives in an urban environment.

3. Sample for regressions in columns (1) to (5) and (7) to (11) includes all working individuals not currently attending school. Sample for regression in colums (6) and (12) include only individuals not currently working and not currently attending school. Sample for regression in column (13) includes only young individuals (age 16 to 24).

4. All regressions include country and year fixed effects.

Table A.1: DHS Survey Countries and Years in Sample, SSA

Country Name	DHS Survey Years
Benin	1996(f&m), 2001(f&m), 2006(f&m)
Burkina Faso	1992(f&m), 1998(f&m), 2003(f&m), 2010(f)
Cameroon	1991(f&m), 1998(f&m), 2004(f&m), 2011(f)
Chad	1996(f&m), 2004(f&m)
Cote d'Ivoire	1994(f&m), 1998(f&m), 2005(f), 2011(f&m)
Ethiopia	2000(f&m), 2005(f&m), 2011(f&m)
Gabon	2000(f&m), 2012(f&m)
Ghana	1993(f&m), 1998(f&m), 2003(f&m), 2008(f&m)
Guinea	1999(f&m), 2005(f&m)
Kenya	1993(f&m), 1998(f&m), 2003(f&m), 2009(f&m)
Lesotho	2004(f&m), 2009(f&m)
Madagascar	1992(f), 1997(f), 2004(f&m), 2009(f&m)
Malawi	1992(f&m), 2000(f&m), 2004(f&m), 2010(f&m)
Mali	1995(f&m), 2001(f&m), 2006(f&m)
Mozambique	1997(f&m), 2003(f&m), 2009(f), 2011(f&m)
Namibia	1992(f), 2000(f&m), 2007(f)
Niger	1992(f&m), 1998(f&m), 2006(f&m)
Nigeria	1990(f), 1999(f&m), 2003(f&m), 2008(f&m)
Rwanda	1992(f&m), 2000(f&m), 2005(f&m), 2010(f&m)
Senegal	1992(f&m), 1997(f&m), 2005(f&m), 2011(f&m)
Tanzania	1992(f&m), 1996(f&m), 1999(f&m), 2004(f&m), 2008(f), 2010(f&m)
Uganda	1995(f&m), 2000(f&m), 2006(f&m), 2011(f&m)
Zambia	1992(f), 1996(f&m), 2001(f&m), 2007(f&m)
Zimbabwe	1994(f&m), 1999(f&m), 2006(f&m), 2011(f&m)

Note: "f" indicates survey collects data only on women; "f&m" indicates survey collected data on women and men.

Table A.2: Comparing Our Africa Sample to African Countries Not in Our Sample

	SSA rest	SSA rest (excl. South Africa)	SSA our sample	Difference (1) - (3)	Difference (2) - (3)
	(1)	(2)	(3)	(4)	(5)
GDP per capita, PPP (constant 2005 international $)	4,359	4,167	1,760	2,600	2,407
	6,332	*6,412*	*2,574*	*0.07*	*0.10*
Mortality rate, infant (per 1,000 live births)	73.85	74.81	74.89	-1.05	-0.08
	32.66	*33.04*	*17.00*	*0.89*	*0.99*
Years of Schooling	5.08	4.84	4.88	0.20	-0.04
	2.17	*2.05*	*2.00*	*0.79*	*0.95*
Years of Primary Schooling	3.50	3.33	3.72	-0.22	-0.39
	1.41	*1.31*	*1.47*	*0.68*	*0.46*
Years of Secondary Schooling	1.50	1.43	1.10	0.40	0.33
	0.82	*0.80*	*0.80*	*0.17*	*0.26*
Years of Tertiary Schooling	0.08	0.08	0.07	0.01	0.01
	0.07	*0.06*	*0.07*	*0.56*	*0.71*
Raw materials exports as prop. of total exports; WDI period average	0.12	0.12	0.17	-0.05	-0.05
	0.10	*0.10*	*0.12*	*0.16*	*0.19*
Share of NRX in GDP (%) in 2000	24.28	24.83	18.14	6.14	6.69
	24.76	*25.28*	*12.51*	*0.29*	*0.26*
Undervaluation Index; average during period (PWT7)	-0.10	-0.09	-0.05	-0.05	-0.04
	0.24	*0.24*	*0.36*	*0.58*	*0.66*
Employment in agriculture (% of total employment)	42.95	48.01	61.75	-18.81	-13.74
	28.37	*26.46*	*18.64*	*0.05*	*0.14*
War and minor conflict	0.09	0.09	0.13	-0.04	-0.03
	0.29	*0.29*	*0.34*	*0.68*	*0.72*
Non-state conflict	0.09	0.09	0.21	-0.12	-0.12
	0.29	*0.29*	*0.41*	*0.25*	*0.28*
One sided conflict	0.17	0.18	0.13	0.05	0.06
	0.39	*0.39*	*0.34*	*0.65*	*0.60*
Any kind of conflict	0.22	0.23	0.25	-0.03	-0.02
	0.42	*0.43*	*0.44*	*0.80*	*0.86*
Total population (in millions)	212.925	165.726	542.110		
				708	0.765869041
Number of countries	24	23	24		

Notes: All estimates are for 2005 with the exception of Share of NRX in GDP (2000). Standard deviations in italics. For columns 3 and 6, number in italics is p-value from two-sided test of difference in means.