# Measuring Agricultural and Structural Transformation

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***Selected Paper prepared for presentation at the 2017 Agricultural & Applied Economics Association Annual Meeting, Chicago, Illinois, July 30-August 1***



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## Introduction

Over the past three decades, global progress in reducing poverty and hunger has been impressive with extreme poverty declining from 44% in 1981 to 13% in 2012 (World Development Indicators, 2016) and hunger from 19% in 1991 to 10% in 2012 (FAO, 2016). The process underlying the achievements to date is structural transformation of economies from subsistence agriculture to one of wage employment in the manufacturing and service sectors. Agricultural technical change and greater agricultural productivity has helped enable investment in and demand for domestic non-agricultural production of goods and services, which coupled with manufacturing development generated economy-wide growth with rapid and sustained reductions in poverty and hunger. Examples of agricultural productivity led structural transformation include the Green Revolutions in parts of Asia and Latin America; China, after the 1978 introduction of the household responsibility system and ensuing agricultural and non-agricultural policy changes; and Vietnam after the doi moi reforms in the mid 1980s,

However a similar transformation has not been achieved in Africa, even though many countries adopted similar policies in the 1970s that aimed to increase productivity through massive government support to agriculture (Djurfeldt et al., 2005). As a consequence, these countries have recorded slower growth that did not fully meet societal objectives such as the Millennium Development Goal (MDG) target to reduce hunger and extreme poverty by 50% by 2015, e.g. sub-Saharan Africa's 2012 (most recent available) poverty rate of 39.1% was far in excess of the MDG target of 23.8% (Shaw & Kristjanson, 2013; Badiane & Makombe, 2015). Globally 800 million individuals remain hungry, and of those obtaining sufficient calories many remain malnourished (Fan, 2016). Eighty per cent of the world's extremely poor population resides in South Asia or Africa (Drolet, 2015). Reducing poverty and hunger continue to be at the top of both the global development agenda (e.g. Sustainable Development Goals (SDGs) 1 and 2) and the African agenda (e.g. the Malabo Declaration on Accelerated Agricultural Transformation).

The differing growth paths and country trajectories raises two related questions: first, what processes have defined structural transformation that may explain the differences in the observed outcomes, and secondly will these processes remain the best available mechanism for ending hunger and extreme poverty by 2030?

A growing literature is addressing these questions. In a nutshell, the preponderance of evidence and thought has shown that

1) Structural transformation of economies based largely on subsistence agriculture to economies with a commercial agricultural orientation and dynamic non-agricultural sectors remains the best option for achieving rapid economic growth
2) Agricultural and food systems remain a necessary component of structural transformation and economic growth processes in agriculturally based economies, and agricultural growth tends to be more inclusive with greater poverty reduction than does growth originating in non-agriculture

3) Non-agricultural growth is an equally necessary component of economic growth processes, and food manufacturing, food service, and agriculturally based trade can make significant contributions to non-agricultural growth processes including employment generation

This is not to say that there are not significant open debates about the details of these processes or that other processes may be equally important. Recent work on the topic suggest that the African transformation will be different in form (Byerlee, de Janvry, & Sadoulet, 2009; de Janvry, 2010; de Janvry & Sadoulet, 2010). New opportunities may create an environment that is more conducive to a rural centered agricultural transformation. Examples include new agricultural value-added products and services closer to farms allow households to generate incomes through non-farm activities, often enabled by information and communication technologies and other technical advances. Institutional advances are allowing some smallholders to capture (as a group) economies of scale in the provision of input services such as mechanization and could have wide implications for SSA. At the same time, the increased competition for export markets and the decline in manufacturing's share in total employment imply that the opportunity for growth based primarily on export-led industrial development--a hallmark of the Asian structural transformation experience-- may be limited for economies of Sub-Saharan Africa (SSA) (McMillan, Rodrik, & Verduzco-Gallo, 2014b).

Given these and other opportunities and challenges, the characterization of contemporary structural transformation primarily in terms of productivity, employment, and migration seems unsatisfactory. Other attributes need to be considered that may affect the process of structural transformation. There are considerable differences in the initial conditions and the global economic environment in which today's agriculturally based economies find themselves in, that the process of structural transformation is likely to be different in the coming decades. This paper reviews and highlights these differences, and provides a summary of current thought and evidence related to stimulating structural transformation.

The document proceeds with a conceptual discussion of how current economic transformation processes differ from those accessed in earlier periods. We then discuss characteristics of agricultural transformation that need to be considered and then turn to empirical assessment of a more holistic notion of structural transformation. We review aggregate country level indicators that help us understand contemporary structural transformation and how it might be measured. We apply these indicators to study how a transformation is unfolding in the Senegal River Delta as an example.

## What's different about structural transformation today?

For almost two centuries, development theory and policy has centered on structural transformation characterized by massive migration of labor from a relatively low-income rural agricultural sector to a high-wage urban industrial sector. An agricultural transformation defined in terms of rapid and sustained farm productivity increases is a necessary component of structural transformation (Timmer, 1998). Development policies have been designed to encourage this type of transformation and quicken its pace.

A useful framework for understanding the process of (20$^{th}$ century) neo-classical models of transformation is provided by (Timmer, 1998) who viewed the process as having four distinct evolutionary stages. The

starting point was assumed to be a low-input (except labor), low-productivity, labor-intensive agrarian economy. The initial stage of development occurs when technology begins to improve farm productivity along with improved rural infrastructure and market development (Timmer, 1988; Staatz, 1994; Eicher, 1995; Naylor & Falcon, 1995; Staatz & Eicher, 1998; Timmer, 1998). In the second stage food prices fall, industrial growth is supported by investment from farm revenues and rural markets for manufactured goods, and labor begins to migrate to manufacturing (Johnston & Mellor, 1961; Timmer, 1988; Staatz, 1994; Timmer, 1995; Rooyen & Sigwele, 1998; Ellis & Biggs, 2001; Dorward et al., 2004). In the third stage agricultural and food systems operate much as any other sector in the economy, but with declining budget shares (Ruttan, 1969; Schultz, 1978; Whitehead, 1984; Hyami & Ruttan, 1985; Denslow et al., 1990; Sanginga et al., 2003; Wrbka et al., 2004; Benayas et al., 2007). In the final stage the consumer spending on food shrinks and within the food 'category' the consumer spends more on food manufacturing and services than the raw food product, farm sizes have increased and employment is minimal, and environmental concerns and 'way of life' (e.g. sustainable rural communities) issues arise (Timmer, 1988; Rooyen & Sigwele, 1998; Timmer, 1998; Johnson, 2000; Van Rooyen, 2000; Bresciani, Deve, & Stringer, 2004; Lafourcade et al., 2005).

The broad parameters of such a structural transformation process are likely to continue, especially with regards to the eventual decline of agriculture's labor and income shares in the economy. However the process is far richer than previously recognized. Furthermore, current options for structural transformation of African and South Asian agriculturally based economies are economically, demographically, agriculturally, socially, politically, ecologically and temporally separated from 20$^{th}$ century structural transformations.

Economically, in prior structural transformations the majority of the income gain was proximately associated with migration of underemployed agricultural labor to year-round, high-wage employment in urban manufacturing. The deindustrialization of income and/or employment suggests that Africa will not achieve significant levels of manufacturing employment (McMillan, Rodrik, & Verduzco-Gallo, 2014a; Gollin, Jedwab, & Vollrath, 2016). Even China, which saw significant reductions in poverty associated with both rapidly increasing farm productivity and rapid employment gains in both coastal urban and rural city manufacturing, now faces job growth challenges as, e.g., contemporary microchip manufacturing requires only 10% of the labor of first-generation Chinese cellphone factories (Lin, 1992; Banister & Cook, 2011; Forrest, 2015). Cost of employing workers in China is also on the rise, with wages alone having increased by 187% between 2004 and 2014. Rising wages in Asia, especially China, could offer an opportunity to countries in Africa as lower skilled manufacturing looks to relocate to more wage competitive environments (Lin, 2012). The cumulative effect of these trends on the role of high-wage industrialization on structural transformations is unclear as is the role of African urbanization in generating income growth.

Demographically, in prior structural transformations a demographic transition occurred at or about the same time as the economic transformation and industrialization, so that urban growth was based largely on rural-urban migration and rural populations declined. Africa has not yet realized a demographic transition and current projections are i) urban growth will be mainly organic rather than from migration, ii) the absolute size of the rural population will continue to grow past 2050 , and iii) most of the growth in rural populations is occurring at the lowest income levels (Masters et al., 2015; Ghosh, 2016). Moreover,

rural non-farm employment and entrepreneurship is increasingly recognized as contributing significantly to rural poverty alleviation (Johnston & Mellor, 1961; Haggblade, Hazell, & Reardon, 2010). The implication is to elevate attention to an emerging role for rural towns and small cities in providing income opportunities (Lipton, 1982; Johnson, 1993).

Even though Africa's population is estimate to grow at rate of 2%, many African countries are still relatively sparsely populated, especially as compared to Asian countries at the time of the Green Revolution. Induced innovation theory suggests that, therefore, labor-saving technologies would have to play a much larger role much earlier in the transformation process than was the case in Asia. Evidence indicates that not much progress has been made in this regard, as mechanization has been largely neglected (Mrema et al., 2008; Kienzle et al., 2013). An analysis of changes in land and labor productivity from 1960 to 2013 by Pardey (2015) shows that Africa has been the continent with by far the lowest increase in labor productivity. One reason can be seen in the predominance of manual labor, which still accounts for the major share of labor input. Considering that land is still relatively abundant in many regions of Africa, labor saving technologies, particularly mechanization, need to be an essential element of the African agricultural transformation. African agricultural policy-makers, as shown by a recent study (Mockshell and Birner, 2015), are well aware of this problem and express concern that agriculture is mainly based on "hoe and cutlass", which is not attractive to the youth. This concern is well reflected in the "push" type of migration from rural to urban areas, which is not based on labor-demand in the non-agricultural sector, but rather by the low returns to labor in the agricultural sector (cf. Haggblade et al., 2010).

Agriculturally, Green Revolutions were based on rapid increases in production of rice, maize and wheat that provided significant increases in the incomes of those farmers able to adopt productivity-increasing technology (Byerlee & de Polanco, 1983; Ravallion & Datt, 1996). However, real staple crop prices have been on a downward trend for a century and a half: for example, real US wheat prices have fallen almost 60% over the past half century.[2] With increasing globalization and interlinked food markets the scope for smallholder income increases from staple crop production shrinks as real prices fall. Over the past 50 years fruits and vegetables are finding an increasing relative role in consumption patterns: growth in global cereals production averaged 2.2% annually from 1961 to 2013, compared to 2.6% for primary fruit (1961-2013, most recent available), 3.2% for primary vegetables, and 3.3% for citrus fruit (FAO production database); projections are that this more rapid growth of fruit and vegetable consumption will continue (*Beyond a middle income Africa: transforming African economies for sustained growth with rising employment and incomes*, 2015; Badiane & Makombe, 2015). With urbanization and income growth there is increasing demand for animal sourced foods The implication is that the farm-level physical productivity increase in staple crops that stimulated Green Revolutions may need to be rethought with greater emphasis on fruits, vegetables, and livestock products not just on the farm but throughout the supply chain (Pingali, 2015); on-farm productivity considerations include emphasis on farm labor productivity and value productivity in addition to yields.

Socially, Green Revolutions were underpinned by supportive market and social institutions. In Mexico, land rights regulation and institutions were restructured before farmers could profitably adopt hybrid

[2] Authors' calculations based on USDA Wheat Yearbook and BLS Consumer Price Index data.

maize (Byerlee & de Polanco, 1983). Asia had functional input and credit markets and output markets that Africa lacks, hindering African agricultural development (Johnson, Hazell, & Gulati, 2003; Dorward et al., 2004). Africa's lack of institutional development that enables private sector activity has been cited as the underlying cause of African poverty (Acemoglu, Johnson, & Robinson, 2000; Rodrik, 2004; Acemoglu, Johnson, & Robinson, 2005). The diversity of agro-ecologies and cropping systems seriously limits the possibilities to benefit from spill-overs from public and private Research and Development (R&D) investments from other regions (World Bank, 2007), and overcoming it will require strong efforts and institutions to invest in R&D and exploit economies of scale in R&D collaborating within the region. The implication is that African institutional strengthening may be a prerequisite to successful African agricultural and structural transformation.

Politically, the global post-2015 development agenda is conditioned by sustainability as exemplified by the SDGs and the Paris Agreement (COP21), globalization as exemplified by free trade under the World Trade Organization and subsidiary free trade agreements, nutritional issues as exemplified by the World Health Association targets, etc. This means, for example, that the Brazilian path to success of the last century is likely unacceptable for contemporary Africa in terms of deforestation, loss of biodiversity and high levels of agricultural greenhouse gas emissions. Habitat III will raise questions about planned urban development including linkages between large urban areas and rural areas as well as the development of planned rural towns and cities. Geo-politically, the emergence of terrorism makes it both harder to work in some remote areas but also raises the stakes of successful development of these areas to a point where they are less likely to be havens for extremist elements. Thus there is a significant normative element particularly to the rural component of structural transformation that has not been there to the same extent in the past, and this normative element both constrains some transformation paths and opens others.

Both the breadth and intensity of ecological concerns increased substantially since the 1960s. Environmentalists call for a double-green revolution or similar revolution that produces both food and ecological services (Conway, 1998). Multi-functional landscape perspectives have arisen as an underlying concept in sustainable development strategies that integrate cultural, social, economic and ecological functions (Brandt, 2003; Matthews & Selman, 2006; Mander, Helming, & Wiggering, 2007). Analogously, a multi-functional approach can enhance the ability to use policy to increase resilience and adapt to global climate change (Adger, Arnell, & Tompkins, 2005). For example, the Paris Agreement emphasizes restoring degraded land in Africa and Latin America. Using agroforestry to transform a potential 300 million hectares of African dryland landscapes could "raise food production by an estimated 88 million tons and store and equivalent of one-third of global direct emissions from agriculture" (Hurni et al., 2015; Klytchnikova et al., 2015). Importantly, over a generational period, global climate change threatens the sustainability of coastal urban areas, calling into question the traditional structural paradigm of migration to large urban areas, which remains current in strategic discussion (Collier & Dercon, 2014; Pachauri, 2015).

Temporally, agricultural and food systems have evolved dramatically over the past half century. They have become increasingly complex with longer supply chains both geographically and in terms of a number of processing links, associated with increasing consumption of processed foods among all income

categories in all countries with available data (Tschirley, Reardon, et al., 2015; Tschirley, Snyder, et al., 2015). Agricultural output markets have transformed accordingly (Reardon & Timmer, 2007). There is growing recognition of the roles that agricultural and food systems play in providing ecological services to countries including their cities, from sustainable food production to pollution remediation and carbon sequestration (Richards et al., 2016). The issue is whether or not cost-saving technical change on the farm, which represents a shrinking share of consumer food costs, remains sufficient to drive inclusive growth processes and reductions in poverty.

Given the significant changes in the forces influencing structural transformation and the multiple possibilities of how a transformation might unfold, this paper proceeds by taking a holistic and empirical approach to understanding current transformation and growth processes. The next section describes components of the agricultural and structural transformation process that have been emphasized in the conventional narrative, as well the emerging contemporary perspective. These components--or alternatively attributes, characteristics and issues--have either been a consistent feature of transformation, or will be in the coming years.

The components of structural transformation are used as the basis to summarize and interpret the results of two recent investigations into African transformation processes. First, we present cross-country assessment of structural transformation using indicators for the each of the components identified. The cross country analysis helps in identifying possible relationships between national income and indicators of structural transformation. This is supplemented with trend analysis of key indicators given the long term nature of structural transformation. Second, a sub-national example from the Senegal River Delta is used to study how structural transformation evolves following a specific development intervention relative to regions where such interventions are absent. Taken together, they provide an empirically grounded view of structural transformation that can be employed in policy analysis and diagnostics.

## Country level indicators of transformation

The profession is currently engaged in an academic discussion of what emergent structural transformations (if any) look like. With the role of agriculture and rural spaces likely to be different in the coming decades, there is a need to provide a more detailed and nuanced view of transformation than previously available. We begin with a key stylized fact about structural transformation-- economic growth and greater national income is associated with a relative shift from rural based societies to one that is more urbanized. As such we begin by describing the drivers of change along the rural/urban divide and the main elements that that are associated with equitable and sustained growth. In addition, we discuss how interactions between the two sectors evolve (in terms of value chains, trade, markets and migration) and how they are both shaped by external forces and common institutions.

### Shifts in Sectoral Shares of Employment and Income

Within the rural sector, agriculture--often associated with on farm production-- dominates in many countries that are just starting the structural transformation process. However, one of the defining features of agricultural and structural transformation is that the declining relative role of agriculture in

both total employment and value added declines as countries get richer. Shares of employment and value added by economic sector have been widely used to represent this trend, often as cross-country comparisons that relates the GDP of different countries with relative sectoral shares. Figure 1 shows the inverse relationship between the share of agricultural employment and national income for 214 countries using 2013 data. While there is some spread in employment shares at lower levels of GDP, agricultural employment shares consistently are below 5% for high and upper-middle income countries that have completed a successful structural transformation.

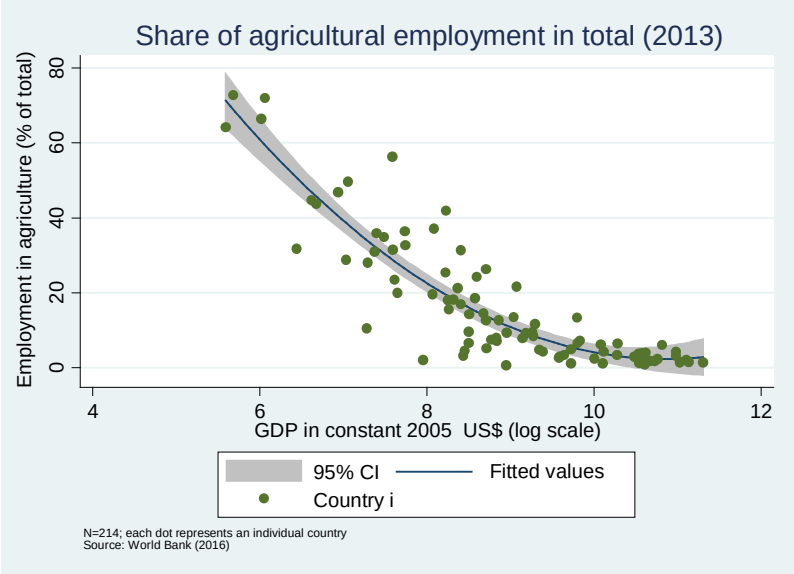



**Figure 1. Share of agricultural employment, multiple countries, 2013**

The relationship between the shares of agricultural value added in the total is much like the case of employment share (Figure 2), with the real value added in the sector rising but the share declining at higher levels of national incomes. However, the share of agricultural value added is usually lower than the corresponding employment share for any given country and point in time. This is consistent with structural transformation, as labor productivity is usually higher for non-agricultural sectors relative to agriculture.

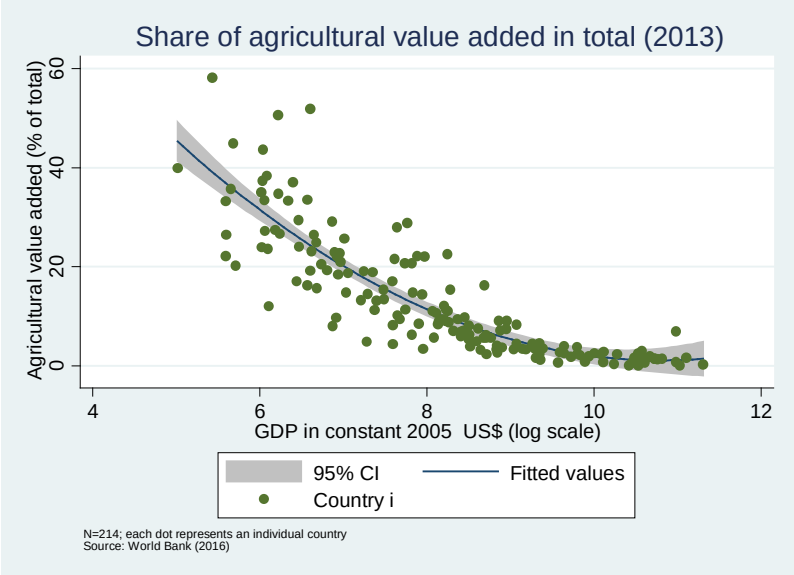



**Figure 2: Share of agricultural value added, various countries, 2013.**

## Employment

Employment and the agricultural sectoral share of employment are stalwart indicators of structural transformation. What is different is the current emphasis on unemployment in urban areas, rural non-farm employment, and job creation in the agricultural and food system in all spatial geographies (Reardon, Barrett, & Webb, 2006; Haggblade, Hazell, & Reardon, 2010; Masters et al., 2013; Traub et al., 2015; Tschirley, Reardon, et al., 2015).

The decline in the share of employment for agriculture is associated with rising employment share in manufacturing and services. Historically, the share of both services and industry rose with rising incomes as agriculture's share declined. While this continues to be the case, there is marked difference in the nature of the sectoral shifts. Figure 3 shows the relationship between sectoral employment shares and national incomes in the year 1980 and 2013[3]. In 1980, higher levels of income were associated with both greater share of employment in services and industry, with the gap between the two being fairly constant (10-20%) and rising only towards the very high income scale. By 2013, however, the services sector share was much higher at all levels of income with the gap between it and the industrial and agricultural sectors much more pronounced.

[3] Each line represents the fitted value of the country scatter plot; *N*=215 countries for 1980 and *N*=214 countries for 2013.

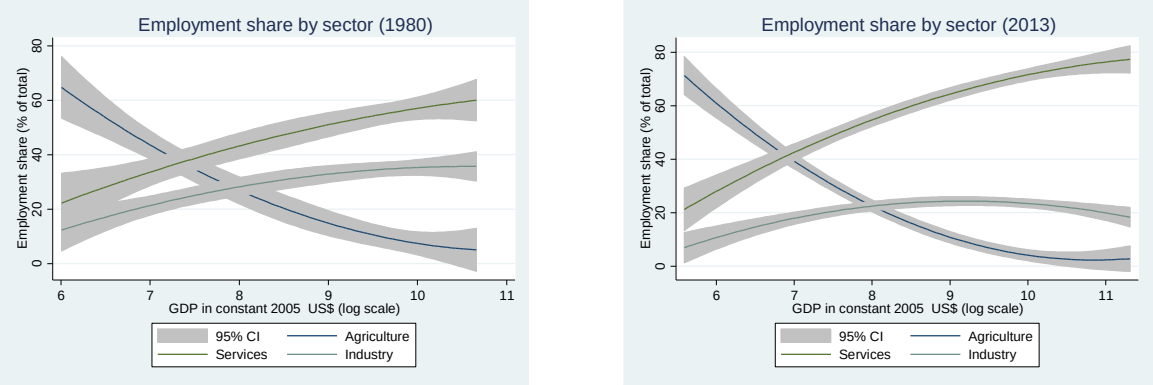



**Figure 3: Employment share by sector (1980 and 2013)**

It is also instructive to see variations across countries and time in terms of their sectoral shares. Figure 4 plots these trends for Ghana and Tanzania for which comparable time series data is available. In 1992, both countries had similar income per capita, and experienced similar growth rates over the next 21 (5.8% per annum for Ghana vs. 5.5% for Tanzania). Yet despite these similarities, the share of employment across the three sectors has remained relatively constant in Tanzania, while in Ghana employment in the service sector is as large as that for agriculture.

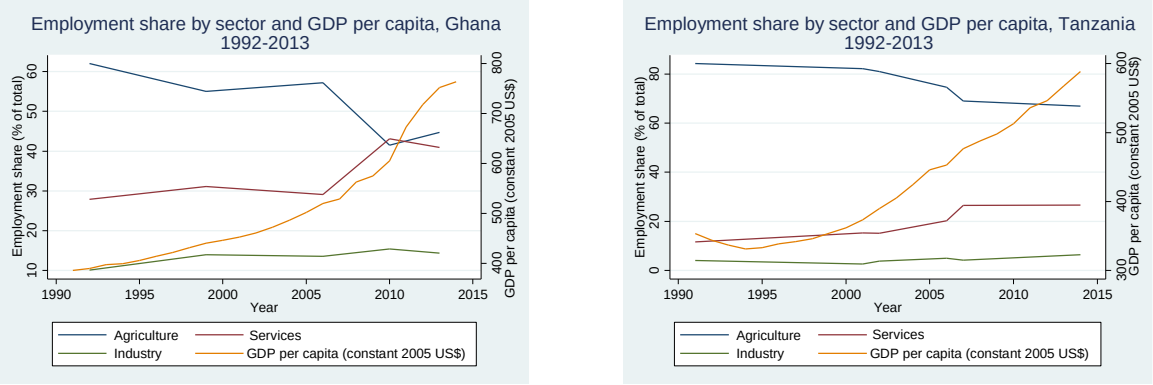



**Figure 4: Employment share and GDP per capita, Ghana vs Tanzania**

In Ghana, the share of agricultural employment has decreased from over 60% in 1992 to the low 40% from 2011-2013. This is consistent with agricultural productivity growth. The share of manufacturing employment increased from 10% in 1992 to 15% in 2013. The rising share of manufacturing is consistent with the start of structural transformation, but the low share is consistent with global de-industrialization and the observation that Africa is seeing manufacturing employment peak earlier in the structural transformation process and at lower levels (Masters et al., 2013). Service sector employment increased from less than 30% in 1992 to over 40% from 2010 on. This is consistent with global deindustrialization and the changing nature of contemporary structural transformation. The example of Tanzania suggests that structural transformation is yet to start in earnest, given that agriculture's share of employment has remained high (60-80%).

## Productivity

Staple crop yields are the canonical indicator of agricultural transformation, and can be used to diagnose productivity constraint for specific crops or groups of crops (such as through yield gap analysis). Figure 5 shows the yield trend for cereal crops for different regions. The limited improvement in yields for SSA, especially relative to other regions, could be considered as aspects of "failed" agricultural transformation for SSA, but also that there exists considerable potential for productivity growth.

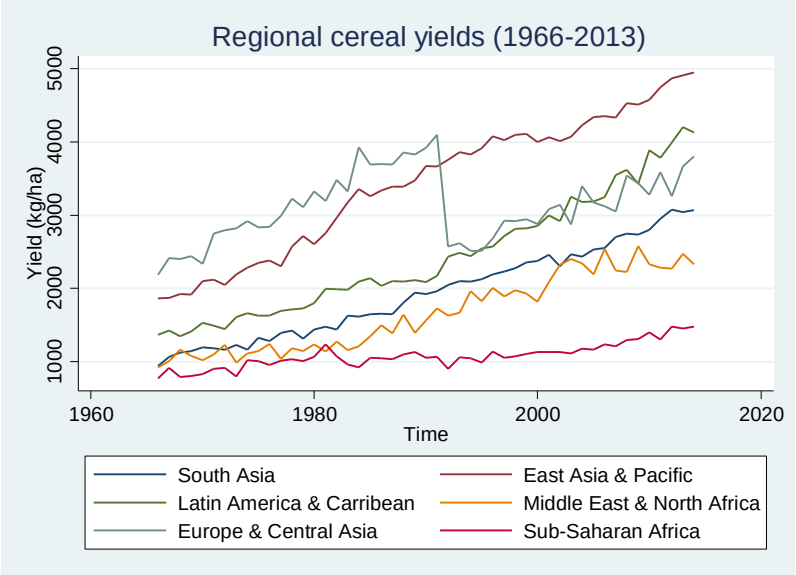



**Figure 5: Regional cereal yields (1996-2013)**

Labor productivity is more closely linked with household income and poverty reduction, and can be constructed for productivity comparison across sectors, time and countries. Figure 6 shows the trends in labor productivity for manufacturing and agriculture for the cases of Kenya and Korea. The stark difference in trends--rapid increases in productivity in Korea, but falling and erratic for Kenya--is one of the key reasons for Korea's successful structural transformation

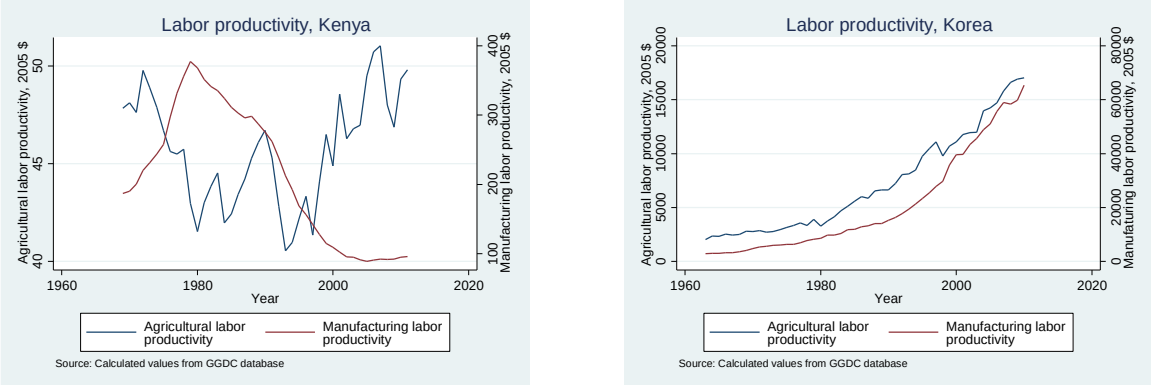



**Figure 6: Sectoral labor productivity, Kenya and Korea.**

Often agricultural output can grow in spite of relatively modest increase in land and labor productivity. By employing more resources, such as land and labor, output growth can be sustained but only in the short run. Growth in the long run will have to come to constant increases in overall productivity, or total factor productivity (TFP)--a broad index that compares the total outputs of agricultural output to the total inputs (land, labor, and capital resources). TFP provides a more inclusive measure that can be applied to crops or livestock and can reflect farmers' value-capture from improving quality or switching to a higher-value commodity. Beyond comparison TFP across countries (see Figure 7) TFP can also be useful in determining the types of investments in R&D, knowledge and technology adoption are likely to result in TFP growth.

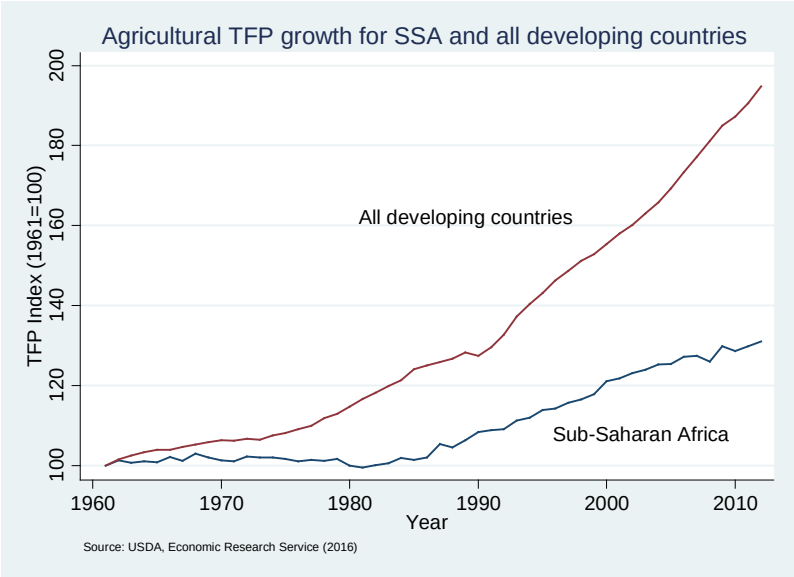



**Figure 7: Agricultural TFP growth**

Consider Figure 8, which shows a positive association between TFP and the agricultural research. An extension of this would be to examine country level TFP growth and its relationship to, say, adoption of new technologies, extension services, private research, agricultural education and host of other variables that may cause TFP growth.

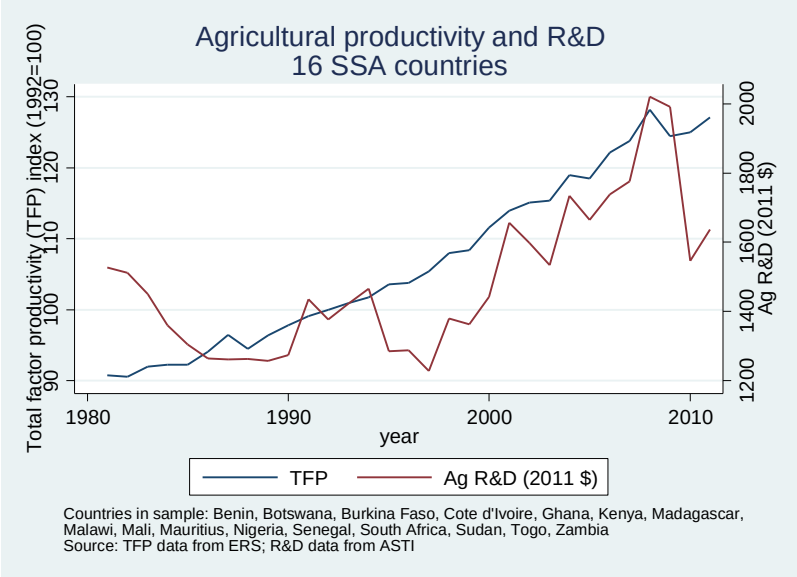
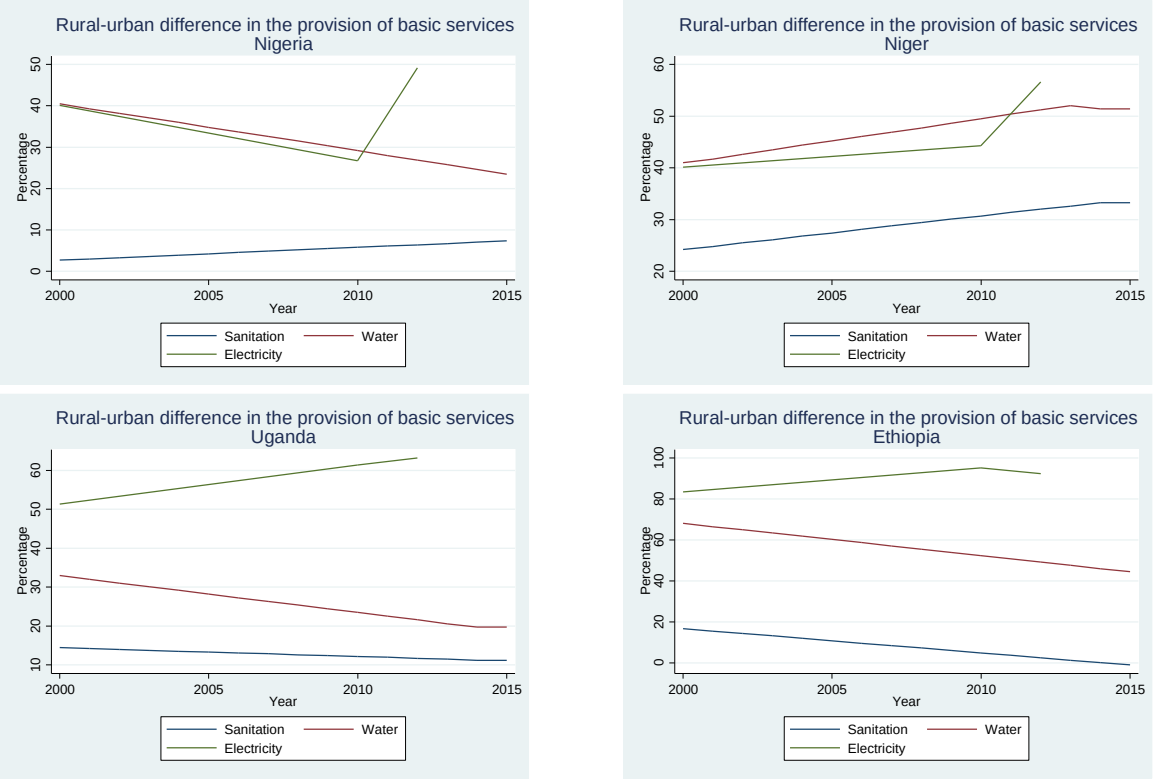



**Figure 8: Agricultural productivity and R&D**

## Communities

In developed country transformations, rural communities were often collateral damage and eliminated as their populations moved to large urban areas (Japan is to a certain degree an exception). More recently (China, Thailand) there has been greater reliance on secondary and tertiary cities as enduring components of the development process. Both positive (e.g. African demographics) and normative (e.g. geopolitical anti-terrorism effects), or the SDG attention to sustainable cities and communities.

One indicator of communities--or quality of life--is whether there is access to basic sanitation, water and electricity services. Access to these services is often better in urban areas due to economies of scale in providing them If contemporary structural transformation includes improved rural public-service delivery, then at a minimum the urban-rural gap in basic services should decline over time. In Figure 5 we observe that the difference in the percentage of population that has access to sanitation, water and electricity is widening for Niger, dropping for Ethiopia but mixed for Uganda and Nigeria. Thus the evidence on structural transformation including improved rural access to public services is mixed and country-specific.




Note: Each point on the line represents the difference between the percentage of rural and urban residents having access to indicated service (= urban % - rural %)
Source: World Development Indicators, World Bank

**Figure 9: Rural-urban differences in the provision of basic services**

Even if rural amenities are improving relative to urban within a country, due to say convergence of basic amenities, other aspects of living conditions might be worsening. Rapid urbanization coupled with poor planning can result in insufficient housing and growth of slums. The share of urban residents living in slums is proposed as a proxy indicator for living conditions and the desirability of cities. Figure 10 shows that percentage of population in slums and access to water and sanitation is closely linked. This is not unexpected since slums as informal and unauthorized forms of housing are served by public utilities.

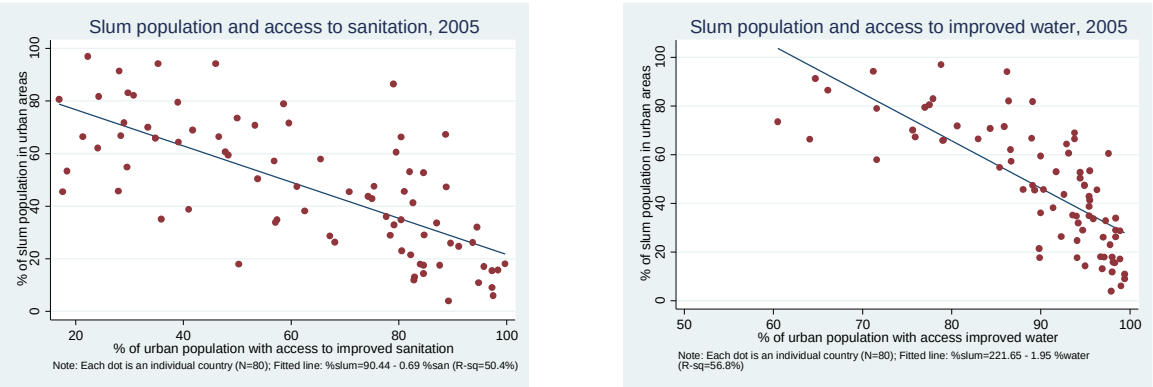



**Figure 10: Slum population and access to basic services, 2005**

## Gender

Analysis of previous structural transformations largely neglect gender—it is unclear whether there was a positive (or any) association between transformation and gender empowerment. More recently the lack of gender-empowering policies and social institutions has been put forth as an explanation for slow income growth at the country level and gender empowerment as a stimulus for inclusive agricultural and economic growth (Landes, 1998; *Gender Equality and Development*, 2011; Quisumbing et al., 2014; Johnson et al., 2016).

In most developing countries, indicators related to gender have been collected but primarily in areas such as health, education and employment. The data on these indicators has been used to show, for example, how low female participation rates in labor markets and unequal access to health and education can negatively affect productivity and growth. However even in these areas, there are gaps in the data that limits cross-country and trend analysis. For other issues that would shed light on gender equity and welfare--such as time use, violence against women and voice and participation--data availability is even more limited.

Efforts are underway to develop indicators and collect data on the extent of gender disparities in agriculture, such as the Women Empowerment in Agriculture Index (WEIA). WEIA is a standardized measure to direcly capture women's empowerment and inclusion levels in the agriculture sectors. More informed knowledge about women's empowerment in particular geogrpahies and related to specific issues (such as access to inputs) can result in targeted approaches to poverty reduction. Currently WEAI is available for 13 FTF countries for the year 2013-2014. While limited in scope , the WEAI has already been used to show that higher empowerment is associated with household educational achievement and positive maternal behavior (Malapit et al, 2014)

Figure 11 relates the WEAI index to specific policies. Many countries have laws regarding equal remuneration between genders, nondiscrimination in employment and sexual harassment in the workplace. For the set of countries represented in the WEAI, there does not appear to be any systematic relationship as country like Haiti (HTI) that has no laws related to these three areas does slightly better on the WEAI relative to Malawi (MWI) that has laws on all three areas. Bangladesh, in spite of laws on two out of the three areas, is ranked at the bottom on the WEAI. It is encouraging to note that Cambodia which has laws in all three areas, is ranked the highest on WEAI. Whether these and related gender-specific laws have led to greater empowerment requires further study.

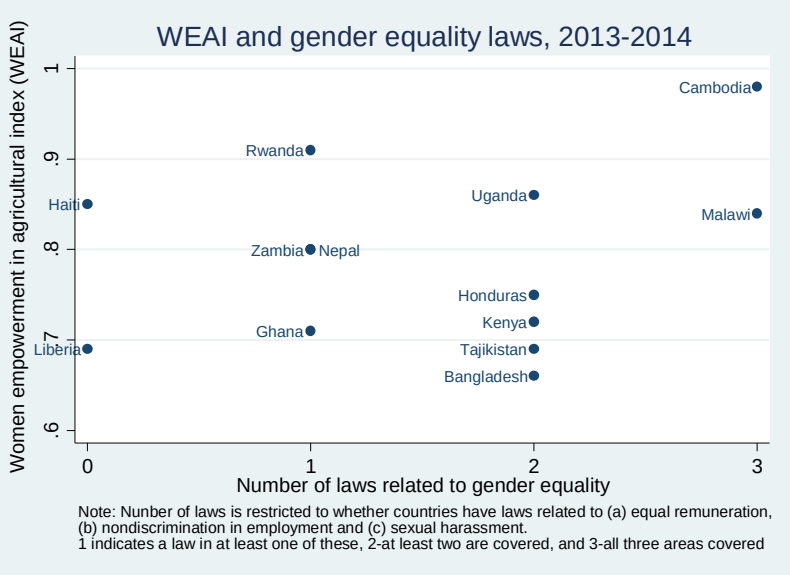



**Figure 11: WEAI and gender equality laws**

## Institutions and Policy

For policy change to be effective and deliver on the intended results often requires quality institutions, good governance and an enabling environment. In many instances policy can only come about in the presences of strong institutions. Recognition of the importance of institutions in economic growth processes dates back at least to Adam Smith, with Oliver North and Douglas Williamson reviving modern interest. Acemoglu et al. contend that weak institutions including policies that impede private sector activity are why Africa is poor (Acemoglu, Johnson, & Robinson, 2001).

Interest in understanding the relationship between institutional and governance quality with economic grown has led to the development of a number of indicators to measure institutional quality and the related issues of governance. Both objective and subjective indicators have been developed as well as composite indices that aggregate the individual indices

Most institutions indicators are national in coverage, although some composite indices such as the Mo Ibrahim Index have indices specific to agriculture and the rural sector. Recent efforts by the World Bank to develop and Enabling the Business of Agriculture (EBA) can also be useful in understanding the quality of institution in agriculture. EBA identifies and analyzes legal barriers for the business of agriculture and to quantify transaction costs of dealing with government regulations. Among its subcomponents are the following agricultural markets: seed, fertilizer, machinery, finance, markets, and transport. Each of these subsectors is given a score on a scale of 0-100 (100 being the best) on the regulatory burden and cost of getting products into the market. For example, the fertilizer score assess "the regulations on the registration, import and quality control of fertilizer products. They address factors important to companies importing and selling fertilizer products, farmers using quality fertilizer products to increase their productivity and governments pursuing regulations that ensure the quality of products and

effectiveness of fertilizer markets." A low scores would imply significant constraints in the particular market.

Figure 12 plots the relationship between EBA's fertilizer score and fertilizer score for all countries for which data is available and countries other in Africa. Fertilizer consumption is notoriously low for Africa relative to global and even developing country average. There are many reasons for the low consumption, including high cost and unpredictable supply which could be attributed to a poor business climate for fertilizer firms and their ability to provide low cost fertilizer. However the association between consumption and EBA' fertilizer score is weak and suggest that improving the business of doing fertilizer may not, in and of itself, be enough to increase fertilizer consumption.

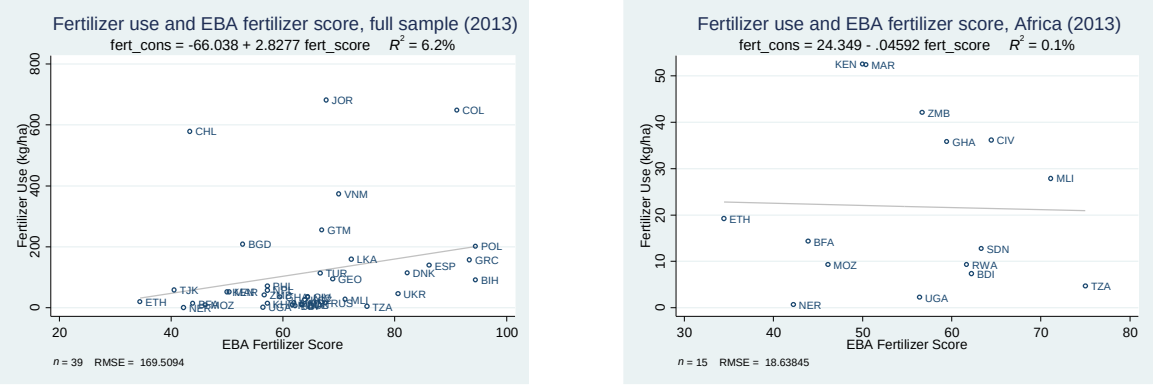



**Figure 12: Fertilizer use and EBA fertilizer score (2013)**

Figure 12 suggests that institutional indicators by themselves are not useful unless than can be shown to be related to some performance indicator. Consider Figure 13, which uses the Mo Ibrahim Rural Index[4] and relates it to the growth in value added for Kenya, Ethiopia, Ghana and Zambia. A first look at the graphs suggest that there is some co-movement of the variables, especially for years 2007 and onwards with some indication that it is strong for Kenya and Ethiopia but less so for Ghana and Zambia


[4] The Mo Ibrahim Rural Index (0-100 scale, with 100 being the best) is subset of the larger Ibrahim Index of African Governance, but with a focus on the rural sector. See http://mo.ibrahim.foundation/iiag/methodology/ for full methodology.


**Figure 13: Growth of agricultural value added and Mo Ibrahim Rural Index**

## Trade

Trade is traditionally considered to be growth enhancing and poverty reducing (Dollar & Kraay, 2003), and currently appears as a target in the Malabo Declaration. At early stages of the transformation process countries are exporting mostly primary and agricultural commodities. At higher levels of national income, trade patterns change and exports consist mostly of industrial and manufactured goods often including processed foods, with increasing trade in services. Agricultural and food may remain a significant (but smaller) component of overall trade, but with a greater share towards processed food.

Unlike some of the other components of agricultural transformation, the availability of trade data across more countries and time periods and broken down by economic categories, allows for some useful comparisons. Figure 14 shows the relationship between the share of agriculture exports and national income, and confirms that low income countries are primarily exporters of agriculture and primary goods. Additionally we see that between 1980 and 2010 agriculture exports are a lower share of total exports even for countries with the same level of income. For example of the 160 countries in our sample for 1980, in 84 countries agriculture constituted 25% or more of their total exports. By 2010, only 39 countries out of much larger sample of countries (188).

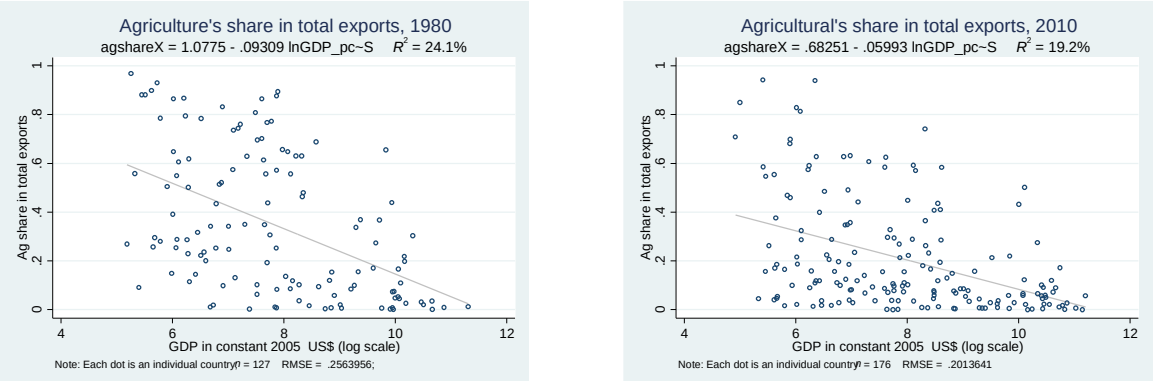



**Figure 14: Agriculture's share in total exports**

In Figure 4.7.2 graphs the trends in agricultural share in total exports for Kenya, Senegal, Ghana and Thailand. Nearly all countries have seen their share of ag exports decline, except Kenya where agricultural exports account from more than 50% of total exports.

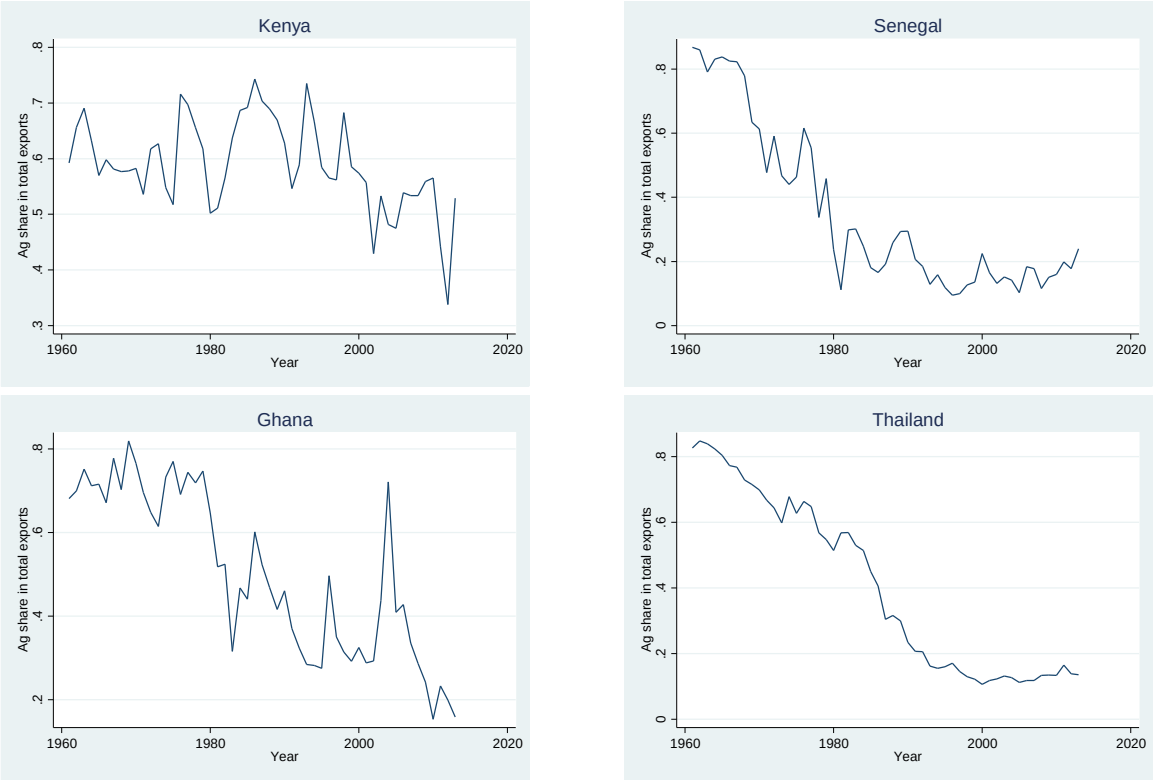



**Figure 15: Agriculture's share in total exports, selected countries.**

## Markets

Neoclassical views of transformation recognized markets as contributors to the modernizations of agriculture , mechanisms for transferring agricultural savings to industrial investment, and as mechanism for organizing payments to factors of production, yet data on market development are rarely provided in descriptions of transformation processes (Johnston & Mellor, 1961; Tolley & Smidt, 1964; Tolley, 1970; Johnson, 1993; McKinnon, 2010).

Competitive markets -- usually characterized by prices being near their marginal cost of production and absence of rent seeking behavior -- ensure efficient use and allocation or scare resources. One way to measure market efficiency is to see how large price gaps are between domestic prices and some reference (e.g. border) price (the Market Development Gap indicator[5]). These gaps could result from factors such

[5] MDG is defined as the "portion of the price gap [between domestic and reference prices] that can be attributed to "excessive" or inefficient access costs within a value chain and imperfect functioning of markets. "Excessive"

as poor infrastructure, high processing costs due to obsolete technology, government taxes and fees (excluding fees for services), high profit margins captured by various marketing agents, illegal bribes and other informal costs. Figure 16 and Figure 17 show trends of the Market Development Gap that for wheat and coffee respectively, in select SSA countries for which data is available. A value close to zero signaling market efficiency (i.e. domestic market prices reflective of world prices), a negative value suggest producers receive a lower price than the reference price and a positive value represents producers receive a higher price (often at the cost of consumers).

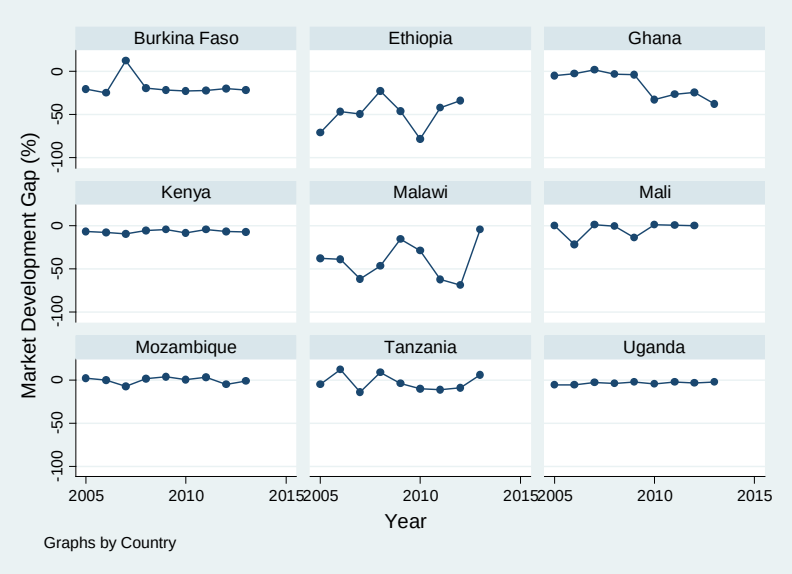



**Figure 16 Market efficiency for wheat, various African countries, 2005-2013.**

access costs may result from factors such as poor infrastructure, high processing costs due to obsolete technology, government taxes and fees (excluding fees for services), high profit margins captured by various marketing agents, illegal bribes and other informal costs."

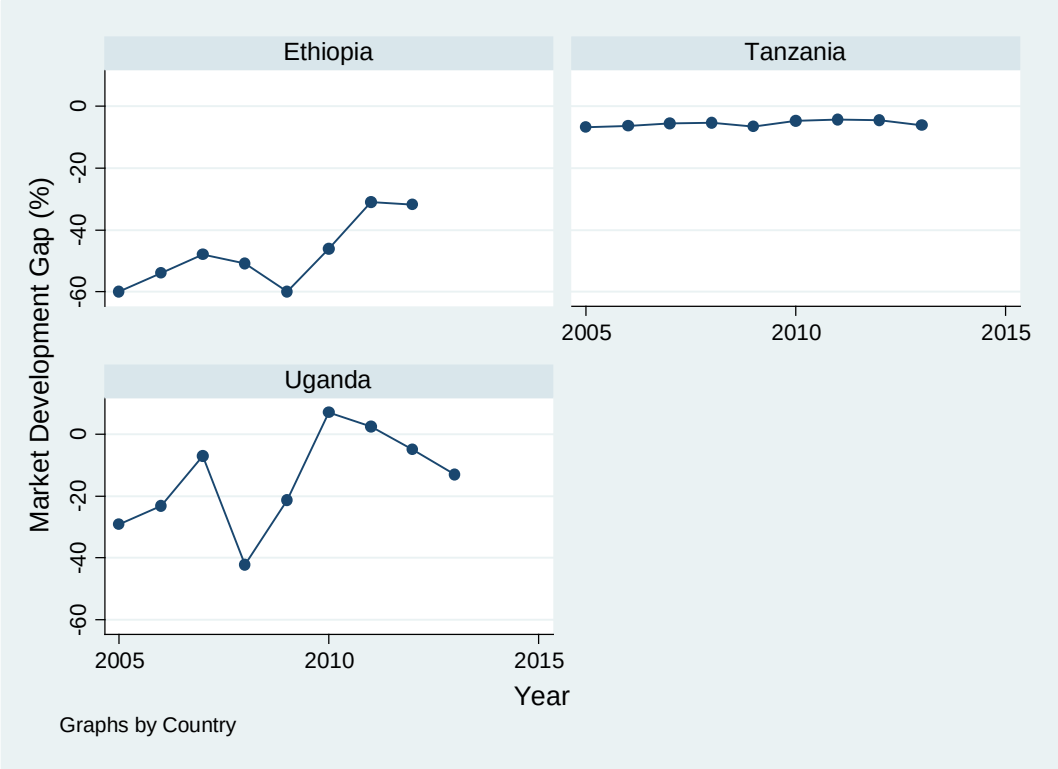



**Figure 17: Market efficiency for coffee, various African countries, 2005-2013.**

## Environment

Relationships between transformation and environment have typically been measured after the fact and usually as negative unintended consequences of structural transformation processes (Carson, 1962; Flaherty, Vandergeest, & Miller, 1999; He, Huo, & Zhang, 2002). The SDGs and the Paris Agreement elevate attention to sustainability and climate action as primary desired outcomes of economic growth processes.

Like markets, environment is a fairly broad category for which several indicator could be used to track different aspects of agricultural transformation. At one level it would be important how agricultural transformation is affecting the environment both locally and globally. Measures such as CO2 emissions, land degradation, soil erosion, and soil nutrient content are all examples of indicators that would be expected to change under agricultural production. Additionally it would be important to track other environmental indicators that are not necessarily related to agriculture, but could be correlated with the transformation process. For example, a worsening urban environment such as high levels of pollutions would be a potential sign of failed transformation that limits

Figure plots the relationship between CO2 emissions from agriculture and GDP. Emissions from the agriculture sector of richer countries is lower than those for poorer countries, a reflection of a more productive and efficient production system.

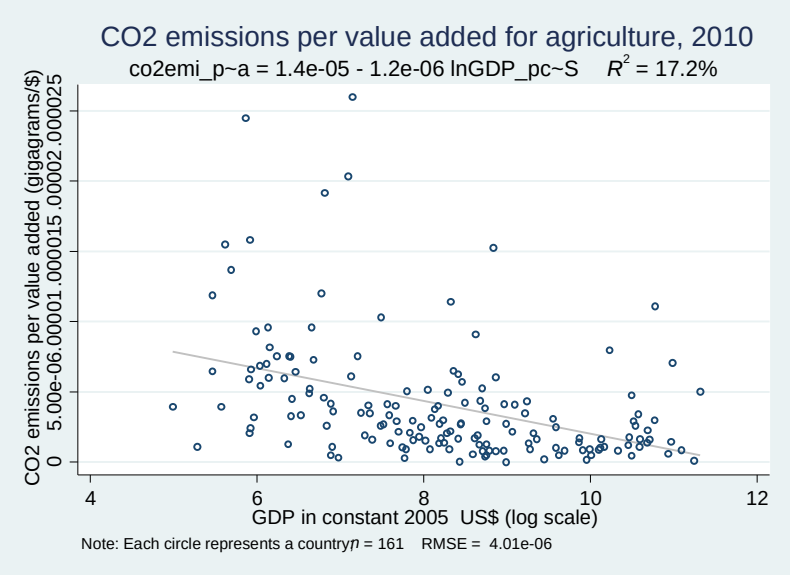



**Figure 18: CO2 emissions per value added for agriculture**

## Investment

All concepts of structural transformation recognize the importance of investment. A wide variety of investments are considered to be important in the literature: investments by the public sector on infrastructure, R&D and other public goods; and private investment, both by household and firms, that enables capital deepening and technology transfer to allow labor to be more productive. The State of Food and Agriculture 2012 examines agricultural investment, finding that in agriculturally-based economies domestic private-sector sources including smallholders invest 3-7 times as much as donors, governments, and the multinational private sector combined (*The State of Food and Agriculture 2012*, 2012).

With increasing national income and the associated structural transformation, government investments in agriculture declines concurrent with decline in the share of agriculture in the total economy. Using data from FAO, Figure 1 plots this relationships which holds globally and for a subset of countries in Africa.

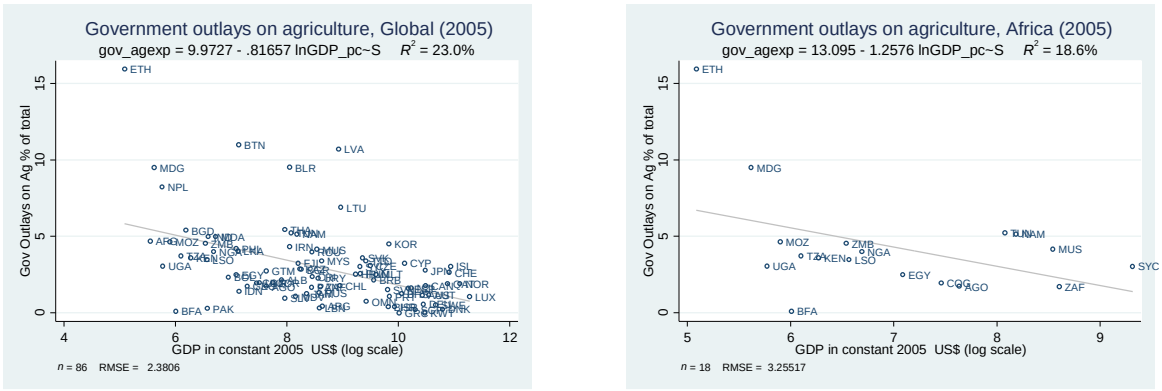
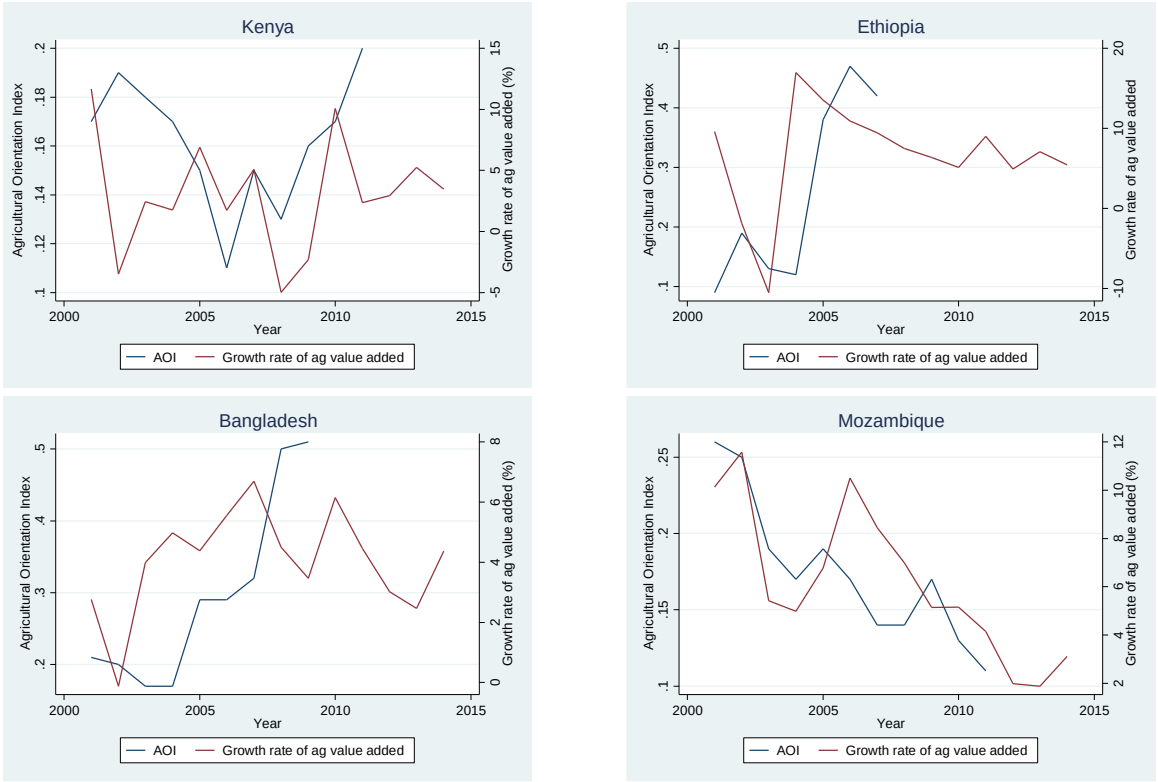



**Figure 19: Government outlays on agriculture (% of total) and GDP, 2005**

At the individual country level, expenditures on agriculture by the government do appear to make a difference on the growth of agriculture value added. Using FAO's Agricultural Orientation Index[6] and relating that to growth of agricultural GDP, we find that there is co-movement of the two variables suggesting that higher investments by government is associated with increased agricultural growth, at least for the four countries in Figure 20




[6] Agricultural Orientation Index is a measure of support for agriculture and is calculated as the ratio between the share of government expenditure in agriculture over total government outlays and the share of agricultural value added over GDP.

Figure 20: Agricultural Orientation Index and agriculture value added growth, various countries

## Nutrition

Classical structural transformation theory arose in part as a conceptual solution to Malthusianism, and therefore focused on enough food (later calories) to feed a growing world population. Following the Green Revolution, the world produces enough food but access is variable, now embodied in the World Health Organization definition and emphasized in the MDGs. Recent trends in obesity cum malnutrition place emphasis on nutrition security. There is little evidence that a nutrition transition to healthy diets has occurred as part of any structural transformation in any county.

Typically as economies grow and with rising wealth, dietary patterns shift from deficiency in food and nutrients to surplus nutrition. Malnutrition is the largest single cause for premature death and disability--under-nutrition for the majority of developing country citizens and over-nutrition in developed countries. The issue of nutrition transition and indicators to measure has been explored most recently by Masters et al (2016). In the paper they document how different nutrition and health indicators vary with national income across 100 countries and over 30 years. There are three aspects of nutrition for which indicators are most useful. First, knowledge of per capita food consumption (measured as kcal/person/day) gives some clue on broad consumption patterns. Using FAO's food balance sheets, we can also obtain the consumption of different food items and how they might be contributing to nutrition diversity. Figure Figure 21 shows that dietary energy consumption increased for the poorest countries, but not for the middle and higher income countries.

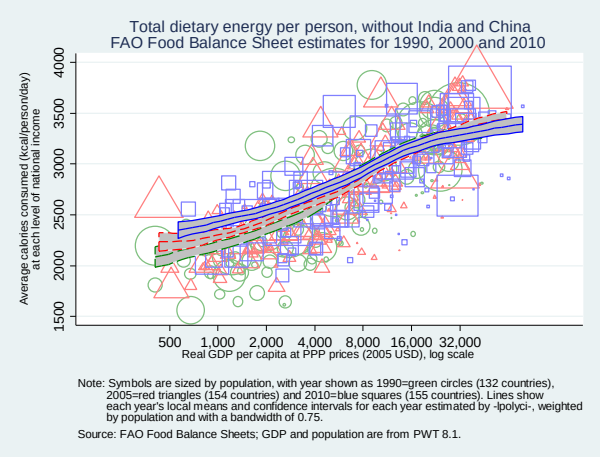



Figure 21: Total dietary energy per person, without India and China

When looking at share of dietary energy from non-staples, the increase is more pronounced for poor countries, but actually declines for middle and higher income countries-- a sign that dietary diversity is worsening at high levels of income.

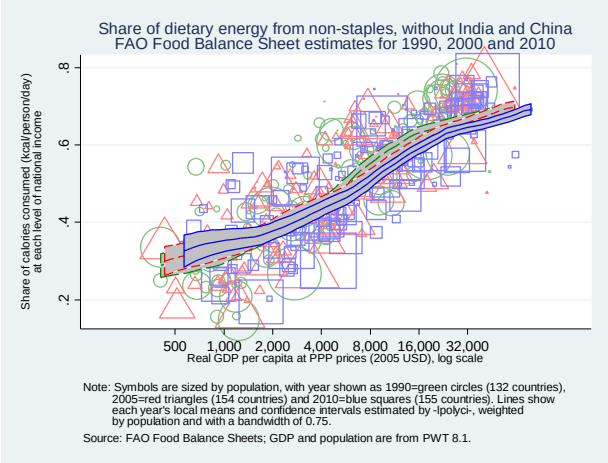



**Figure 22: Share of dietary energy from non-staples, without India and China**

The second type of indicators related to nutrition issues are to measure the quality and diversity of diets (beyond those implied by food balance sheets). One indicator, for example, is the intake of different types of food items using dietary recall survey. Although such data is not collected on an annual or systematic basis across countries, researchers have assembled datasets that contain this information. For example, the Nutrition and Chronic Diseases Expert Group (NutriCoDE) of the Global Burden of Diseases study compiled a total of 74 dietary recall surveys measuring intake of specific foods in comparable ways across numerous countries in various years from 1981 through 2009. Masters et al (2016) use two summary indices (mean healthy food consumption score and mean unhealthy diet score) to relate to national income. In Figure 23 "for the world outside of China and India, mean healthy-diet scores were significantly higher in 2010 than in 1990, but only in countries with per capita income greater than $16,000 per year."


**Figure 23: Diet quality scores based on more intake of 10 healthier foods**

Figure 24 "shows scores from the NutriCoDE study for intake of unhealthy foods, showing this aspect of dietary quality to be worse at higher levels of per capita income. The point estimates at each level of income are higher (less unhealthy) in 2010 compared to 1990, but the differences are not outside the confidence intervals.

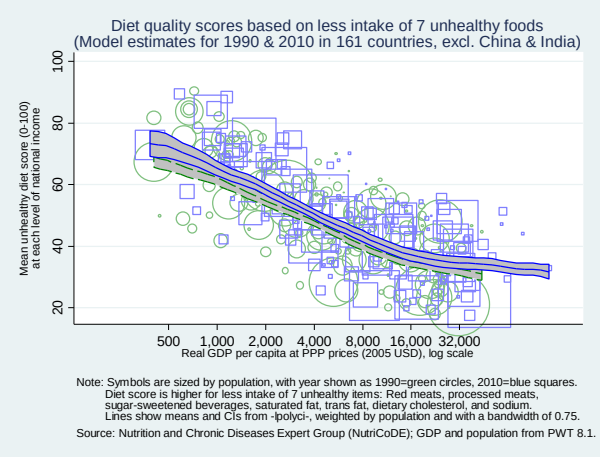



**Figure 24: Diet quality scores based on less intake of 7 unhealthy foods**

Finally, the food intake measures (such as calories consumed per day and diet quality indices) need to be related to health outcomes. The most common of these are indicators that are most directly related to nutrition, such as obesity, undernourishment, anemia and child stunting. Figure 25 shows how obesity increases with rising incomes that it is particularly higher in the 2000s than in the 1990s. However the results are sensitive to the inclusion of India and China, and obesity levels become significantly higher in the 2000s.

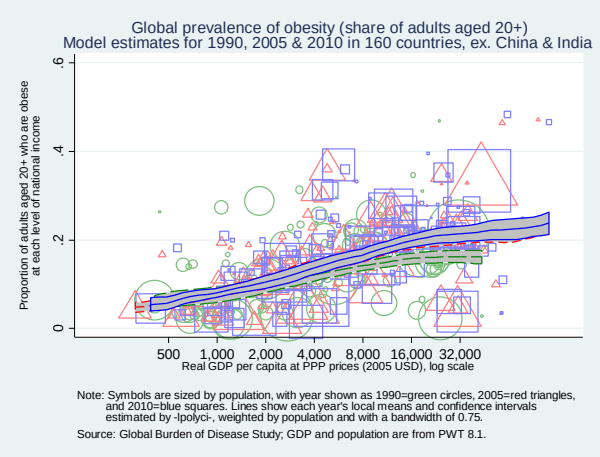



**Figure 25: Global prevalence of obesity**

On the undernutrition side, the global burden of iron-deficiency anemia appears to have increase (Figure 26), but only because risk factors have decline (such as diarrheal diseases) resulting in iron-anemia become more prominent.

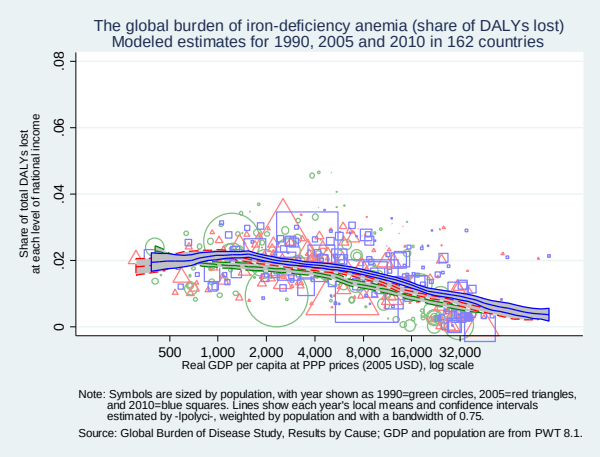



**Figure 26: The global burden of iron-deficiency anemia**

## Non-farm rural activity / income

The concept of the family farmer as generating the vast majority of her income from farm sales has been discarded. In both developed and developing countries small farmers have diversified livelihoods and the poorest are net purchasers of food (Ellis, 2005; Reardon, Barrett, & Webb, 2006). Off farm work employs 47 to 49 males in Latin America and Caribbean, South Asia and in the Middle East and North Africa, and 38 percent in East Asia and the Pacific but only 20 percent of adult males in Sub-Saharan African (Table 1) an indication of lower RNFE opportunities. While RNFE is also important for women, it is less so than for men.

**Table 1 Rural employment by sector of activity, selected countries (% of adults, 2000); Source: (World Bank, 2007)**

| Sector of activity | Sub-Saharan Africa | South Asia | East Asia and the Pacific (excl. China) | Middle East and North Africa | Europe and Central Asia | Latin America and the Caribbean |
|---|---|---|---|---|---|---|
| **Men** | | | | | | |
| Agriculture, self-employed | 56.6 | 33.1 | 46.8 | 24.6 | 8.5 | 38.4 |
| Agriculture, wage earner | 4.0 | 21.8 | 9.4 | 9.4 | 10.1 | 20.9 |
| Nonagriculture, self-employed | 6.9 | 11.8 | 11.5 | 8.8 | 7.4 | 9.2 |
| Nonagriculture, wage earner | 8.6 | 15.4 | 17.4 | 30.9 | 31.3 | 17.2 |
| Nonactive or not reported | 21.7 | 14.6 | 14.4 | 26.0 | 27.5 | 13.4 |
| **Women** | | | | | | |
| Agriculture, self-employed | 53.5 | 12.7 | 38.4 | 38.6 | 6.9 | 22.8 |
| Agriculture, wage earner | 1.4 | 11.4 | 5.7 | 1.0 | 5.4 | 2.3 |
| Nonagriculture, self-employed | 6.8 | 2.9 | 11.3 | 2.8 | 1.6 | 11.7 |
| Nonagriculture, wage earner | 2.8 | 2.7 | 8.4 | 3.9 | 18.1 | 11.5 |
| Nonactive or not reported | 32.7 | 64.3 | 35.5 | 53.3 | 46.9 | 51.2 |

Source: (World Bank, 2007)

## Credit/financing

The preponderance of thought is that financing in general and credit in particular is necessary, but there is a paucity of empirical evidence documenting situations where increased access to credit significantly stimulated or accelerated agricultural growth. Reardon indicates that the overwhelming source of

smallholder investment in agriculture is from savings, not credit. Formal credit to agriculture remains a small share of the total credit provided (average of 5% for N=101 countries in 2012), even if at the household level its significance for household investment is low. At the aggregate level, the provision of formal credit correlates with a country's share of agricultural value added (Figure 27)

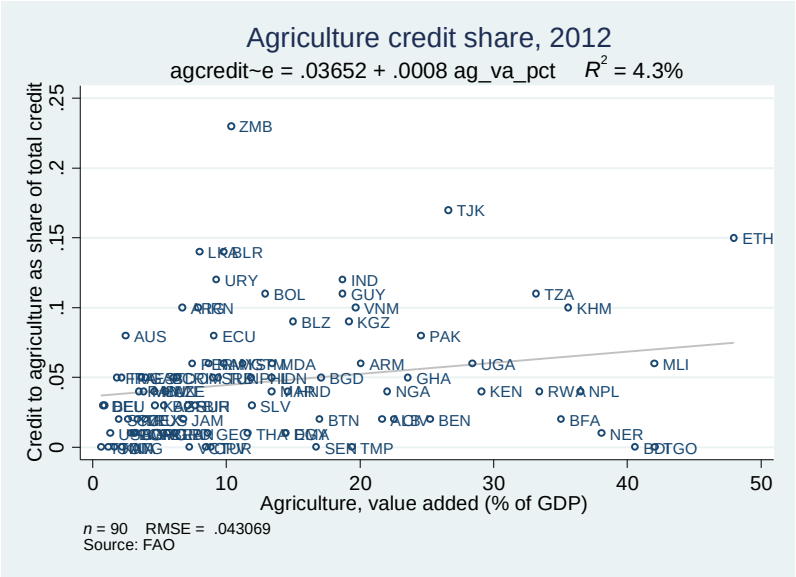



**Figure 27: Agriculture credit share, 2012**

## Resilience

Poverty traps associated with negative shocks and lack of household resilience leading to asset liquidation are considered by some to be the major impediment to inclusive agricultural growth (Barrett, C, & Timmer, 2010; Barrett, Carter, & Timmer, 2010).

## Farm size / specialization

Increasing farm size is a hallmark of structural transformation, particularly in cases where technical progress reduced output prices. However the increase in farm size appears to occur only when countries reach a high level of income Figure 28. For most low and middle income countries, average farm size has decreased due in part to greater population pressures and relatively high rural populations. There remains debate as to whether large commercial farms are more efficient than smallholder farms (Eastwood, Lipton, & Newell, 2010; Collier & Dercon, 2014). Specialization typically occurs with commercialization as farmers produce in their comparative advantage and purchase their food and other needs.

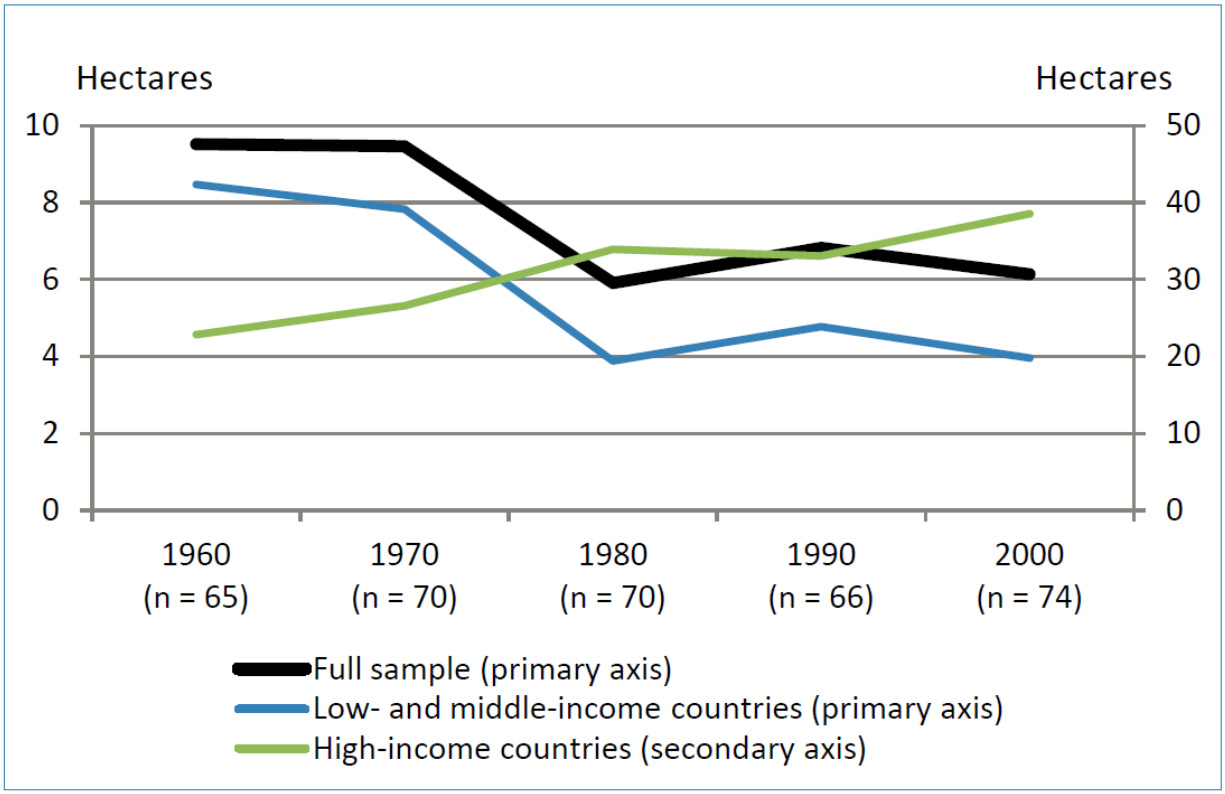



**Figure 28: Weighted average farm size, by income group**

(Source: (Lowder, Skoet, & Singh, 2014)).

## Population and migration

Most of the economic growth in structural transformation comes from migration to urban locations with relative high-wage employment opportunities, with ensuing declines in rural populations. Current trends in rural non-farm employment plus evidence of de-urbanization in some African countries raise the question of the role of different contemporary migration patterns, including migration to sustainable rural towns and small cities (Potts, 1995, 2009, 2010).

Another stylized fact about structural transformation is that while the share of rural population declines over time for all countries, rural population actually increases in absolute terms before itself decreasing. Figure plots the rural, urban and total population by country income groups. High income countries have been experiencing rural population decline throughout the plotted time period. Low and low middle income countries are still undergoing growth of their rural population, although the later at slower rate. Upper middle income countries of today, are also seeing a slowdown in their rural population having reached the peak in the late 1980s. This peak from an increasing to decreasing rural population has been referred to as the structural transformation turning point.

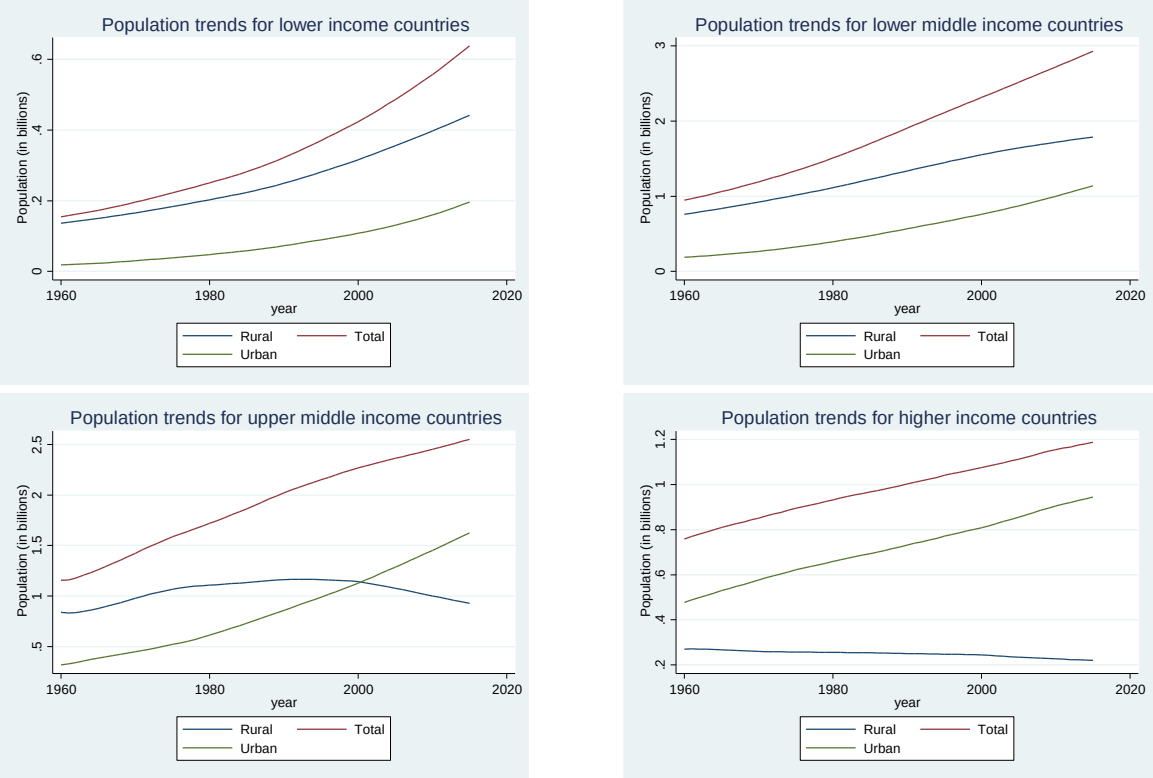



**Figure 29: Population trends by income groups, 1960-2015**

## Household income/ poverty

All models of structural transformation associate it with increases in household income and reductions in poverty. Growth emanating from the agricultural sector has been recognized as having a much larger impact on reducing overall poverty than growth from outside the agricultural sector. In China, growth from the agricultural sector is estimated to have been 3.5 times more effective in reducing poverty, and 2.7 for Latin America. Successful rural transformation is therefore key to reducing poverty since the majority of the poor are initially in rural areas. One element of successful agricultural transformation is the diversification of production and income sources, such as an increasing share of agricultural gross value of non-cereal production (i.e. production of higher value goods). Huang (2016) relates the change of this indicator to changes in rural poverty and finds a strong association. Countries that move into higher value agricultural goods have experienced greater reduction in poverty (Indonesia, China and Vietnam in

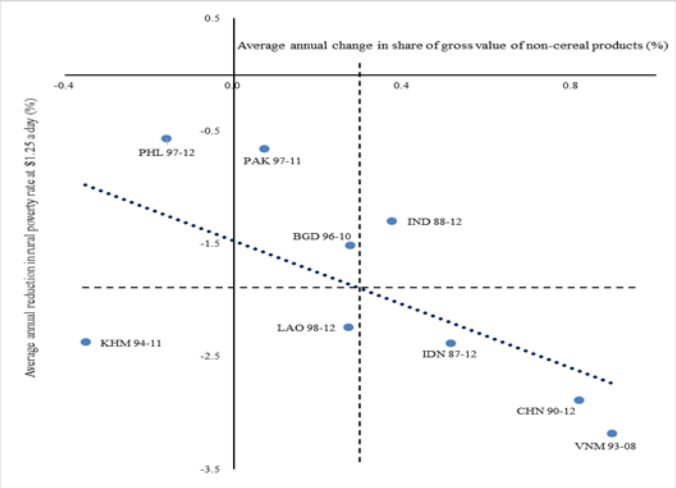



**Figure 30: Rural transformation and poverty reduction.**

Source (Huang 2016)

## Transformation in the Senegal River Delta

This section summarizes the empirical findings from a recent study of an apparently emergent structural transformation in parts of the Senegal River Delta. The data presented represent a comparison of 200 households in ten villages in the area where structural transformation is believed to be emerging (target households) with 200 otherwise comparable households in ten villages that are likely not (or more slowly) engaged in structural transformation processes (control households). In some cases comparisons over time are also included and where this is done the time frame is made explicit. For business activity, evidence was collected separately from businesses in the sample frame villages, and village level data on commercial zoning etc. were collected by observation and/or key informants. Population data are from secondary sources. For more details on the study zone, methods, and results see (Oehmke et al., 2016).

There are five categories of transformation indicators directly related to agriculture and farms. Evidence in each category is consistent with the emergence of a structural transformation.

Evidence in the category of social institutions shows a positive association between the strength of social institutions and the target area.

Evidence in the category of gender empowerment shows no clear association with transformation.

In the category of resilience, target households are less subject to water stress and more resilient to this stressor (this may be due to improved access to irrigation rather than transformation per se; irrigation is related to and perhaps partially causative of the transformation process). They are more likely to be subject to input or output price shocks, which is consistent with commercialization of agriculture, but more likely to be resilient to price shocks. Results in this category are consistent with transformation.

Evidence in the category of non-farm business activity/income shows both greater activity and income in the target zone and greater target household engagement in this activity. These findings are

consistent with contemporary concepts of transformation with reliance on diversified rural livelihoods and a role for rural towns and small cities.

Population growth figures corroborate the reliance on rural towns and small cities as a productive part of the transformation process, at least at this stage.

**Table 2. Summary of variables related to rural economic transformation in the Senegal River Delta, direction of change, results summary, and interpretation**

| INDICATOR | | RESULT STATEMENT (treatment # v. control #) | INTERPRETATION |
|---|---|---|---|
| **AGRICULTURAL VARIABLES** | | | |
| | Farm technology, productivity and production | New/more intensive use of fertilizers (83% v. 68%), improved agronomic practices (41% v. 21%), higher crop yields (rice: 1.0 kg/ha increase; onion 2.4 kg/ha increase), higher production | Results are consistent with agricultural transformation |
| | Market linkages and development | More farmers participating in markets (54% v. 44%) | Consistent with agricultural transformation |
| | | Overall market improvement (49% v. 29%), better conditions for smallholders (68% v. 52%), higher prices due to standards (48% v. 36%), | Consistent with agricultural transformation |
| | Access to and use of credit | More households (52% v. 39%) are accessing larger amounts of credit (449,000 v. 285,000 CFA, about $280 difference) with a greater likelihood of using it for agricultural production (53% v. 36%) | Consistent with agricultural transformation |
| | Farm size and specialization | Farm sizes are higher; greater specialization (86% v. 68% concentration) and emphasis on high-value crops (onion: 49% v. 20%; fruit 16% v. 5%). | Farm size temporal evidence is lacking and effects of opening irrigated perimeters are unclear. Greater specialization and emphasis on high-value crops is consistent with transformation. |
| | Farm and household income | Higher prevalence of self-reported household farm income growth past five years (58.3% v. 46.1%). | Consistent with agricultural transformation |
| | | Higher 5-year household revenue growth (43,810 CFA v. 24,440 CFA) including among the quartile with | Consistent with agricultural transformation. NB Income growth among lowest |

| INDICATOR | RESULT STATEMENT (treatment # v. control #) | INTERPRETATION |
|---|---|---|
| | lowest quality of life (39,000 CFA v. 11,400 CFS). | quartile target households exceeds growth in any segment of control population. |
| **INSTITUTIONS** | | |
| Social institutions | More households benefit from services provided by a farmers' organization or similar organization (53% v. 40%), which provide a wider range of services (producer support services 57% v. 38%; financial services 5% v. 36%) | consistent with institutionally-based descriptions of agricultural transformation |
| **GENDER** | | |
| Gender empowerment | Greater number of women's advocacy organizations | consistent with gendered descriptions of institutional progress with productivity implications |
| **RESILIENCE** | | |
| Resilience to drought, price shocks | Lower likelihood of water shortage (23% v. 44%) and better resilience (20% v. 13%); slightly greater risk of input price shocks (38% v. 35%) but better resilience to them (20% v. 14%); greater risk of output price shocks (24% v. 27%) but better resilience to them (16% v. 11%). | On drought resistance: unable to delineate irrigation effects from transformation effects. Price results consistent with transformation and escape from rural poverty traps but not statistically significant. |
| **NON-FARM BUSINESS ACTIVITY AND INCOME GROWTH** | | |
| Rural non-farm employment and entrepreneurship | More household members employed (1.09 v. 0.55); greater share of household income from commerce, services. | consistent with emerging literature on role of rural towns and small cities in structural transformation |
| Rural employment creation | target-area firms more likely to have agricultural production employees (36% v. 20%) with higher 5-year increase in number of employees (1.6 v. 0.9). | consistent with emerging literature on role of rural towns and small cities in structural transformation |
| Rural business income | Higher rural business income | Consistent with emerging literature on role of rural towns and small cities in structural transformation |
| Rural Town Commercialization | Higher likelihood of a dynamic commercial zone (35% v. 5%) | consistent with emerging literature on role of rural towns and small cities in structural transformation |
| **Population and Migration** | | |

| INDICATOR | | RESULT STATEMENT (treatment # v. control #) | | INTERPRETATION |
|---|---|---|---|---|
| | Rural Population Growth | Higher rural small town population growth rates from 2002-2013: population growth 2.82% and 4.95% in rural town and small city in target area v. 2.82% in St. Louis (nearest coastal city) and 2.66% in Dakar (capital city). | | consistent with emerging literature on role of rural towns and small cities in structural transformation |
| | | | | |
| **SOCIETAL GOALS** | | | | |
| | Poverty reduction | - | Fewer households subjectively report being very poor (10.3% v 11.1%) or poor (61.5% v 66.2%). | results are consistent with all models of structural transformation but not statistically significant |
| | Food security | + | Shorter hungry season (3.2 v 3.8 months), more likely to experience hunger never (21.5% v 18.5%) or rarely (42.0% v. 35.9%). | consistent with all models of structural transformation |

## Conclusions

Agricultural transformation has historically been viewed through a neoclassical lens based on labor shares and productivity, with the implication that labor movement from the low-productivity, farm-dominated rural economies to higher productivity manufacturing-centered urban areas was not only inevitable, but also desirable. Productivity and labor indicators were, in this view, sufficient to measure the structural transformation processes.

Building on recent thought in the literature, we have argued that previous characterization of structural transformation and agricultural transformation paradigm are too narrow for effective 21st century development policy, and that a holistic view of a broader set of economic, political and social forces is required. We suggest key attributes that are likely to be impacted by (and in turn themselves impact) the process of agricultural and structural transformation. Indicators to measure them are used to identify differences across countries and relationships with changing incomes and stages of structural transformation. A wider range of indicators allows for a more nuanced view of structural transformation that can be used in policy impact assessment and diagnostics.

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