Urbanization without Structural Transformation: Evidence from Sub-Saharan Africa*

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Abstract: In most economies across space and time, urbanization has been accompanied by structural transformation. Standard theories of structural change understand the process of urbanization as driven to some degree by productivity growth in agriculture (Green Revolutions) or in non-agriculture (Industrial Revolutions). Present-day African economies appear to be anomalous with respect to this theoretical framework, however. Rapid urbanization has taken place across Africa in spite of very low growth in productivity in either agriculture or industry. This paper explores the forces driving African urbanization. We argue that a key part of the explanation is the reliance of many African countries on exports of natural resources. With non-homothetic preferences, the ensuing resource rents are disproportionately spent on urban goods and services. This drives urbanization through the rise of "consumption cities". By contrast, the urbanization process in much of Asia took place through the rise of "production cities" that export manufactured goods to the rest of the world. We develop a new model of structural transformation and trade that investigates the different development trajectories of economies that have comparative advantages in tradable manufactured goods or, alternatively, natural resource exports. We argue that this model may help to explain Africa's urbanization without development.

Keywords: Urbanization; Structural Change; Resource Curse; Africa
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1. INTRODUCTION

In 1950, most people across the developing world lived in rural areas and worked in agriculture. The urbanization rate in both Africa and developing Asia was 10-15%, approximately the same level as in Renaissance Europe. Most of the countries of the developing world were also poor, and widespread poverty persisted for several decades. As late as 1981, in the countries defined *today* by the World Bank as "low- and middle-income economies", 70% of the population fell below the $2/day poverty line.

In the years since 1950, urbanization has proceeded at rapid rates across the developing world. In both Asia and Africa urban shares of the population reached around 40% by 2010 – roughly comparable to the level in today's rich countries in the years following the Industrial Revolution. In the developing countries of Asia, urbanization has been accompanied by substantial economic growth, as happened previously in Europe and North America.

Somewhat curiously, however, Africa has urbanized with relatively little growth. As Figure 1 shows, urbanization in Africa has occurred at approximately the same pace as urbanization in Asia. But Africa remains far poorer, by almost any measure, than developing Asia.

Why is this a puzzle? Urbanization is usually seen as a consequence of economic development. As a country develops, the process of structural transformation implies that people move out of rural areas and agricultural employment. They move into urban-based manufacturing and service sectors. In a closed-economy model, a subsistence requirement for food consumption almost mechanically implies that development parallels urbanization. With standard Engel curves, economic growth implies increasing consumption of non-agricultural goods and services that are typically produced in urban areas. While this model seems to hold reasonably well for Asia, Africa's urban growth took place in a period with only modest economic growth and without widespread industrialization. So why did Africa urbanize?

Asia is a perfect example of urbanization *with* structural transformation. Standard structural transformation models distinguish labor push and labor pull factors as the main drivers of the rural-urban transition (Alvarez-Cuadrado & Poschke, 2011). The labor push approach shows how a rise in agricultural productivity - a *Green Revolution* - reduces the "food problem" and releases labor for the modern sector (Schultz, 1953; Gollin, Parente & Rogerson, 2002, 2007; Michaels, Rauch & Redding, 2012). The labor pull approach describes how a rise in non-agricultural productivity - an *Industrial Revolution* - attracts underemployed labor from agriculture into the modern sector (Lewis, 1954; Harris & Todaro, 1970; Hansen & Prescott, 2002; Lucas, 2004). Alternatively, a country with a comparative advantage in manufacturing can open up to trade and use imports to solve its food problem (Matsuyama, 1992; Teigner, 2011; Yi & Zhang, 2011). These mechanisms all lead to greater non-agricultural employment, and thus greater urban employment as a proportion of total workforce. The successful Asian economies all went through both a Green Revolution and an Industrial Revolution, with development following corresponding patterns (Evenson & Gollin, 2003; Young, 2003; Bosworth & Collins, 2008; Brandt, Hsieh & Zhu, 2008; McMillan & Rodrik, 2011).

In contrast, Africa offers a perfect example of urbanization *without* structural transformation. First, there has been little evidence of a Green Revolution in Africa. Its food yields have remained low (Evenson & Gollin, 2003; Caselli, 2005; Restuccia, Yang & Zhu, 2008); in 2009, cereal yields were 2.8 times lower than in Asia, while yields were 2.1 times lower for starchy roots. Second, there has been no Industrial Revolution in Africa. Its manufacturing and service sectors are relatively small and unproductive (McMillan & Rodrik, 2011; Badiane, 2011); in 2007, employment shares in industry and services were 10% and 26% for Africa, but 24% and 35% for Asia, and African labor productivity was 1.7 and 3.5 times lower in industry and services, respectively (World Bank, 2010).

We argue that part of Africa's differential pattern of urbanization can be explained by its dependence on natural resource exports, associated with what can be described as a *Natural Resource Revolution* (Jedwab, 2011). Africa is richly endowed with mineral and fuel reserves. In addition, many African countries appear to have a strong comparative advantage in the production and export of various non-food crops, such as cocoa, coffee, tea, cotton, rubber, or timber (Tosh, 1980). We view these production activities as a form of

natural resource extraction, in the sense that these crops take advantage of natural resource availability and produce goods that have essentially no domestic market.

The close relationship between Africa's urbanization and its natural resource can be seen in Figure 2, which plots the urbanization rate against GDP shares of "manufacturing and services" and "natural resource exports" (fuels, minerals and cash crops) for Asia and Africa in 2000. While Asian urbanization is associated with manufacturing and services, the most urbanized African countries are heavily dependent on exports of natural resources.[1]

The effect of resource exports on urbanization could occur through a number of different channels, which we discuss in the African context. One possible channel is that the production or marketing of natural resources could be concentrated in cities. By itself, however, this would not seem to explain the link between natural resource extraction and urbanization. Point-source natural resources (e.g., oil and minerals) are highly capital-intensive, and production of these commodities creates very little direct employment.[2] Cash crops and timber are produced in rural areas and contribute to *rural* employment, rather than urban employment.

A second possible link is that resource exports could have backward and forward production linkages with the urban-based sectors. For example, input marketing and/or output processing could generate jobs in urban areas. In practice, however, mining equipment and inputs are typically imported rather than produced domestically, and the mode of production of cash crops has remained traditional in Africa, with limited use of modern inputs. And there is little or no local processing or transformation of natural resource outputs in Africa; famously, Africa imports its own coffee and tea after they have been processed in Europe.[3]

We focus instead on a third channel of causation. We argue that differences between international prices and local production costs imply that natural resource exports have generated considerable surplus for African countries. If the Engel curve – non-homothetic preferences – implies that this surplus is mainly spent on urban goods and services, this drives urbanization through the rise of *consumption cities*. Because greater opportunities in the urban sector attract people to cities, the model is in line with the labor pull hypothesis, except it considers trade and the resource sector as the main drivers of this transformation. As wealth is created in the rural cash crop sector or urban mining sector, it is spent in the urban non-tradable sector, with demand for these goods driving urbanization. These consumption cities differ from the Asian *production cities* where wealth originates from urban-based production activities such as tradable manufacturing or services.[4]

We develop a model of structural transformation and trade that captures the three types of urbanization. In the model economy, urbanization can be driven by a Green Revolution (an increase in agricultural productivity), an Industrial Revolution (an increase in manufacturing or service productivity), or a Resource Revolution (which can be thought of as being driven by high productivity or a high price in the resource sector).

The model considers two small open economies that will differ in their resource endowments. Each economy has two factors of production – unskilled labor and skilled labor. We consider four distinct production sectors: food, natural resources, and other tradable and non-tradable goods and services. We

[1] In 2000, 27 out of 41 Sub-Saharan African countries and 4 out of 22 Asian countries have more than 10% of their GDP coming from natural resource exports. In 1960, there were 31 African countries and 3 Asian countries satisfying this criterion. We obtain an Asian pattern for Latin American countries and an African pattern for Middle East and North African countries.

[2] For instance, Angola's urbanization rate was 15% before oil was discovered there, and it is 60% in 2010. Crude oil now accounts for over 50% of GDP, but it employs fewer than 10,000 nationals. Botswana has a similar urbanization rate, but while the diamond sector accounts for 36% of GDP, it provides employment for approximately 13,000 people.

[3] The reasons for the lack of local transformation of natural resources in Africa (e.g., oil refining or cash crop processing) is beyond the scope of this paper. Transformation is capital-intensive, and downstream marketing may require specialized knowledge of consumer tastes. Poor physical infrastructure and weak institutions may have reduced the incentives for firms to locate processing industries in the developing world, but this is largely speculation. For whatever reasons, however, African economies perform very little processing or transformation of natural resource raw materials.

[4] Surely, there are consumption cities in Asia, as in Mongolia, and production cities in Africa, as in South Africa and Botswana. But overall we believe that the patterns found in Figure 2 show how distinct Asia and Africa are.

think of tradables and non-tradables as urban-based activities corresponding to the non-agricultural goods that people favor after they have satisfied their subsistence consumption needs. In addition to services such as haircuts, bars and restaurants, construction, health care, and retailing, we think of the non-tradable sector as producing some manufactured goods that are not traded – such as the local production of some goods such as clothing, footwear, furniture, and customized metal work (e.g., metal gates and window bars for houses). Any relative expansion of these two sectors will raise the urbanization rate.

One of the economies has a factor endowment that gives it a comparative advantage in natural resources. We think of this as our archetypal African economy. The othe economy, which we think of as a representative Asian country, has a comparative advantage in tradables. We abstract from questions about the sources of these comparative advantages. There is a lengthy literature arguing that Africa's dependence on natural resource exports is the end result of weak institutions, rather than some intrinsic characteristic based on geographic determinism. We accept this point of view. Our purpose is not to focus on the sources of comparative advantage or to untangle the relative importance of institutional factors and geographic factors as causes of development. Instead, we ask how this pattern, once in place, may drive different types of urbanization.

In autarky, both of our model economies are poor and rural. In either economy, a Green Revolution will have the effect of alleviating the food problem and releasing labor for other sectors. This allows the countries to specialize in their sectors of comparative advantage. Our Asian country exports tradables to the rest of the world. As the production of tradables takes place in cities, this country urbanizes through the rise of production cities. The African country exports natural resources to the rest of the world. As the Engel curve implies that the surplus of the resource sector is spent in the cities, this country also urbanizes – but through the rise of consumption cities that produce non-tradables. We assume the production of tradables requires unskilled labor and skilled labor, while the production of resources and non-tradables uses unskilled labor.

Urbanization is thus associated with economic development – rising wages – in the long run in the Asian country. In contrast, our model African country remains relatively poorer for the same level of urbanization. Although very simple, our model accounts for the fact Africa is urbanized but poor. Figure 3 confirms that resource-rich countries are much more urbanized than resource-poor countries in Africa, although the difference in per capita income is not staggering.

This paper is related to a large body of work on the role of sectoral labor productivity in driving structural change; i.e. the decline in agriculture, the rise and fall of manufacturing. and the rise of services (see Herrendorf, Rogerson & Valentinyi 2011 for a survey of the literature). A first strand of the literature looks at the origins of structural change in developed countries. The labor push approach shows how a rise in agricultural productivity – a *Green Revolution* – reduces the "food problem" and releases labor for the modern sector (Schultz, 1953; Gollin, Parente & Rogerson, 2002, 2007; Nunn & Qian, 2011; Michaels, Rauch & Redding, 2012). The labor pull approach describes how a rise in non-agricultural productivity - an *industrial revolution* - attracts underemployed labor from agriculture into the modern sector (Lewis, 1954; Harris & Todaro, 1970; Hansen & Prescott, 2002; Lucas, 2004; Alvarez-Cuadrado & Poschke, 2011). A second strand of the literature studies whether income effects or price effects explain structural change. Non-homothetic preferences and rising incomes mean a reallocation of expenditure shares towards non-agricultural goods (Caselli & Coleman II, 2001; Gollin, Parente & Rogerson, 2002, 2007; Matsuyama, 1992, 2002; Voigtländer & Voth, 2006; Galor & Mountford, 2008; Duarte & Restuccia, 2010; Alvarez-Cuadrado & Poschke, 2011). Ngai & Pissarides (2007) and Acemoglu & Guerrieri (2008) see structural change as a consequence of price effects: assuming a low elasticity of substitution across consumption goods, any relative increase in the productivity of one sector leads to a relative decrease in its employment share. Buera & Kaboski (2009), Yi & Zhang (2011) and Michaels, Rauch & Redding (2012) adopt or compare both approaches. According to the income effects approach, any rise in sectoral productivity leads to a reallocation of labor from inferior goods to superior goods. According to the price effects approach, the patterns can only be explained by a rise in agricultural productivity followed by a rise in manufacturing productivity.

We make three contributions to the literature. First, we show how adding the resource sector to the

three-sector growth model with non-homothetic preferences produces urbanization. This explains how a country can urbanize without any change in agricultural and manufacturing productivity, particularly in an open economy setting (Corden & Neary, 1982; Matsuyama, 1992; Echevarria, 2008; Galor & Mountford, 2008; Teigner, 2011; Yi & Zhang, 2011). Price effects do not necessarily hold here, as any rise in sectoral productivity could increase employment if it leads to more exports. In our model, the African country has a comparative advantage in natural resources and urbanizes as a result of a strong income effect. The Asian country has a comparative advantage in tradable manufactured goods and services and urbanizes as a result of a strong specialization effect. Third, our paper offers a single framework that can account for the differential paths of urbanization in Africa and Asia. Our model gives an explanation for the fact that Africa is urbanized but poor and also contributes to an understanding of the fact that Africa's decline in agricultural employment is associated with a rise in services but not in manufacturing .

Our second contribution relates to the literature on urbanization in developing countries. While the structural transformation literature cited above portrays urbanization as a by-product of economic development, the economic geography literature suggests that agglomeration promotes growth, in both developed countries (Rosenthal & Strange, 2004; Henderson, 2005) and developing countries (Overman & Venables, 2005; Henderson, 2010; Felkner & Townsend, 2011). Given that urbanization is a form of agglomeration, it has been argued that cities could promote growth in developing countries (Duranton, 2008; Venables, 2010; World Bank, 2009; McKinsey, 2011).[5] The structural transformation and agglomeration economies could explain why urbanization appears as strongly correlated with economic development (Acemoglu, Johnson & Robinson, 2002; Henderson, 2010). Yet an optimistic view of urbanization in developing countries is perhaps difficult to square with empirical evidence on Africa. A few studies argue that Africa has urbanized without it being fully explained by economic development (Bairoch, 1988; Fay & Opal, 2000). This excessive urbanization is attributed to pull and push factors feeding rural exodus. Some argue that Africa's urban growth can be attributed to rural poverty (Barrios, Bertinelli & Strobl, 2006; Poelhekke, 2010; de Janvry & Sadoulet, 2010). But the fact that urban growth was concentrated in resource-rich countries suggests that natural resources have been a more important factor. Others have focused on theories of urban bias, arguing that urban-biased policies have led to overurbanization and primacy in poor countries (Lipton, 1977; Bates, 1981; Ades & Glaeser, 1995; Davis & Henderson, 2003). However, there cannot be any urban bias without a surplus in the economy for governments to redistribute. In our view, resource-rich countries urbanize because of the surplus generated by resource exports; governments just amplify this effect by reallocating an even greater share of the surplus to cities. In our model, the African country is urbanized but poor because it urbanizes without tradables – tradable manufactured goods and services – and without human capital accumulation. Our paper thus provides an explanation for the growing "urbanization of global poverty" (Ravallion, Chen & Sangraula, 2007).

Finally, this paper contributes to the literature on Dutch disease and the resource curse (Corden & Neary, 1982; Matsuyama, 1992; Sachs & Warner, 2001; Robinson, Torvik & Verdier, 2006; Angrist & Kugler, 2008; Michaels, 2011; Caselli & Michaels, 2012). Dutch disease models explain why a country deindustrializes when its resource sector booms. The boom shifts labor away from the manufacturing sector into the non-tradable service sector, yet the net effect on urbanization is ambiguous. These models do not explain why African countries never industrialized and directly transitioned from agricultural economies into service economies. In our model, resource booms unambiguously increase urbanization through the income effect, and resource-rich countries fail to develop their manufacturing sectors because the country imports manufactured goods from the rest of the world. In some sense, we highlight a new dimension of the resource curse – the fact that resource booms drive urbanization through the rise of (relatively unproductive) consumption cities. In our model, the African country is relatively urbanized for its income level and does not accumulate human capital.

The paper is organized as follows: The next section describes in greater detail the differential patterns of structural transformation in Asia and Africa and provides a more detailed motivation for examining the

[5]For instance, McKinsey (2011) writes (p.3-19): "Africa's long-term growth also will increasingly reflect interrelated social and demographic trends that are creating new engines of domestic growth. Chief among these are urbanization and the rise of the middle-class African consumer. [...] In many African countries, urbanization is boosting productivity (which rises as workers move from agricultural work into urban jobs), demand and investment."

differences between the two. Section 3 outlines a model of structural transformation in a closed economy. Section 4 extends this model to an open economy. Section 5 examines the dynamics of the structural transformation process. Section 6 concludes.

2. DIFFERENTIAL PATTERNS OF URBANIZATION: ASIA AND AFRICA

This section continues the discussion of urbanization patterns developed in the introduction and provides additional evidence. We begin by carefully documenting a series of stylized facts regarding urbanization in Asia and Africa. Our data are drawn from a variety of sources and cover a period of time during which economies in both regions have undergone substantial urbanization.

2.1 Data Sources

The United Nations report the official urbanization rate for most countries by decade from 1960 to 2010 (http://esa.un.org/unpd/wup/index.htm), which we use for an initial examination of the data. A potential problem with comparing countries using these data is that different countries use different definitions for urbanization. Although our descriptive statistics rely on these data, we have begun to test the validity of the comparisons. For instance, the UN data include text explaining the definition of urbanization adopted by each country for each census year. Preliminary evidence indicates that most countries use a population threshold to identify cities; i.e. a locality is defined as "urban" if it has more than a specified number of inhabitants. The average threshold value is approximately the same across the set of African and Asian countries for which we have data (around 4,200 inhabitants). In future regression analysis, we will control directly for this threshold value.

Data on natural resource exports are more problematic. Commonly used data from the World Bank and COMTRADE are very imperfect because of omissions and because of problems related to the unit values of trade. We prefer to use data coming from the United States Geological Service, which has published annual country reports from 1960 to the present that have detailed and consistent estimates of the export share of mining and fuels. For data on agricultural exports, which we also view as a form of natural resource exports, we have relied on the UN Food and Agriculture Organization's online FAOSTAT database. Together with standard data sources on national income accounts and PPP-adjusted measures of income per capita, these sources will allow us to calculate most of the ratios that our analysis requires.

2.2 Urbanization in Africa and Asia

At the beginning of the 20th century, both Africa and Asia were poor and heavily rural. Their economies were heavily dependent on low productivity agriculture, and from the admittedly sparse data that are available, it appears that urbanization rates in both regions were less than 5% (Bairoch 1988), the same level as in Medieval Europe. Half a century later, the two regions still looked quite similar: poor and rural. By 1950 their urbanization rates had crept up to 10-15%, which was still as low as in Renaissance Europe. By the start of the 21st century, urbanization has now reached around 40% in both Africa and Asia, which is comparable to the level attained in today's developed countries after the Industrial Revolution.

Urban growth has taken place in cities of all sizes. Although the literature emphasizes the growth of the largest cities in the developing world, urban growth has in fact taken place in cities of all sizes - large, medium, and small. The distribution of city size across regions is quite similar, too. For example, in 2010, there were 257 Asian and 60 African "mega-cities" with over 750,000 inhabitants. Since Asia is roughly four times more populous than Africa, this means that Africa and Asia have approximately the same number of megacities per capita. The megacities represent around 40% of the urban population in both continents.

But although urbanization patterns in Africa and Asia look quite similar for the past half century, there are two striking differences. The first is that Asia's urbanization has occurred in conjunction with rapid growth

in per capita income. And the second is that urbanization in Asia has coincided with a rapid movement of people out of agriculture into manufacturing and industry, whereas in Africa urbanization has been accompanied primarily by a movement into services. Figure 1 shows a comparison of income growth and urbanization in Asia and Africa; it is clear that although African GDP per capita has lagged far behind that of Asia, urbanization has proceeded in more or less the same fashion in both regions.

2.3 Structural Transformation in Africa and Asia

African countries have always been highly specialized in the export of natural resources, whether mineral products, fuels or cash crops. In 1960, 31 out of 41 Sub-Saharan African countries and only 3 out of 22 Asian countries had more than 10% of their GDP coming from natural resource exports. In contrast, Asian countries developed through expansion of their manufacturing sectors, with industrialization successively sweeping through Japan, South Korea, Hong Kong, Singapore, Taiwan, Malaysia, Thailand and China.

These differences have persisted in the recent period. In 2000, 27 out of 41 Sub-Saharan African countries and 4 out of 22 Asian countries have more than 10% of their GDP coming from natural resource exports. By comparison, manufacturing and services account for 85.1% of GDP on average in Asia, against 54.4% in Africa.

While Asian urbanization is associated with manufacturing and services, the most urbanized African countries export natural resources. This is confirmed by Figure 2 which plots the urbanization rate against GDP shares of “manufacturing and services” and “natural resource exports” for Asia and Africa in 2000. We obtain an “Asian” pattern for Latin American countries and an “African” pattern for Middle East and North African countries.

Figure 1 shows that both Africa and Asia have followed the same urbanization patterns. Yet Africa’s urban growth was achieved in a period with only modest economic growth and without industrialization. Until the mid-1960s, Africa and Asia had the same level of per capita income. Asia has experienced strong economic growth in the subsequent period, as a result of industrialization and the rise of services. Resource exports have fostered African economic growth till the mid-1970s, but the subsequent period was characterized by macroeconomic disequilibria, social unrest and general impoverishment. The 1980s was a “lost decade” for Africa. Africa now has only one-fourth the income per capita of Asia, although it is equally urbanized. We will use the shorthand terminology of saying that Africa is “urbanized but poor”.

2.4 Different Paths among African Countries

Arguably there are many respects in which Africa differs from Asia, so it may not be convincing to seize on natural resource exports as the source of their different paths. However, we can also look within the African continent to compare countries with different levels of dependence on natural resource exports. It is hardly news to find a negative relationship between natural resource exports and income levels; this is simply the "resource curse" that has received much attention. But we note an additional fact: natural resource dependence within Africa seems to be closely (and positively) related to urbanization, which is not a point that is typically noted in the literature on resource curses.

Figure 3 shows the evolution of urbanization and per capita GDP for four groups of African countries depending on the average share of natural resource exports in GDP in 1960-2000. Urbanization rates were similar across the four country groups at independence, but resource rich countries are now much more urbanized (while the difference in per capita income is not staggering). For example, the urbanization rate of the resource-rich countries is 50.3% on average in 2010, while it is 25.1% on average for the resource-poor countries.

Moreover, when we look within countries, making use of time series data, it appears that resource-rich countries have all experienced dramatic urbanization after resource production boomed, whether as a

result of the discovery of mining deposits and oil fields or the adoption of agricultural innovations in the cash crop sector. Figure 4 shows urbanization patterns for eight African countries that have experienced a resource boom in the post-1960 period. In Gabon, Nigeria and Angola, urbanization boomed after oil was discovered in the early 1970s. In Liberia, urbanization increased after iron ore, gold and diamonds boomed in the 1960s-1970s. In Ghana and Ivory Coast, urbanization was largely driven by the cocoa booms, in the 1960s and 1990s in the former and in the 1960s, 1970s and 1980s in Ivory Coast (Jedwab 2012). In Zambia, copper boomed in the 1960s-1970s. Interestingly, urbanization decelerated after 1980 due to a collapse in copper prices. In Botswana, diamonds were discovered after 1973, and urbanization boomed as a result.

We can also look at those countries that were relatively urbanized at independence (taking as a threshold a 20% level of urbanization in 1960). In almost all cases, these were countries that had experienced resource booms in the pre-independence period. These were mostly countries that had experienced booms in agricultural commodities: rubber production boomed as early as the 1920s in the DRC, groundnut production boomed in the 1930s in Senegal, and cocoa production boomed in the 1930s in Ghana. In terms of mining exports, gold and diamonds were discovered in South Africa in the 1910s, while diamonds were discovered in the Central African Republic in 1930s.

By comparison, some Africa countries are still not very urbanized; these are countries with low exports of cash crops and little natural resource production. Figure 5 shows urbanization for 8 of these countries.

2.5 Central Questions

This cursory look at the data raises a series of questions that we will take up theoretically and with empirical analysis. The first question is whether these relationships have a plausible theoretical foundation and whether the data can be rationalized by a standard model of structural transformation. A second question is quantitative: how much urbanization could we have expected to see in Africa if it had been able to develop comparative advantages in sectors other than natural resource extraction. It is clear that urbanization would have increased anyway, as a result of demographic growth and the availability of food imports. Yet we believe that Africa's urbanization rates today are driven to high levels by natural resource exports that promote the development of "consumption cities" where natural resource rents are used to purchase non-tradable services. We are not convinced that these consumption cities display the same agglomeration externalities in production that have characterized urbanization in other parts of the world, which might account for the different relationship between urbanization and income levels that we currently observe.

3. A MODEL OF STRUCTURAL CHANGE

The evidence shows that structural change and urbanization are not monotonically related to income per capita. Africa from 1950–2010 experienced structural change and urbanization similar in magnitudes to that in East Asia, but without the rapid rise in living standards. Here we present a model that captures this distinction between the two regions. The model expands on existing models of structural change by allowing for several types of non-agricultural goods: tradable goods, non-tradable goods, and natural resources. Furthermore, we distinguish urban sectors (tradable and non-tradables) from rural sectors (resources and agriculture). These finer distinctions allow us to describe the processes of structural change and urbanization in more detail, which in turn provides a means to explain the distinction between Africa and Asia in the post-war period.

The driving difference between Africa and Asia is their comparative advantage in the production of natural resources versus tradable goods. The natural wealth of Africa led that continent to specialize in resource extraction, using the proceeds to import desired tradable goods. The ability to export resources raised incomes, leading to increased demand for other non-agricultural goods, in particular non-tradable goods. The increased demand for non-tradables leads to a structural shift towards that sector, which also involves

greater urbanization. However, non-tradable goods have relatively low human capital requirements and so Africa does not have the incentive to develop a skilled workforce. In contrast, Asia specializes in tradable goods, and this along with the associated income effect on non-tradables raises urbanization there. However, as a producer of tradable goods with relatively high human capital requirements, Asia faces incentives favoring more skilled (and hence higher paid) workers.

We show that even starting from essentially equal conditions around 1950, the difference in comparative advantage in the two regions is sufficient to introduce a gap in living standards between them despite experiencing similar shifts of workers into urban areas.

To proceed we first describe the a simple static model of the allocation of labor across different sectors. The model provides a richer description of urbanization than is present in most models of structural change, and allows for differences in the kinds of workers that locate in urban areas. Using that model, we examine the response to free trade in economies that have different comparative advantages. Specifically, we compare an economy with an advantage in producing natural resources to one with an advantage in producing tradable consumption goods. We show how even though both types of economies benefit from trade and begin urbanizing, they differ in the kinds of work being done in urban areas and hence in output per capita.

The section following this one expands on the static model to add in dynamics regarding choices the skill mix of the labor force and allows for technological change over time.

3.1 Individual Utility and Budgets

Individuals have a constant-elasticity of substitution utility function

$$U_t = \left[\theta_f^{1/\phi}(c_f - \overline{c}_f)^{(\phi-1)/\phi} + \theta_C^{1/\phi} C^{(\phi-1)/\phi}\right]^{\phi/(\phi-1)} \tag{1}$$

where c_f is the amount of food consumed and $\overline{c}_f$ captures a subsistence amount of food that all individuals must consume. This utility for the food good is typical in models of structural change, as it leads to an income elasticity less than one for food, consistent with Engel's law.

The term C is an aggregator of non-food consumption items. The parameter ϕ determines the degree to which individuals are willing to substitute between food and the non-food consumption goods. We will go forward assuming that $\phi > 1$, implying that these goods are substitutes. This is consistent with explanations of structural change that emphasize changing relative prices, as opposed to income effects. A change in relative prices that makes C cheaper will, even holding income constant, lead to a shift out of food consumption and towards C.

The aggregator C is defined as

$$C = \left[\theta_r^{1/\epsilon} c_r^{(\epsilon-1)/\epsilon} + \theta_n^{1/\epsilon} c_n^{(\epsilon-1)/\epsilon} + \theta_d^{1/\epsilon} c_d^{(\epsilon-1)/\epsilon}\right]^{\epsilon/(\epsilon-1)}, \tag{2}$$

also a constant elasicity of substitution function of three goods: resources (r), non-tradables (n), and tradables (d). θ_j are the weights individuals put on each good j and ϵ is the elasticity of substitution between them. With this aggregate, we assume that $\epsilon < 1$, meaning the goods are complements. Thus anything that lowers the price of one of these goods will lead to increased consumption of the other goods.

The budget constraint is

$$p_f c_f + p_r c_r + p_n c_n + p_d c_d = w \tag{3}$$

where p_j are the prices of the goods and w is the wage. Individuals earn only labor income. It is useful to re-write the budget constraint as follows

$$p_f(c_f - \overline{c}_f) + p_r c_r + p_n c_n + p_d c_d = w - p_f \overline{c}_f \tag{4}$$

where $w - p_f \bar{c}_f$ is the surplus income available to individuals after they have met their subsistence requirement for food.

Maximizing utility subject to this budget constraint, it is easiest to express the resulting demand functions in terms of expenditure shares. To aid in the exposition, define the following two price indices

$$P_C = \left[p_r^{1-\epsilon}\theta_r + p_n^{1-\epsilon}\theta_n + p_d^{1-\epsilon}\theta_d\right]^{1/(1-\epsilon)} \tag{5}$$

$$P = \left[p_f^{1-\phi}\theta_f + p_C^{1-\epsilon}\theta_C\right]^{1/(1-\phi)}. \tag{6}$$

The first, P_C, is a price index of the non-food goods, while the second is the aggregate price index.

The fraction of surplus income that will be spent on net food consumption, $c_f - \bar{c}_f$ is denoted Ω_f,

$$\Omega_f = \frac{p_f^{1-\phi}\theta_f}{P^{1-\phi}}, \tag{7}$$

and so total expenditures on net food are given by

$$p_f(c_f - \bar{c}_f) = (w - p_f\bar{c}_f)\Omega_f. \tag{8}$$

Given that the fraction Ω_f of surplus income is spent on food, the remaining fraction $1 - \Omega_f$ of surplus income is spent on the three non-food goods. The split of expenditures among the three goods is dictated by their price relative to the aggregate price P_C. Specifically, the fractions of surplus income expended good $j \in (r, n, d)$, denoted Ω_j, is

$$\Omega_j = (1 - \Omega_f)\frac{p_j^{1-\epsilon}\theta_j}{P_C^{1-\epsilon}}. \tag{9}$$

It is tedious but straightforward to confirm that $\Omega_f + \Omega_r + \Omega_n + \Omega_d = 1$.

Once we have the production side of the economy in place, we will be able to use this demand structure to determine the allocation of labor across the various sectors of the economy.

3.2 Production and Factor Payments

The four goods are produced by technologies linear in labor. So for any given sector j the production technology is

$$Y_j = A_j L_j \tag{10}$$

for $j \in (f, r, n, d)$, where A_j is productivity in that sector and L_j is the labor employed in that sector.

Labor is assumed to move freely between the sectors so that in autarky the wage is equivalent to

$$w = p_f A_f = p_r A_r = p_n A_n = p_d A_d \tag{11}$$

which will be used to determine the relative prices between various goods. There is an adding up constraint for labor employed across the sectors

$$L = L_f + L_r + L_d + L_n + L_d. \tag{12}$$

To proceed, it will be useful to define two indices of productivity.

$$A_C = \left[A_r^{\epsilon-1}\theta_r + A_n^{\epsilon-1}\theta_n + A_d^{\epsilon-1}\theta_d\right]^{1/(\epsilon-1)} \tag{13}$$

$$A = \left[A_f^{\phi-1}\theta_f + A_C^{\phi-1}\theta_C\right]^{1/(\phi-1)}. \tag{14}$$

Note that an increase in the productivity in any individual sector raises both indices. Furthermore, using the definition of the aggregate price index given previously, it is the case that the real wage is

$$\frac{w}{P} = A. \tag{15}$$

Hence an increase in productivity in any sector raises the real wage.

3.3 Equilibrium in Autarky

Without trade, all sectors operate to provide goods to consumers. To begin solving for the equilibrium allocation of labor to the various sectors, note that (11) shows that the relative price between any two sectors can be written as $p_i/p_j = A_j/A_i$. In addition, the relative price of food to the non-food aggregate can be expressed as $p_f/p_C = A_C/A_f$.

Using these relative prices, we can re-write the fractions of expenditures in terms of productivity levels. We have that

$$\Omega_f = \frac{A_f^{\phi-1}\theta_f}{A^{\phi-1}}. \tag{16}$$

From this, and given our assumption that $\phi > 1$, an increase in the productivity of the food sector will raise the fraction of surplus income spent on food. On the other hand, an increase in the productivity of any of the non-food sectors will raise A and lower the fraction spent on food as individuals substitute away to the cheaper non-food items.

Similarly, we can write the expenditure shares of the non-food items in terms of productivity levels,

$$\Omega_j = (1-\Omega_f)\frac{A_j^{\epsilon-1}\theta_j}{A_C^{\epsilon-1}} \tag{17}$$

for $j \in (r,n,d)$. Here, an increase in the productivity of sector j has two conflicting effects. First, if A_j rises, this lowers Ω_f as noted above, and this tends to increase Ω_j. Secondly, though, an increase in A_j will lower Ω_j due to our assumption that $\epsilon < 1$. An increase in the productivity of sector j lowers the price of good j. But as complements, the lower price of good j allows individuals to put more of their expenditures into other sectors.

To solve for the equilibrium allocation of labor across sectors, we equate total expenditures on a given sector to the total value of goods produced in that sector. For $j \in (r,n,d)$ we have that

$$p_j Y_j = L(w - p_f \bar{c}_f)\Omega_j, \tag{18}$$

while for the food sector we have that

$$p_f Y_f = L(w - p_f \bar{c}_f)\Omega_f + L p_f \bar{c}_f. \tag{19}$$

Given the definition of the production functions, the free mobility of labor, and the definitions of the Ω terms, the solution for the fraction of labor employed in any given sector $j \in (r,n,d)$ is

$$\frac{L_j}{L} = \left(1 - \frac{\bar{c}_f}{A_f}\right)\Omega_j \tag{20}$$

while the fraction employed in food production is

$$\frac{L_f}{L} = \left(1 - \frac{\bar{c}_f}{A_f}\right)\Omega_f + \frac{\bar{c}_f}{A_f}. \tag{21}$$

In each sector, the term $(1-\bar{c}_f/A_f)$ represents the surplus time available to workers after they have worked

long enough to afford their subsistence amount of food. The expenditure shares Ω determine how much of that surplus time is allocated to each sector. For food production, we must also add back in the labor employed producing the subsistence requirement.

Given our solutions for labor allocations, we can also describe the level of urbanization in the economy. We assume that the non-tradable and tradable sectors operate within urban areas due to economies of scale and agglomeration effects. Hence the urbanzation rate is

$$u = \left(1 - \frac{\overline{c}_f}{A_f}\right)\left(\Omega_n + \Omega_d\right). \tag{22}$$

Our model contains within it the typical model of agricultural-led structural change and urbanization. An increase in A_f will increase the surplus time available to workers, and this will raise the fraction of workers employed in the resource, non-tradable, and tradable sectors, while reducing the fraction in food. On net, as Ω_n and Ω_d are rising, urbanization will increase.

An industry-led process of structural change and urbanization can also take place. If A_d increases this has several influences. First, the fraction Ω_f falls as individual substitute away from food consumption. This raises the fraction of time spent on *all* of the non-food goods. There will be some reallocation away from tradables towards resources and non-tradables due to the complemtarity of these goods, but on net Ω_d will increase. Therefore urbanization will rise overall with industry-led productivity growth.

Note, though, that it is quite possible for resources to lead the urbanization and structural change process. An increase in A_r will have similar effects to an increase in A_d. Labor will be drawn away from food production and into non-food production. In autarky, greater natural resource wealth can be conducive to structural change into tradable production. As we will see below, the effects of greater resource wealth change once there is the possibility of free trade.

4. OPEN ECONOMIES

Starting from autarky situation just described, what happens if we allow the economy to trade? When the economy can trade, the optimal allocations to different sectors, and hence the level of urbanization, will change according to their comparative advantage. We presume that both resources and tradables can be traded at fixed world prices, p_r^* and p_d^*.

4.1 Comparative Advantage in Tradables

We first consider an economy where the autarky price is such that $p_r/p_d > p_r^*/p_d^*$, so the economy will export tradables and import resources. We conceive of this situation as representing the typical model of export-led development, in which a country uses a comparative advantage in producing tradables to urbanize and increase living standards. Effectively, trade allows this economy to "produce" resources in urban areas by employing tradable sector workers.

The index of non-food productivity in this economy is thus altered from that in the autarky case, and we can write the productivity index in the tradable economy as

$$A_C^D = \left[\left(\frac{p_d^* A_d}{p_r^*}\right)^{\epsilon-1}\theta_r + A_n^{\epsilon-1}\theta_n + A_d^{\epsilon-1}\theta_d\right]^{1/(\epsilon-1)} \tag{23}$$

The productivity of this economy in turning labor into resource goods now is dependent on their tradable-sector productivity A_d and the relative price of tradable and resource goods. Note that because $p_d^* A_d/p_r^* > A_r$ in this economy, trade has increased productivity and hence the real wage.

Free mobility between the three sectors that operate ensures that

$$w = p_f A_f = p_n A_n = p_d^* A_d. \tag{24}$$

The determination of the allocation of labor proceeds as before, only now note that the fraction of labor in the resource sector is zero, and the tradable sector must employ enough labor to supply tradable goods that can be traded for the resources demanded.

$$\frac{L_d}{L} = \left(1 - \frac{\overline{c}_f}{A_f}\right)\left(\Omega_d + \Omega_r\right), \tag{25}$$

where Ω_d and Ω_r are defined similarly to before, only they now have A_C^D in their denominators. The expenditure fraction for resources no longer depends on domestic A_r, and is instead

$$\Omega_r = \left(\frac{p_d^* A_d}{p_r^*}\right)^{\epsilon-1} \theta_r / A_C^D. \tag{26}$$

The fraction employed in non-tradables and food are determined as in autarky, simply noting that A_C^D replaces A_C in the denominators of Ω_f and Ω_n.

There are two aspects of trade that lead to increased urbanization in the economy with a comparative advantage in tradable goods. First, trade has increased the productivity of the economy and this will lead to substitution away from food and into non-food goods, which includes tradables and non-tradables. Secondly, labor that would have otherwise been employed in producing resources is reallocated by trade into the tradable sector.

In the economy that specializes in tradable goods, increased urbanization is associated with structural change in the sense that workers are moving out of agriculture and into the tradable sector.

4.2 Comparative Advantage in Resources

We can constrast the situation of a comparative advantage in tradables to an alternative, a comparable advantage in resources. Assume that $p_r/p_d < p_r^*/p_d^*$, so that an economy has relatively cheap resources compared to the world. It thus exports resources and imports tradable goods.

For this economy, the index of non-food productivity is now

$$A_C^R = \left[A_r^{\epsilon-1}\theta_r + A_n^{\epsilon-1}\theta_n + \left(\frac{p_r^* A_r}{p_d^*}\right)^{\epsilon-1}\theta_d\right]^{1/(\epsilon-1)}. \tag{27}$$

The economy is able to convert labor into tradable goods at a higher rate by employing it to produce resources that can be traded for tradable goods. The productivity level A_C^R is higher than in autarky, and so the real wage has increased through trade.

The three sectors that operate employ all the labor of the economy, and again we assume free mobility between sectors so that we have

$$w = p_f A_f = p_r^* A_r = p_n A_n. \tag{28}$$

The labor allocations can be solved for as before. The resource sector must meet domestic demand as well as provide exports to acquire tradable goods, so we have

$$\frac{L_r}{L} = \left(1 - \frac{\overline{c}_f}{A_f}\right)\left(\Omega_r + \Omega_d\right), \tag{29}$$

where Ω_r and Ω_d are defined as before, except with A_C^R in their denominators. Ω_d is not dependent on

domestic tradable productivity, but is now

$$\Omega_d = \left(\frac{p_r^* A_r}{p_d^*}\right)^{\epsilon-1} \theta_d / A_C^R. \tag{30}$$

While labor is moved out of the tradable sector and into the resource sector in this economy due to trade, there is also a tendency for higher urbanization due to the income effect of trade. Productivity in the non-food sectors has risen, and this induces a subsitution away from the food sector and into non-tradables and resources. The non-tradable sector thus increases in size, which acts to raise urbanization.

In a situation where the tradable sector was very small to begin with, as was the case in Africa in the immediate post-war period, the net effect of opening to trade can be positive for urbanization. In this sense we have resource-led urbanization, but that is not associated with a structural shift towards tradable production. The urban population consists entirely of non-tradable workers.

Additionally, consider the consequences of an increase in A_r, representing increased productivity in resource productivity or alternatively the discovery of new sources of resources for trade. As A_r rises, so does the productivity index A_C^R. This causes a substitution away from food production and into the non-food sectors. While there also is a reallocation within the non-food sectors of labor from resources into non-tradables, it can be shown that the following holds

$$\frac{\partial L_n/L}{\partial A_r} > 0 \textbf{ and } \frac{\partial L_r/L}{\partial A_r} > 0. \tag{31}$$

The result is that when A_R rises the urbanization rate increases, as shown in Figure 6. In addition, the fraction of labor employed in resources (which is also the fraction of GDP in resources in our model) also rises, and so we have a positive relationship between the urbanization rate and the size of the resource sector, as in Figure 6.

5. DYNAMICS OF STRUCTURAL CHANGE WITH TRADE

To this point we have established the effect of a one-time opening to trade on the structure of two different types of economies. Here, we extend the analysis to consider the paths of these economies over time.

To proceed, we presume that there is positive productivity growth in both the tradable and resource sectors. One can think of a learning-by-doing setting in which production of the good leads to greater skill in producing the good. For resources, however, the productivity growth is slower as there is the additional drag of declining stocks of resources. The result is that productivity growth is positive, but lower, in resources than in the tradable sector.

Positive growth in A_d in the tradable economy will lead to urbanzation and a structural shift out of food production and non-tradables and towards tradable production. Figure 7 shows how urbanization and the shares in the two urban sectors change over time with productivity growth in A_d. As can be seen, urbanization consists of an increasing share of tradable workers.

The resource economy experiences growth in A_r, which also promotes urbanization. However, as this economy only has non-tradable production in urban areas, urbanization consists entirely of an increase in the that sector. As mentioned previously, the rise of "consumption" cities, as opposed to the production cities in the tradable-specializing economy.

Finally, we can compare the effect on living standards between the two countries. To compare the real wage between the two types of economies, we need a common price level, which we denote P^*, representing some international price index. The real wages of the tradable economy relative to the resource economy can be written as follows

$$\frac{w^D/P^*}{w^R/P^*} = \frac{p_d^* A_d^D}{p_r^* A_r^R} \tag{32}$$

and depends on the relative price of tradables to resources as well as the levels of technology in those sectors in the two economies. We presume that the relative price of tradables stays constant, as we are not modelling the equilibrium determination of that price, and it likely depends heavily on the characteristics of developed countries. The comparison of relative wages depends entirely on the path of productivity in the exporting sectors of the two economies, and as noted earlier we presume that learning-by-doing is more pronounced in the tradable economy. Hence the real wage in the tradable economy is going to advance faster than in the resource economy, despite both beginning to urbanize. Figure 8 shows the increase in relative wages in the tradable economy relative to the resource exporter.

6. CONCLUSION

This paper develops a new model of structural transformation in open economies that can help account for the divergent patterns of urbanization and development observed in Asia and Africa. Asia has experienced urbanization with structural transformation and growth in incomes; in our model, this reflects their success in exporting tradable manufactured goods and services to the rest of the world. Since these tradables are produced in cities, comparative advantage and specialization drive urban growth through the rise of production cities.

In contrast, we argue that Africa has experienced urbanization without structural transformation. African countries export natural resources to the rest of the world. Resource revenues are spent in the cities, whether by private recipients of resource rents or by governments. The income effect drives urban growth through the rise of consumption cities.

If the production of tradable manufactured goods and services requires more skilled – and higher paid – workers, then Asia's pattern of urbanization will be associated with development, while Africa's pattern will lead to urbanization with little income growth.

Our model makes three contributions to our understanding of the relationship between structural change, urbanization and economic development. The first contribution is to establish that Africa has followed a different pattern of urbanization from elsewhere. We argue that this is because Africa did not urbanize following a Green Revolution or an Industrial Revolution, but as a result of natural resource exports. The second contribution is to question the supposedly positive relationship between urbanization and economic development. Although resource-rich countries are much more urbanized than resource-poor countries within Africa, resource-rich countries are over-urbanized for their level of economic development. We explain this result by the fact that African cities developed without producing tradable goods and without human capital accumulation. The third contribution is to highlight a new mechanism for the resource curse. Resource-rich countries urbanize but remain poor.

This paper leaves several open questions. The first is why African countries have been unable to acquire or develop a comparative advantage in sectors other than those based on resource extraction. We acknowledge the possibility that institutions and colonial history, as well as resource endowments, may have driven this initial specialization. But we do not attempt to model this directly. A second question that we leave unanswered is why consumption cities do not evolve into production cities over time. Our model does not allow for this, and we view it as an important question that warrants further study.

REFERENCES

Acemoglu, Daron, and Veronica Guerrieri. 2008. "Capital Deepening and Nonbalanced Economic Growth." *Journal of Political Economy*, 116(3): 467–498.

Acemoglu, Daron, Simon Johnson, and James A. Robinson. 2002. "Reversal Of Fortune: Geography And Institutions In The Making Of The Modern World Income Distribution." *The Quarterly Journal of Economics*, 117(4): 1231–1294.

Ades, Alberto F, and Edward L Glaeser. 1995. "Trade and Circuses: Explaining Urban Giants." *The Quarterly Journal of Economics*, 110(1): 195–227.

Alvarez-Cuadrado, Francisco, and Markus Poschke. 2011. "Structural Change Out of Agriculture: Labor Push versus Labor Pull." *American Economic Journal: Macroeconomics*, 3(3): 127–58.

Angrist, Joshua D., and Adriana D. Kugler. 2008. "Rural Windfall or a New Resource Curse? Coca, Income, and Civil Conflict in Colombia." *The Review of Economics and Statistics*, 90(2): 191–215.

Badiane, Ousmane. 2011. *Agriculture and Structural Transformation in Africa.* Center on Food Security and the Environment: Stanford Symposium Series on Global Food Policy and Food Security in the 21st Century.

Bairoch, Paul. 1988. *Cities and Economic Development: Frow the Dawn of History to the Present.* Chicago: The University of Chicago Press.

Barrios, Salvador, Luisito Bertinelli, and Eric Strobl. 2006. "Climatic Change and Rural-Urban Migration: The Case of Sub-Saharan Africa." *Journal of Urban Economics*, 60(3): 357–371.

Bates, Robert. 1981. *Markets and States in Tropical Africa: The Political Basis of Agricultural Policies.* Berkeley: University of California Press.

Bosworth, Barry, and Susan M. Collins. 2008. "Accounting for Growth: Comparing China and India." *The Journal of Economic Perspectives*, 22(1): 45–66.

Brandt, Loren, Chang-Tai Hsieh, and Xiaodong Zhu. 2008. "Growth and Structural Transformation in China." In *China's Great Economic Transformation*. , ed. L. Brandt and T. G. Rawski, 683–728. Cambridge: Cambridge University Press.

Buera, Francisco J., and Joseph P. Kaboski. 2009. "Can Traditional Theories of Structural Change Fit The Data?" *Journal of the European Economic Association*, 7(2-3): 469–477.

Caselli, Francesco. 2005. "Accounting for Cross-Country Income Differences." In *Handbook of Economic Growth*. Vol. 1, , ed. P. Aghion and S. Durlauf, Chapter 9, 679–741. Elsevier.

Caselli, Francesco, and Guy Michaels. 2012. "Do Oil Windfalls Improve Living Standards? Evidence from Brazil." *American Economic Journal: Applied Economics*, Forthcoming.

Caselli, Francesco, and Wilbur John Coleman II. 2001. "The U.S. Structural Transformation and Regional Convergence: A Reinterpretation." *Journal of Political Economy*, 109(3): 584–616.

Corden, W Max, and J Peter Neary. 1982. "Booming Sector and De-Industrialisation in a Small Open Economy." *Economic Journal*, 92(368): 825–48.

Davis, James C., and J. Vernon Henderson. 2003. "Evidence on the political economy of the urbanization process." *Journal of Urban Economics*, 53(1): 98–125.

de Janvry, Alain, and Elisabeth Sadoulet. 2010. "Agriculture for Development in Africa: Business-as-Usual or New Departures?" *Journal of African Economies*, 19(suppl 2): ii7–ii39.

Duarte, Margarida, and Diego Restuccia. 2010. "The Role of the Structural Transformation in Aggregate Productivity." *The Quarterly Journal of Economics*, 125(1): 129–173.

Duranton, Gilles. 2008. "Viewpoint: From Cities to Productivity and Growth in Developing Countries." *Canadian Journal of Economics*, 41(3): 689–736.

Echevarria, Cristina. 2008. "International trade and the sectoral composition of production." *Review of Economic Dynamics*, 11(1): 192–206.

Evenson, Robert E., and Douglas Gollin. 2003. "Assessing the Impact of the Green Revolution, 1960 to 2000." *Science*, 300(5620): 758–762.

Fay, Marianne, and Charlotte Opal. 2000. "Urbanization without growth : a not-so-uncommon phenomenon." The World Bank Policy Research Working Paper Series 2412.

Felkner, John S., and Robert M. Townsend. 2011. "The Geographic Concentration of Enterprise in Developing Countries." *The Quarterly Journal of Economics*, 126(4): 2005–2061.

Galor, Oded, and Andrew Mountford. 2008. "Trading Population for Productivity: Theory and Evidence." *Review of Economic Studies*, 75(4): 1143–1179.

Gollin, Douglas, Stephen L. Parente, and Richard Rogerson. 2002. "The Role of Agriculture in Development." *American Economic Review*, 92(2): 160–164.

Gollin, Douglas, Stephen L. Parente, and Richard Rogerson. 2007. "The food problem and the evolution of international income levels." *Journal of Monetary Economics*, 54(4): 1230–1255.

Hansen, Gary D., and Edward C. Prescott. 2002. "Malthus to Solow." *American Economic Review*, 92(4): 1205–1217.

Harris, John R., and Michael P. Todaro. 1970. "Migration, Unemployment & Development: A Two-Sector Analysis." *American Economic Review*, 60(1): 126–42.

Henderson, J. Vernon. 2005. "Urbanization and Growth." In *Handbook of Economic Growth*. Vol. 1, , ed. P. Aghion and S. Durlauf, Chapter 24, 1543–1591. Elsevier.

Henderson, J. Vernon. 2010. "Cities and Development." *Journal of Regional Science*, 50(1): 515–540.

Herrendorf, Berthold, Richard Rogerson, and Akos Valentinyi. 2011. *Growth and Structural Transformation.* Draft prepared for the Handbook of Economic Growth.

Jedwab, Remi. 2011. "Why is Africa So Urbanized? Evidence from Resource Exports in Ghana and Ivory Coast." Unpublished manuscript, Department of Economics, Paris School of Economics and London School of Economics.

Lewis, Arthur. 1954. "Economic Development with Unlimited Supplies of Labour." *The Manchester School*, 22(2): 139–191.

Lipton, Michael. 1977. *Why Poor People Stay Poor: Urban Bias in World Development.* Cambridge: Harvard University Press.

Lucas, Robert E. 2004. "Life Earnings and Rural-Urban Migration." *Journal of Political Economy*, 112(S1): S29–S59.

Matsuyama, Kiminori. 1992. "Agricultural Productivity, Comparative Advantage, and Economic Growth." *Journal of Economic Theory*, 58(2): 317–334.

Matsuyama, Kiminori. 2002. "The Rise of Mass Consumption Societies." *Journal of Political Economy*, 110(5): 1035–1070.

McKinsey. 2011. *Lions on the Move: The Progress and Potential of African Economies.* London : Mc Kinsey Global Institute.

McMillan, Margaret S., and Dani Rodrik. 2011. "Globalization, Structural Change and Productivity Growth." NBER Working Papers 17143.

Michaels, Guy. 2011. "The Long Term Consequences of Resource-Based Specialisation." *The Economic Journal*, 121(551): 31–57.

Michaels, Guy, Ferdinand Rauch, and Stephen J. Redding. 2012. "Urbanization and Structural Transformation." *The Quarterly Journal of Economics*, 127(2): 535–586.

Ngai, Rachel L., and Christopher A. Pissarides. 2007. "Structural Change in a Multisector Model of Growth." *American Economic Review*, 97(1): 429–443.

Nunn, Nathan, and Nancy Qian. 2011. "The Potato's Contribution to Population and Urbanization: Evidence from an Historical Experiment." *The Quaterly Journal of Economics*, 126(2).

Overman, Henry, and Anthony J. Venables. 2005. "Cities in the Developing World." Centre for Economic Performance, LSE CEP Discussion Papers dp0695.

Poelhekke, Steven. 2010. "Urban Growth and Uninsured Rural Risk: Booming Towns in Bust Times." *Journal of Development Economics*, In Press.

Ravallion, Martin, Shaohua Chen, and Prem Sangraula. 2007. "New Evidence on the Urbanization of Global Poverty." *Population and Development Review*, 33(4): 667–701.

Restuccia, Diego, Dennis Tao Yang, and Xiaodong Zhu. 2008. "Agriculture and Aggregate Productivity: A Quantitative Cross-Country Analysis." *Journal of Monetary Economics*, 55(2): 234–250.

Robinson, James A., Ragnar Torvik, and Thierry Verdier. 2006. "Political Foundations of the Resource Curse." *Journal of Development Economics*, 79(2): 447–468.

Rosenthal, Stuart S., and William C. Strange. 2004. "Evidence on The Nature and Sources of Agglomeration Economies." In *Handbook of Regional and Urban Economics*. Vol. 4, , ed. J. V. Henderson and J. F. Thisse, Chapter 49, 2119–2171. Elsevier.

Sachs, Jeffrey D., and Andrew M. Warner. 2001. "The Curse of Natural Resources." *European Economic Review*, 45(4-6): 827–838.

Schultz, Theodore W. 1953. *The Economic Organization of Agriculture.* New York: McGraw-Hill.

Teigner, Marc. 2011. "The Role of Trade in Structural Transformation." Unpublished manuscript, University of Chicago, Department of Economics.

Tosh, John. 1980. "The Cash Crop Revolution in Tropical Africa: An Agricultural Reappraisal." *African Affairs*, 79(314): 79–94.

Venables, Anthony J. 2010. "Economic Geography and African Development." *Papers in Regional Science*, 89(3): 469–483.

Voigtländer, Nico, and Hans-Joachim Voth. 2006. "Why England? Demographic Factors, Structural Change and Physical Capital Accumulation During the Industrial Revolution." *Journal of Economic Growth*, 11(4): 319–361.

World Bank. 2009. *World Development Report 2009: Reshaping Economic Geography.* Washington DC: World Bank Publications.

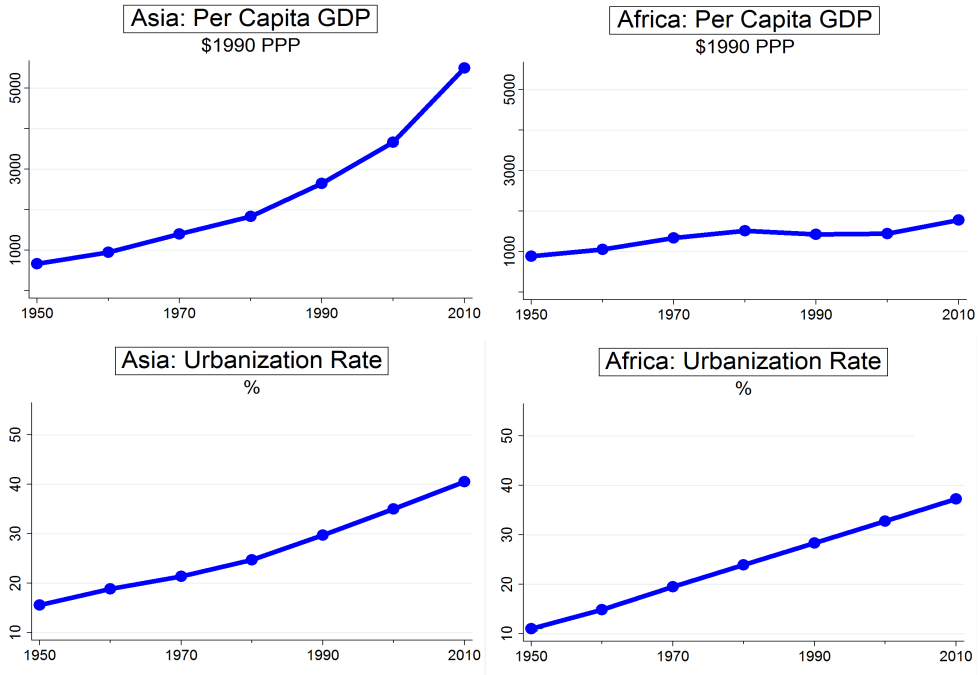
World Bank. 2010. *International Financial Statistics.* Washington D.C.: World Bank.

Yi, Kei-Mu, and Jing Zhang. 2011. "Structural Change in an Open Economy." *Federal Reserve Bank of Minneapolis Staff Report*, 456.

Young, Alwyn. 2003. "Gold into Base Metals: Productivity Growth in the People's Republic of China during the Reform Period." *Journal of Political Economy*, 111(6): 1220–1261.

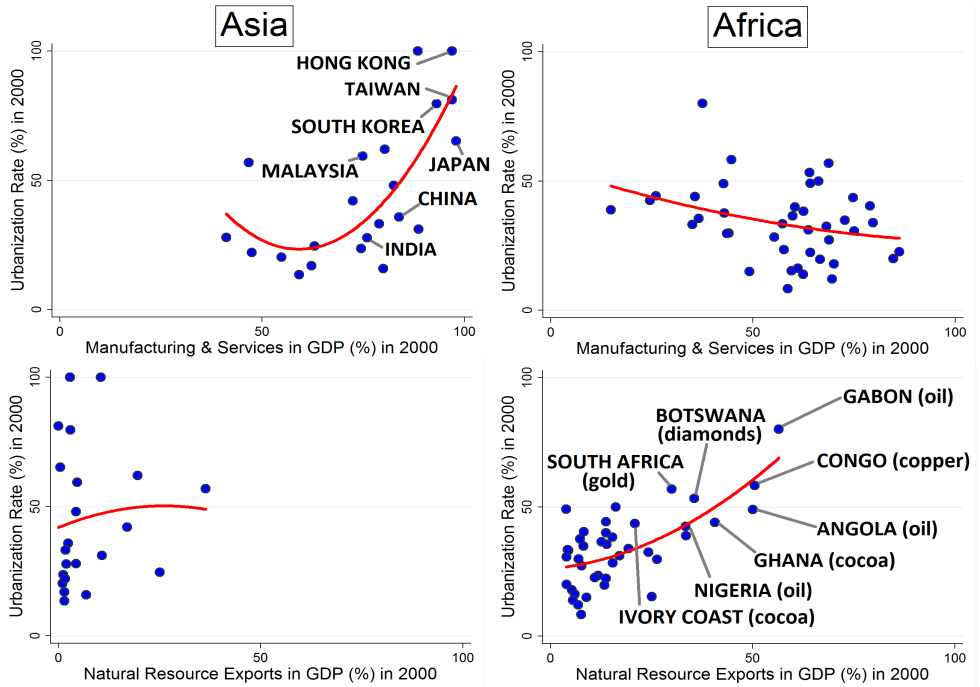
FIGURES

Figure 1: Income and Urbanization, Asia versus Africa, 1950-2010.



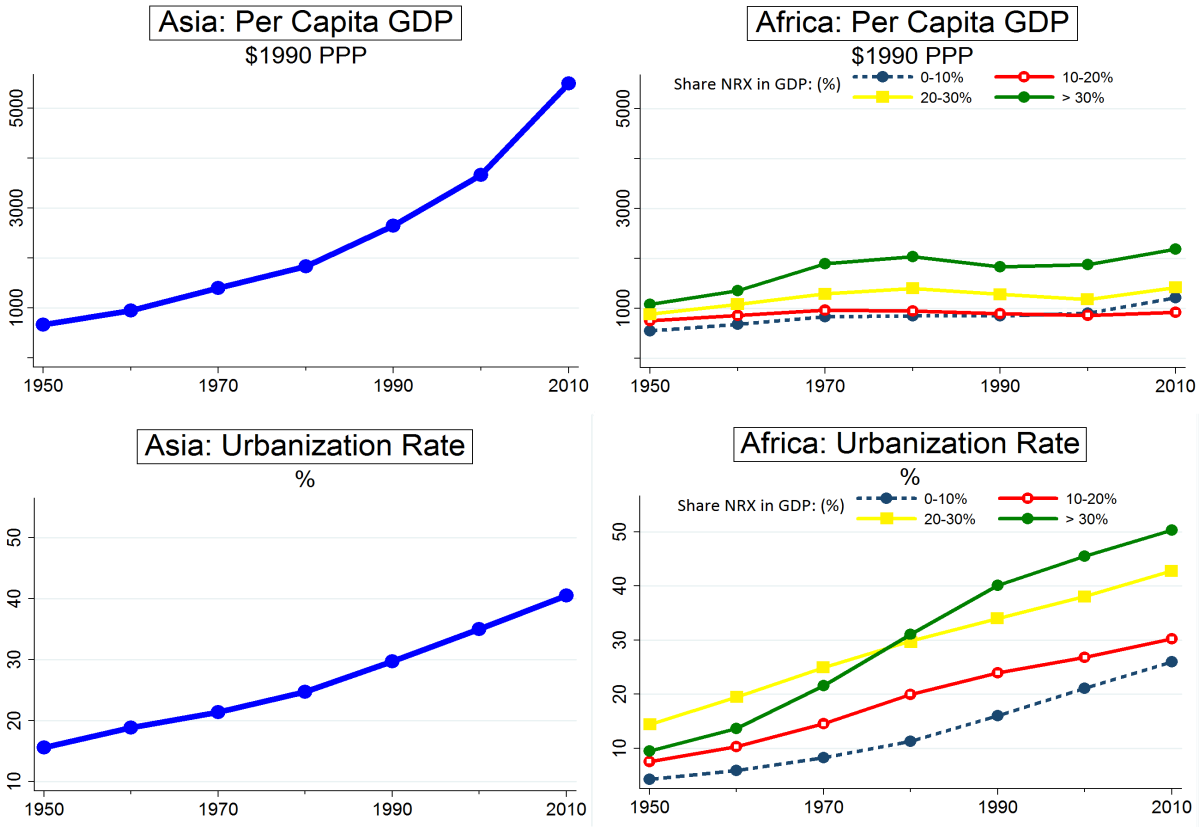
Sources: Maddison 2008, UN 2011, WDI 2011, USGS 2011, authors' calculations. Per capita GDP is reported in 1990 Geary-Khamis dollars (constant, PPP). The urbanization rate is reported using national urban definitions. The data includes 22 Asian countries (Eastern, South-Eastern and South Asia) and 41 Sub-Saharan African countries.

Figure 2: Urbanization and Composition of GDP, Asia versus Africa, 2000.



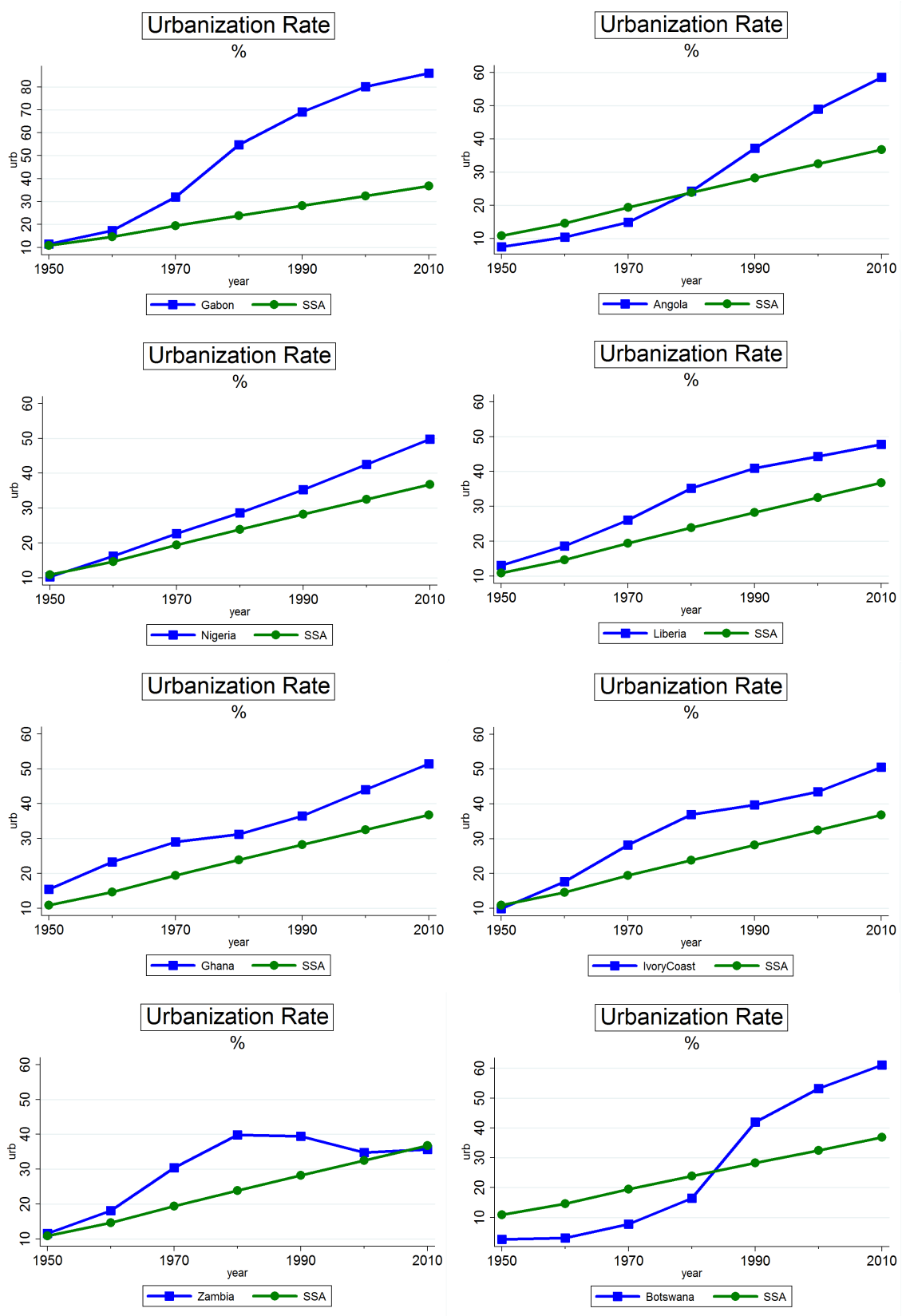
Sources: WDI 2011, USGS 2011, FAO 2011, UN 2011, authors' calculations. The urbanization rate is reported using national urban definitions. GDP is decomposed into manufacturing and services, resource exports (fuel, mining and cash crop exports) and agriculture (for domestic consumption). The GDP share of agriculture is not reported. The data includes 22 Asian countries (Eastern, South-Eastern and South Asia) and 41 Sub-Saharan African countries. We display in red the quadratic prediction plots.

Figure 3: Income, Resource Exports and Urbanization in Africa, 1950-2010.



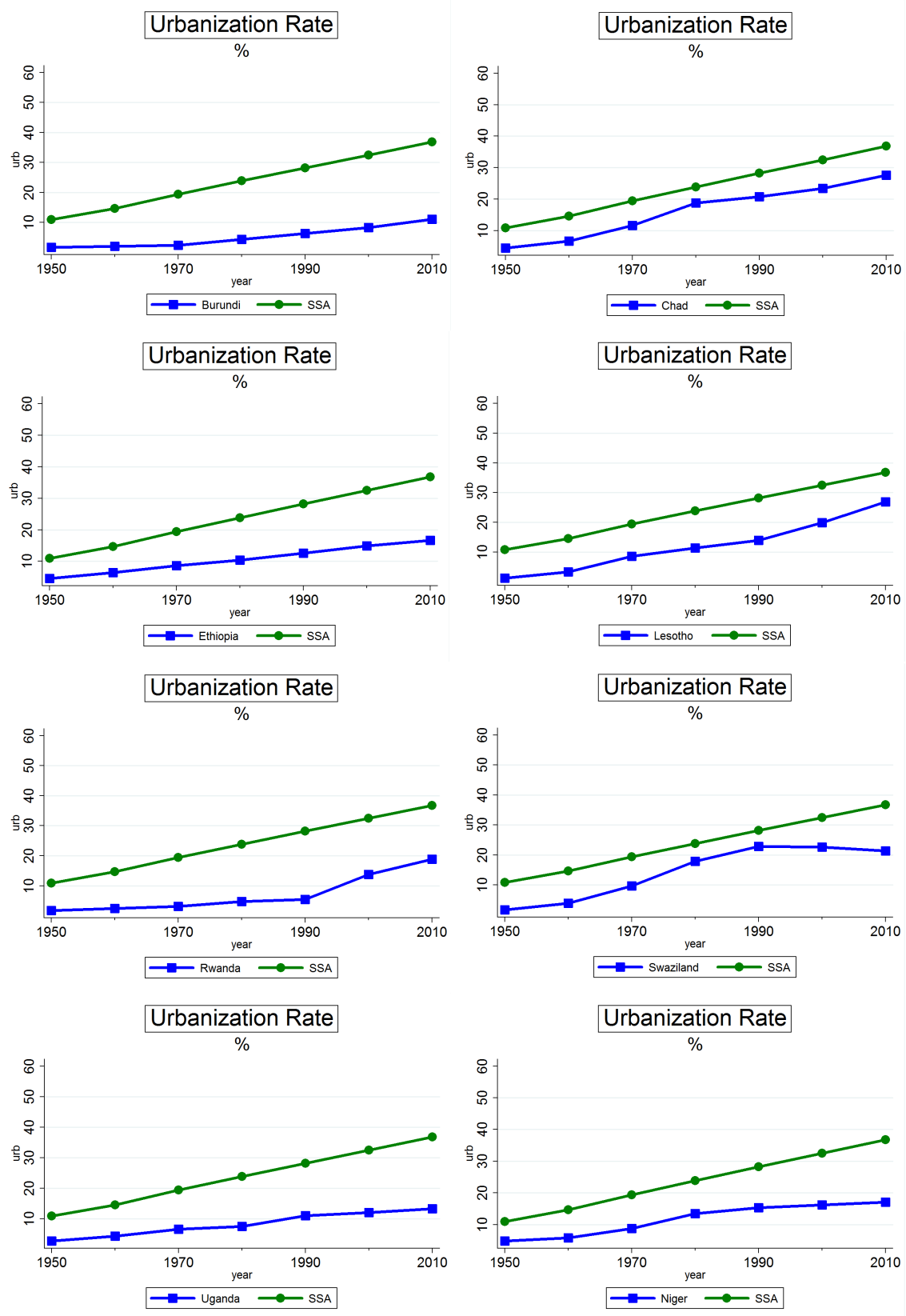
Sources: Maddison 2008, UN 2011, WDI 2011, USGS 2011, authors' calculations. Per capita GDP is reported in 1990 Geary-Khamis dollars (constant, PPP). The urbanization rate is reported using national urban definitions. The data includes 22 Asian countries (Eastern, South-Eastern and South Asia) and 41 Sub-Saharan African countries. African countries are separated into four groups, depending on the average GDP share (%) of natural resource exports in 1960-2000.

Figure 4: Urbanization for Eight Resource-Rich African Countries, 1950-2010.



Sources: UN 2009, authors' calculations. The urbanization rate is reported using national urban definitions. The eight resource-rich African countries are Gabon (oil), Angola (oil), Nigeria (oil), Liberia (iron ore, gold and diamonds), Ghana (cocoa and gold), Ivory Coast (cocoa and coffee), Zambia (copper) and Botswana (diamonds).

Figure 5: Urbanization for Eight Resource-Poor African Countries, 1950-2010.



Sources: UN 2009, authors' calculations. The urbanization rate is reported using national urban definitions. The eight resource-poor African countries are Burundi, Chad, Ethiopia, Lesotho, Rwanda, Swaziland, Uganda and Niger.

Figure 6: Comparative Advantage in Resources

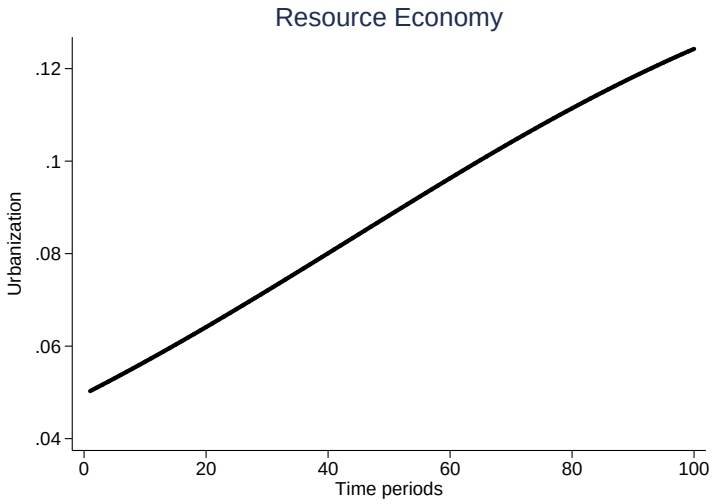


Figure 7: Comparative Advantage in Tradables

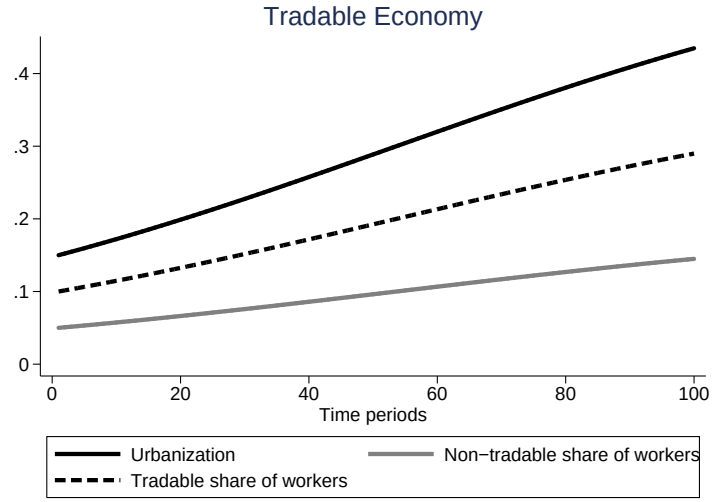


Figure 8: Comparison of Real Wages over Time

