Urbanization with and without Industrialization*

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Abstract: Many theories link urbanization with industrialization; in particular, with the production of tradable (and typically manufactured) goods. We document that the expected relationship between urbanization and the level of industrialization is not present in a sample of developing economies. The breakdown occurs due to a large sub-sample of resource exporters that have urbanized without increasing output in either manufacturing or industrial services such as finance. To account for these stylized facts, we construct a model of structural change that accommodates two different paths to high urbanization rates. The first involves the typical movement of labor from agriculture into industry, as in many models of structural change; this stylized pattern leads to what we term "production cities" that produce tradable goods. The second path is driven by the income effect of natural resource endowments: resource rents are spent on urban goods and services, which gives rise to "consumption cities" that are made up primarily of workers in non-tradable services. We document empirically that there is such a distinction in the employment composition of cities between developing countries that rely on natural resource exports and those that do not. Our model and the supporting data suggest that urbanization is not a homogenous event, and this has possible implications for long-run growth.

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1. INTRODUCTION

Many theories of development view urbanization and industrialization as essentially synonymous. In fact, the connection between the two is so strong that urbanization rates are often used as a proxy for income per capita (Acemoglu, Johnson & Robinson, 2002, 2005). Standard views reflect a stylized theory of the development process in which the process of structural transformation from agriculture into manufacturing and services involves a shift of labor out of rural areas and into urban ones. In typical closed-economy models of this process, urbanization and the structural transformation are mechanically linked through a combination of a low income elasticity for food and the assumption that manufacturing and services are predominantly or exclusively urban activities.

In this paper, however, we document that the expected relationship between urbanization and the level of industrialization is absent in a sample of developing economies. Across countries today there is not a particularly strong association between urbanization and industrialization, as proxied by the fraction of GDP coming from manufacturing and services. Figure 1 plots this relationship for the year 2010 for 116 countries, along with a quadratic fit. As can be seen, there are a number of countries that are highly urbanized without having industrialized much. The data even point towards a *negative* relationship for countries that are at particularly low levels of manufacturing and services in GDP.[1]

The breakdown occurs due to a large sub-sample of resource-exporting countries that have urbanized without increasing output in either manufacturing or industrial services. A clue to the source of urbanization without industrialization can be found by noting that those countries with particularly high urbanization rates but low shares of manufacturing and services in GDP are oil producers such as Brunei (BRN), Gabon (GAB), Libya (LBY), Kuwait (KWT), Qatar (QAT) and Venezuela (VEN). We define resource-exporters as those in which natural resource exports make up more than 10% of GDP. They are represented by grey squares in figure 1.[2] This disconnection can be seen more clearly in figure 2 in which we plot the relationship of urbanization and industrialization separately for resource-exporters and non-resource-exporters. Here we see that the non-exporters line up neatly with the expectations of standard models of structural change and growth, with urbanization tightly associated with the fraction of GDP coming from manufacturing and services. In comparison, for resource-exporters, there is no tendency at all for urbanization rates to be associated with industrialization. However, figure 3 shows that for these same resource-exporters, urbanization exhibits a strong positive correlation with their level of resource exports.

Growth economists are accustomed to ignoring major oil-producing countries in their analysis, as they do not fit into typical models of development. What figures 2 and 3 indicate, though, is that there are a host of other countries that also deviate from the typical pattern of industrialization and urbanization seen in figure 1. One conclusion may be that *all* of the countries with natural resource exports over 10% of GDP should be ignored when studying the "normal" process of development. However, that excludes nearly half of our entire sample from consideration, many of which are African and Middle-Eastern countries.

In our view, the data suggest that urbanization can follow different patterns in different settings. To be sure, many countries conform with standard views of structural transformation. In these economies, urbanization is a by-product of either a "push" from agricultural productivity growth or a "pull" from industrial productivity growth. In these countries urbanization occurs *with* industrialization and generates "production cities," with a mix of workers in tradable and non-tradable sectors. For a distinct subset of countries that rely on natural resource exports, however, urbanization has increased at an equally rapid pace, but urbanization has not been associated with growth in the manufacturing or service shares of GDP. In these countries, urbanization is driven by the income effect of natural resource endowments: resource

[1] Our definition of industrialization includes manufactured goods and industrial services such as finance and business services, as industrialized countries also have a comparative advantage in the production and export of these services (Jensen & Kletzer, 2010). Tradable services now account for a large share of GDP for various countries, such as Hong Kong, South Korea or The Bahamas. This evolution of world output requires us to look beyond the manufacturing sector. As international sector data do not distinguish tradable and non-tradable services, we use services as an imperfect proxy for tradable services.

[2] Our definition of natural resource exports includes fuel, mining, cash crop and forestry exports. Cash crops include tropical crops such as cocoa, coffee and tea but excludes food staples such as maize, rice and wheat. A full list of the commodities included in our calculation can be found in the Online Data Appendix.

rents are disproportionately spent on urban goods and services, which gives rise to “consumption cities” where the mix of workers is heavily skewed towards non-tradable services.

In the remainder of the paper, we further document a number of facts regarding urbanization and structural change. In particular we show that the influence of natural resource exports on urbanization is robust to controlling for a variety of alternative explanations for urbanization. This holds in both cross-sectional and panel regressions for our sample of 116 countries, and using different definitions of resource dependence. Following the existing literature (Sachs & Warner, 2001; Brückner, 2012; Henderson, Roberts & Storeygard, 2013), we use commodity price shocks and/or discoveries as instruments for natural resource exports and show they have a causal effect on urbanization rates.

We then construct a model that can account for these facts. We adapt a standard model of structural change to explain how resource endowments can lead to urbanization as well as affect the sectoral composition of the urban labor force. The driving force in the model is a standard Balassa-Samuelson effect in which income and substitution effects from resource exports lead to the growth of non-tradables production. We argue that this framework provides useful insights into why resource exporters have experienced urbanization without industrialization. We also discuss how this path to urbanization may have implications for the pace of long-run growth in these countries. It is not obvious that agglomeration externalities are found in non-tradable services to the extent that they are in manufacturing and tradable services, and therefore urbanization without industrialization may lead to slower long-run growth.

In our model, the processes of urbanization and industrialization are driven by sources familiar from the literature on structural change, but unlike that literature we will make a sharp distinction between the concepts of urbanization and industrialization. An increase in income will shift demand away from goods produced in rural areas (food) and towards goods that tend to be produced in urban areas. These urban goods will consist of industrial goods (manufactures and tradable services) as well as non-tradable goods (personal services and the like). An alternative source of urbanization is a change in relative productivities, which induces a substitution of labor towards the higher productivity sector. The effect of this on industrialization and urbanization depends on precisely which sectors experience productivity changes.

This leads to several possible patterns of development within the model. A large endowment of natural resources will lead to a strong income effect, shifting labor into urban areas, but as the relative productivity of the industrial sector has not increased this will result in urbanization without industrialization. This particular pattern of urbanization involves what we call “consumption cities”, as their emergence is explained by the consumption of a resource rent in the form of urban goods and services. These cities consist mainly of workers in non-tradable services, while the industrial goods are mainly imported from abroad.[3] A different path of development arises when industrial productivity increases. This also leads to an income effect that drives labor into urban areas, but the change in relative productivity implies that urbanization is coincident with industrialization. This pattern involves what we term “production cities”, in that the source of urbanization is industrialization itself. Production cities differ from consumption cities, in that their origin is different, which affects their sectoral composition, and hence their future prospects for growth.[4]

The model has several implications that we confirm hold in the data. First, our model suggests that the relationship of income per capita and urbanization should be similar regardless of the source of urbanization. We show that conditional on income per capita, urbanization rates are unrelated to the share of natural

[3] For example, The Economist (2012) writes: “Angola is now one of Africa’s economic successes - thanks almost entirely to oil. [...] Teams of gardeners are putting the finishing touches to manicured lawns, palm trees, tropical shrubs and paved walkways. Soon these will stretch the whole way along the Marginal, the seafront road that is being turned into a grand six-lane highway sweeping around the horseshoe-shaped bay of Luanda, Angola’s buzzing capital. Modern offices, hotels and apartment blocks are sprouting up behind, replacing the pretty pink-and-white colonial buildings, drab crumbling flats and teeming shanty-towns. Across the bay, fancy yachts and speed boats crowd the shores of the Ilha, a once almost deserted strip of sand used mainly by poor fishermen, on which smart restaurants and nightclubs for the new elite are now springing up. [...] Shiny shopping malls are filled with everything the Angolan heart could desire, from gourmet food to the latest fashions and car models. Prices are wildly inflated. Virtually everything, even basic building materials, still has to be imported.”

[4] Our theory says that any rent leads to an income effect that drives labor into urban areas. We focus on natural resource exports because of the magnitude of their income effect. According to our estimates, they account for 10% of the developing world’s GDP in 2010 (but one third in Africa and the Middle-East), against 1% for international aid and 1% for remittances.

resource exports in GDP or the share of manufacturing and services in GDP. Second, there is a distinction in the pattern of trade depending on what drives urbanization. The model predicts that resource exporters will import more food, industrial goods and services as a percent of GDP, conditional on their urbanization rate and income per capita. We show that this holds in the data as well. Finally, because of the different sources for urbanization, the composition of urban employment should differ between resource exporters and non-exporters. Using a novel data set on sector of employment for a set of countries we confirm that cities in resource-exporting countries are "consumption cities", with a larger fraction of workers in non-tradable services such as trade and transportation, personal and government services. Cities in countries that do not export significant resources are "production cities", with more workers in industrial sectors such as manufacturing and tradable services.

Within the framework of our model, we consider the consequences of the different patterns of urbanization on long-run outcomes. Many economists have argued that tradable manufacturing and service sectors are capable of higher labor productivity growth than non-tradable services (Timmer & Vries, 2007; Duarte & Restuccia, 2010; Rodrik, 2011; Buera & Kaboski, 2012). In this case, the economic composition of urban areas may matter for aggregate productivity growth. Natural resource exporters that urbanize through "consumption cities" will experience slower productivity growth than countries urbanizing according to the standard model. By skewing the urban mix away from faster-growing sectors, in the long-run resource-exporters may end up urbanized but relatively less rich.

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 (what we might think of as a *Green Revolution*) reduces the "food problem" and releases labor for the modern sector (Schultz, 1953; Matsuyama, 1992; Caselli & Coleman II, 2001; Gollin, Parente & Rogerson, 2002, 2007; Voigtländer & Voth, 2006; 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). We document that it is quite possible for an economy to urbanize without any change in agricultural and manufacturing productivity, which are the only sources of structural change in standard models. Then, a few models actually consider an open economy and look at the interactions of trade and structural change (Matsuyama, 1992, 2009; Galor & Mountford, 2008; Yi & Zhang, 2011)

Our second contribution relates to the literature on urbanization and economic growth. First, a few studies argue that some parts of the world have urbanized without it being explained by manufacturing growth (Hoselitz, 1955; Bairoch, 1988; Fay & Opal, 2000). This excessive urbanization is attributed to pull and push factors feeding rural exodus, such as rural poverty (Barrios, Bertinelli & Strobl, 2006) or urban-biased policies that led to overurbanization and urban primacy (Lipton, 1977; Bates, 1981; Ades & Glaeser, 1995; Davis & Henderson, 2003). Our paper shows that countries that did not experience manufacturing growth can still urbanize with growth if they export natural resources. In line with Henderson, Roberts & Storeygard (2013), we do not find that Africa is relatively urbanized for its level of economic development. Second, the literature suggests that agglomeration promotes growth, in both developed countries (Rosenthal & Strange, 2004; Henderson, 2005; Glaeser & Gottlieb, 2009; Combes et al., 2012; Duranton & Puga, 2013) 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; World Bank, 2009; Venables, 2010; McKinsey, 2011).[5] However, Henderson (2003) does not find any effect of urbanization *per se* on economic growth. How can we reconcile the fact that there are strong agglomeration effects at the micro level (at the sector or city level) but no growth effects at the macro level (at the country level)? It must be that some types of

[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."

urbanization are not as growth-enhancing as others and that cross-country regressions also capture these rather than just the best types.[6] One possibility that our data raise is that the "consumption cities" that arise in resource-exporters are less effective at generating productivity growth than the "production cities" seen in others.

Our "consumption cities" differ from the "consumer cities" of Glaeser, Kolko & Saiz (2001). Using U.S. data, they show that high amenity cities have grown faster than low amenity cities, and urban rents have gone up faster than urban wages. Our theory differs somewhat in that it is because income increases that people spend more on urban goods and services, and hence that the country urbanizes. Weber (1922) also contrasts "consumption cities" and "'production cities": the former are primate cities that cater for the needs of a political elite, while the latter address the needs of manufacturers and merchants. In his view consumption cities emerge from rent redistribution rather than rent generation and they are thus not that different from the "parasitic cities" of Hoselitz (1955) and the urban bias theory. Urbanization is not associated with economic growth, in contrast to our theory. We argue that resource-exporters are more urbanized simply because they are wealthier. If these countries also adopt urban-biased policies, this just augments the initial effects of natural resource exports on urbanization.

Finally, this paper contributes to the literature on Dutch disease and the resource curse (Corden & Neary, 1982; Matsuyama, 1992; Sachs & Warner, 2001; Harding & Venables, 2013). The mechanism that drives the rise of "consumption cities" in our model is the same as in a Dutch disease model - a boom in resource rents shifts labor away from the tradable manufacturing sector and towards non-tradable services. We document that this mechanism is able to explain a significant portion of the rapid urbanization seen in much of the developing world, a phenomenon overlooked by the Dutch disease literature to this point. Whether this constitutes a resource curse is not immediately clear. As we show, the high urbanization rates in resource-exporters are driven by high incomes that are spent on urban goods and services, so in that sense there is no curse. However, urbanizing through "consumption cities" may put a long-run drag on growth if non-tradable urban services do not experience productivity growth similar to the tradable sector, leading to a possible resource curse result.

The paper is organized as follows: Section 2 describes in greater detail the differential patterns of urbanization and industrialization. Section 3 presents our model, while section 4 compares its implications to the data. Section 5 examines the long-run implications of these different patterns. Section 6 concludes.

2. PATTERNS OF URBANIZATION IN DEVELOPING COUNTRIES

Figures 1, 2 and 3 showed simple cross-sectional correlations between urbanization and industrialization for a sample of countries. First, it is useful to consider patterns within specific regions of the world, as they display the correlations more starkly. Second, we show that the correlations shown in the figures are robust to controlling for other determinants of urbanization.

2.1 Regional Patterns of Urbanization

Latin America and the Caribbean (LAC) and the Middle-East and North Africa (MENA) are relatively more urbanized than Africa and Asia, with urbanization rates about 80% and 60% in 2010 respectively. In both Africa and Asia, the urbanization rate was only 10-15% in 1950, which is characteristic of pre-industrial societies (Bairoch, 1988). It is now around 40%, as high as in developed countries after the Industrial Revolution.[7] Asia and the LAC region are examples of the standard story of urbanization *with*

[6] Overman & Venables (2005) explain that the extent of localization and urbanization economies varies substantially across industries and across countries. Agglomeration effects seem to be larger in manufacturing and hi-tech services. Henderson (2003) shows that there is an optimal level of urban concentration, and significant deviations from this optimal level reduce growth.

[7] Appendix Figure 1 shows the urbanization rates for the four regions from 1950 to date. We do not include Western countries in our analysis, as they were already highly urbanized in 1960. We also omit Eastern European and Central Asian countries due to the lack of data before the end of the cold war in 1991. We then include the developed countries of Asia and the Middle-East, such as South Korea, Taiwan or Kuwait, as they were relatively poor and unurbanized in 1960. Our analysis is therefore focused

industrialization. The successful Asian and Latin American economies typically went through both a Green Revolution and an industrial revolution, with urbanization following along as their economic activity shifted away from agricultural activities (Ranis, 1995; Stiglitz, 1996; Gollin, Parente & Rogerson, 2002, 2007; Evenson & Gollin, 2003). A few exceptions are Brunei, Mongolia and Venezuela which were also heavily dependent on natural resource production post-1960. Some countries are both industrialized and resource-exporters, such as Chile, Indonesia, Malaysia, and Peru.

In contrast, Africa and the Middle East offer a perfect example of urbanization *without* industrialization. First, there has been little evidence of a Green Revolution in Sub-Saharan Africa. Its food yields have remained low (Evenson & Gollin, 2003; Caselli, 2005; Restuccia, Yang & Zhu, 2008); in 2010, 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 2010, employment shares in industry and services were 5% and 29% for Africa, but 15% and 35% for Asia, and African labor productivity was 1.9 and 2.3 times lower in industry and services, respectively (World Bank, 2013).[8] Despite the lack of the standard push out of agriculture or pull from industry, Africa has urbanized to the same level as Asia over the last half-century. The relatively more urbanized countries export oil (e.g., Angola, Gabon and Nigeria), gold and/or diamonds (e.g., Botswana and South Africa), copper (e.g., Zambia) or cocoa (e.g., Ghana and Ivory Coast). In the MENA countries, food yields are higher but arable land is scarcer. Most of them export oil and are less industrialized than their Asian counterparts for the same income level. A few exceptions are Jordan, Lebanon and Tunisia which are specialized in tradable services or manufacturing.[9]

Urbanization in resource-exporters is not driven by meaningful shifts of labor into urban areas to work in the resource sector. Point-source resources are highly capital-intensive, and their production creates very little direct employment. For example, Angola's urbanization rate was 15% before oil was discovered in the 1960's, but it was 60% in 2010 (an urban population of 11 million people). While oil now accounts for over 50% of GDP it employs fewer than 10,000 nationals and a small number of expatriates. Botswana has a similar urbanization rate to Angola, and while the diamond sector accounts for 36% of GDP, it only provides employment for 13,000 people. Mining accounts for 1% of total urban employment on average in our sample of resource-exporters. Cash crops are produced in rural areas and contribute to *rural* employment, rather than urban employment. Rather, urbanization in these areas appears to be driven by a *natural resource revolution* that provides a different origin for a "pull" into urban areas as the increased purchasing power made available from resources increases demand for urban goods.[10]

A related question is whether urbanization in Africa is different (Henderson, Roberts & Storeygard, 2013). Our claim is not that the effects of green, industrial or natural resource revolutions are different in Africa than in the rest of the world, but that Africa's development path has thus far been tied closely to the production of primary products. We do not insist that this is an effect of resource endowments *per se*, nor do we take a geophysically deterministic view of development. Africa's resource dependence is quite likely endogenous, at some level. Resource dependence surely reflects historical patterns of institutional development, in addition to geographic factors. In a proximate sense, though, we argue that resource dependence accounts for a substantial part of the difference in urbanization patterns between Africa and Asia. We do not need to invoke African exceptionalism, either; the same forces shaping urbanization in Africa also seem to explain patterns in the MENA region. Even within a single country, we can see evidence that a green revolution, an industrial revolution and a natural resource revolution can all contribute to

on the developing world, which initially consisted of Africa, Asia (incl. the Middle-East) and Latin America.

[8]There are exceptions to this broad characterization (McKinsey, 2011; Young, 2012). Growth has resumed in Africa, following the economic reforms of the 1980s and the democratization wave of the 1990s. Some countries have diversified their economy, such as Mauritius and South Africa. However, most countries remain highly dependent upon resource exports.

[9]Appendix Figure 2 confirms that within Asia and Latin American and the Caribbean the expected pattern of urbanization and the share of manufacturing and services in GDP holds up well. By comparison, Appendix Figure 3 shows that urbanization in Africa and the Middle-East is positively associated with the importance of natural resources exports in GDP.

[10]Jedwab (2013) investigates the causal effect of the production of cocoa, a rural-based natural resource, on the growth of cities in Ghana and Ivory Coast, using a natural experiment and district panel data spanning one century. In both countries, the cocoa farmers received about half of the resource rent and the government captured the rest. This distribution of the rent gave rise to a "dual" urban distribution consisting of small towns in the cocoa-producing areas and large government cities.

urbanization – as exemplified by countries such as Chile, Indonesia, Malaysia and South Africa.

2.2 Cross-Sectional and Panel Robustness Checks

Table 1 presents results of cross-sectional regressions using a sample of 116 countries (c) for the year 2010. The five columns use the urbanization rate in 2010 as the dependent variable ($URB_{c,2010}$), regressed on the average share of natural resource exports in GDP in 1960-2010 ($NRX_{c,1960-2010}$) as well as the share of manufacturing and services in GDP in 2010 ($INDU_{c,2010}$):[11]

$$URB_{c,2010} = \alpha + \beta NRX_{c,1960-2010} + \gamma INDU_{c,2010} + u_{c,2010} \quad (1)$$

The regressions are all population weighted. Column (1) shows that across the entire sample, with no other control variables, both variables have a significant positive relationship with urbanization. The positive effect of manufacturing and services fits with the standard model of industrialization and urbanization. However, the positive association of natural resource exports to urbanization is less obvious, given that natural resources employ very few urban workers directly. The positive effects of both persist when we include area fixed effects (Africa, Asia, LAC and MENA) in column (2).

There are several alternative theories for urbanization in developing countries that may make the results in columns (1) and (2) spurious. A few studies have argued that some parts of the world have urbanized without it being fully explained by economic development. This excessive urbanization is attributed to pull and push factors feeding rural exodus. In the Harris-Todaro model, there will be rural-to-urban migration as long as the (expected) urban wage is higher than the rural wage. First, land pressure and man-made or natural disasters may result in a lower rural wage, with rural migrants flocking to the cities. We include the following controls at the country level: rural density in 2010 (1000s of rural population per sq km of arable area) and the annual population growth rate in 1960-2010 (%) to control for land pressure, and the number of droughts (per sq km) since 1960 and an indicator equal to one if the country has experienced a civil or interstate conflict since 1960 to control for disasters.[12] Second, we include an indicator equal to one if the country's average combined polity score since 1960 is strictly lower than -5 (the country is then considered as autocratic according to *Polity IV*). We suppose that the urban bias was stronger in more autocratic regimes, as shown by Ades & Glaeser (1995). We also add the primacy rate (%) in 2010, as an alternative measure of the urban bias. Third, if natural resource exporters systematically use different methods for calculating urbanization rates, the correlations may simply reflect measurement errors.[13] We get around this issue by adding controls for the different possible definition of cities in different countries: four indicators for each type of urban definition used by the countries of our sample (*administrative*, *threshold*, *threshold and administrative*, and *threshold plus condition*) and the value of the population threshold to define a locality as urban when this type of definition is used. Lastly, we also control for country area (sq km), country population (1000s), a dummy equal to one if the country is a small island ($<$ 50,000 sq km) and an indicator equal to one if the country is landlocked, as larger,

[11]While the share of manufacturing and services in GDP in 2010 serves as a good proxy for the extent of industrialization in 1960-2010, the share of natural resource exports in GDP in 2010 does not measure well the historical dependence on natural resource exports. First, many countries have recently started exporting oil such as Chad, Equatorial Guinea, Mauritania, Mozambique and Yemen. For these countries, the share of natural exports in GDP does not explain well the contemporaneous urbanization rate. Second, a few countries that were highly specialized in natural resource exports before have become more industrialized over time, such as Indonesia, Malaysia, Mauritius, Singapore and South Africa. Lastly, the contribution of natural resource exports to GDP depends on international commodity prices, which are highly volatile in the short run. Using the average share of natural resource exports in 1960-2010 minimizes these concerns, as in Sachs & Warner (2001).

[12]Rapid population growth and land pressure could theoretically drive urban growth if the rural wage decreases. However, excess (urban) population growth could also decrease the urban wage. Ultimately, the urbanization rate only increases if urban growth is faster than rural growth, which is not obvious here. For example, we do not find any correlation between demographic growth and urbanization in the data. We nonetheless control for rural density and demographic growth in the regressions.

[13]Potts (2012) shows that the urbanization rate could be overestimated for a few countries for which the quality of the data is poor. Our correlations are robust to dropping Nigeria and a few other countries that have been identified as problematical in the urban studies literature. Another issue is the fact that different countries use different urban definitions. This only affects our estimates if the urbanization rate is systematically overestimated or underestimated in resource-exporters.

non-island and landlocked countries could be relatively less urbanized for various reasons.[14]

As can be seen in column (3), the inclusion of these controls does not alter the positive association of natural resource exports with urbanization rates. These correlations are very strong. A one standard deviation in the share of natural resource exports in GDP is associated with a 0.48 standard deviation increase in the urbanization rate. In comparison, a one standard deviation in the share of manufacturing and services in GDP is associated with a 0.39 standard deviation in the urbanization rate. Since half of our sample consists of resource-exporters, industrialization and natural resource exports were possibly equally important sources of urbanization in our sample. To address the possibility that the regressions in columns (1) through (3) are still picking up an unobserved effect driving both urbanization and resource exports, in column (4) we also control for initial conditions in 1960. Specifically, we include the level of urbanization rate in 1960 (%) and the share of natural resource exports in GDP in 1960 (%). Thus column (4) is essentially like looking at a long-differenced relationship of the change in resource exports and the change in urbanization. As can be seen, results are not altered much. Lastly, we can also include thirteen region fixed effects (e.g., Western Africa, Central Africa, Eastern Africa and Southern Africa for Africa) to compare neighboring countries. The point estimates remain high and significant (see column (5)).

We verify that these correlations are robust to (see Appendix Tables 2 and 3): (i) restricting the sample to Africa and the MENA region or Asia and the LAC region only (the correlation of resource exports with urbanization is then not different in both groups), (ii) dropping China and India, due to their population size, or dropping population weights, (iii) controlling for the average share of manufacturing exports in GDP in 1960-2010 (%) as a proxy for industrialization, instead of using the share of manufacturing and services in GDP in 2010 (%), (iv) using the share of resource exports in GDP in 2010 instead of the average share in 1960-2010, and (v) using the average log value of natural resource exports in 1960-2010 and the log value of manufacturing and service GDP in 2010 instead of the GDP shares.[15]

When looking at the distinct correlations of fuel and mining exports and cash crop and forestry exports with urbanization, we find that urbanization is not significantly associated with cash crop exports. We only find a positive effect of cash crop and forestry exports for Africa countries, but this effect appears to be driven by cocoa and forestry exports only, and not other crops. The correlations are then stronger for oil than for other mineral resources, such as copper, diamonds and gold. Regarding cash crops, the correlation is only significant for cocoa, while no effect is found for other crops, such as coffee or sugar.[16]

We also test whether the results are robust to using a multivariate panel analysis for a sample of 112 countries (c) and 6 years ($t = [1960, 1970, 1980, 1990, 2000, 2010]$). We investigate the correlations between the share of natural resource exports in GDP at period t-1 ($NRX_{c,t-1}$) and the urbanization rate at period t ($URB_{c,t}$), while controlling for the share of manufacturing and services in GDP in 2010 interacted with a time trend ($INDU_{c,2010} \times t$) and adding country fixed effects (v_c) and period fixed effects (w_t). As the share of manufacturing and services in GDP is missing for many countries before 2010, we include the share of manufacturing exports in GDP at period t-1 ($MFGX_{c,t-1}$) to control for industrial booms. Since we examine the effects of variables at period t-1 on period t, we lose one round of data:

$$URB_{c,t} = \alpha' + \beta' NRX_{c,t-1} + \gamma' INDU_{c,2010} \times t + \kappa MFGX_{c,t-1} + v_c + w_t + u'_{c,t} \quad (2)$$

Standard errors are clustered at the country level. The unconditional results are shown in the column

[14]See Online Data Appendix for a description of the sources for all of these variables.

[15]Wood (2003) uses total land area as a proxy for general natural resource wealth, citing the trouble of accurately measuring resource wealth. We are using actual resource exports, as reported by the USGS (2013) and World Bank (2013), and are not trying to impute values for natural resource stocks that may or may not exist. See Appendix for full details on how we construct the resource export data series.

[16]These (non-)results on cash crops are in line with Jedwab (2013), who finds a positive causal effect of cocoa production on urban growth in Ghana and Ivory Coast, and Brückner (2012) and Henderson, Roberts & Storeygard (2013) who find a negative causal effect of agricultural exports on urbanization in Africa when using agricultural price shocks as a source of identification. Positive price shocks may deter urbanization if workers are drawn into the agricultural sector, as in many two-sector models (Matsuyama, 1992; Henderson, Roberts & Storeygard, 2013). In our regressions, the correlation is negative for sugar. Countries that export cotton also appear to be relatively less urbanized. While the sugar industry contributed to the establishment of towns in the Caribbean during the colonial period, the development of the sugar beet industry in the 19th century probably reduced the rents available in the sector. Likewise, the invention of synthetic fibers post-1930 reduced the rents available in the cotton sector.

(1) of Table 2. These results are robust to: (i) adding 20 continent-period fixed effects (see col. (2)), (ii) including the same controls as in Table 1 when they are time-varying, for example population growth between t-1 and t (see col. (3)), (iii) controlling for initial conditions (urbanization and natural resource exports in 1960) interacted with a time trend (see col. (4)), and (iv) adding 65 region-period fixed effects (see col. (5)). The correlation between natural resource exports and urbanization is rather strong. A one standard deviation in natural resource exports is associated with a 0.08-0.10 standard deviation in the urbanization rate. This correlation is fivefold lower than in the cross-sectional analysis. Cross-sectional and panel estimates cannot be readily compared with each other. Panel regressions measure the short-term effects of short-term variations in resource exports on urbanization, and permit the inclusion of country fixed effects to control for time-invariant heterogeneity. Cross-sectional (and long-differenced) regressions measure the long-term effects of long-term variations in natural resource exports. The cross-sectional regressions could potentially capture the accumulation of short-term effects.

Are these cross-sectional and panel estimates causal? Natural resource exports could be endogenous to the urbanization process.[17] We could assume that resource production is exogenous (Harding & Venables, 2013). The panel regressions appear to corroborate this hypothesis. In the column (5) of Table 2, we include 65 region-period fixed effects to ensure we compare neighboring countries over time. We also verify that urbanization has no effect on natural resource exports the next period, and that natural resource exports have no contemporaneous effect on urbanization (see Appendix Table 4, columns 1 and 2). Second, we expect stronger effects for point-source resources, as their international supply is relatively inelastic and their production process is not labor-intensive, contrary to cash crops. We find strong effects for fuels and mining products, but no significant effects for cash crops, in both cross-sectional and panel regressions. In particular, we find stronger effects for oil than for other mineral resources, such as copper, diamonds or gold, or cash crops, such as cocoa. For instance, why a country would endogenously specialize in oil rather than diamonds is not obvious, as it mostly depends on resource endowments, but we find significantly larger effects for the former (see Appendix Table 2).

As an alternative identification strategy we use resource discoveries or commodity price shocks as instruments, as suggested by the literature (Sachs & Warner, 2001; Brückner, 2012; Henderson, Roberts & Storeygard, 2013). For each resource-exporter, we create a post-discovery indicator whose value is one if the country's chief natural resource in 1960-2010 has already been "discovered" at period t-1. The effect of resource exports is then identified for these countries for which the discovery occurred post-1960. For example, figure 4 shows examples of countries that urbanized faster than their respective area (Africa or MENA) after a "discovery": Angola (oil; 1968), Botswana (diamonds; 1971), Gabon (oil; 1963), Libya (oil; 1960) and Oman (oil; 1964). Another potential instrument is the price index of their main natural resource. Zambia offers a perfect example of this identification strategy, as shown in figure 4. The slump in copper prices in 1975 clearly led to "counter-urbanization" in Zambia (Potts, 2005). Results are robust to using discoveries or price shocks or both as instruments (see Appendix Table 4, columns 3–8). This works even when restricting the sample to resource-exporters only (in that case, we simply compare the early and late discoverers). The IV estimates are higher than the OLS estimates, which thus provide a lower bound of the true effects. However, the estimated effects could be local average treatment effects giving more weight to those countries for which the instruments had a strong effect. Despite these concerns, the results confirm the general patterns documented in the figures. Urbanization and industrialization should not be seen as synonymous, as the presence of resource exports are significantly related to urbanization rates.

3. A MODEL OF URBANIZATION AND INDUSTRIALIZATION

[17] It is not clear which way the bias would run. Urbanized countries could have fewer resources (e.g., land or labor) available for resource production. This would lead to a downward bias. Or, industrial countries may not export the natural resources they produce if they use them as intermediary or consumption goods. For example, China and Mexico are among the top oil producers. As these countries are also more urbanized, this leads to a downward bias. From the other side, investments in domestic transportation infrastructure both facilitate the exploitation of natural resources and promote urbanization, leading to upward bias. Poor institutions that foster an urban bias and restrict industry could also lead to high resource exports as well as high urbanization.

As seen in the data, the typical model of structural change is unlikely to be appropriate when describing industrialization and urbanization in resource-exporters. Here we begin developing a model that incorporates both resource-led urbanization as well as standard industrialization-led urbanization.

Our model is of a small economy open to international trade, with four specific-factor sectors in which labor can be employed. *Tradables* are produced in urban areas; this sector includes both manufacturing and tradable services such as finance. This is the sector associated with industrialization, and its output can be traded internationally at a world price. *Non-tradables* are also produced in urban areas. This sector encompasses government and personal services, as well as construction, education and health, retail and wholesale trade and transportation.[18] The output, unsurprisingly, cannot be traded internationally and so its relative price will be determined endogenously. *Food* is produced in rural areas and can be traded internationally. *Resources* are by assumption produced rurally and traded internationally at a given price as well.[19]

There are two drivers of urbanization in the model: relative productivity and surplus income. An increase in tradable-sector productivity pulls labor in from other sectors, increasing both urbanization and industrialization at the same time. The increased productivity also increases income, and this will reinforce the effect by increasing demand for urban goods in general. This generates what we term "production cities", driven by the increased relative productivity of tradables.

There are alternative routes to urbanization, however. Increased productivity in the resource sector, whether through a discovery of new stocks of the resource or a sustained increase in the world price, also drives urbanization. The relative productivity effect suggests that labor is pulled out of the tradable sector and into the resource sector. However, the surplus income generated from higher resource productivity increases demand for non-tradables, and on net the urbanization rate rises. This type of urbanization, driven by the surplus income generated by resources, leads to what we term "consumption cities". These cities are dominated by non-tradables if tradables are imported from abroad.[20]

To begin we develop the baseline model, and then provide extensions involving non-homotheticities in demand as well as urban-biased policies. In following sections we will discuss how the predictions of the model match up against the data and explore its implications for long-run growth.

3.1 Individual Utility and Budgets

We assume that individuals have a log-linear utility function over three goods: food (c_f), tradable goods (c_d), and non-tradable goods (c_n),

$$U = \beta_f \ln c_f + \beta_d \ln c_d + \beta_n \ln c_n \tag{3}$$

where β_f, β_d, and β_n are all between zero and one, and $\beta_f + \beta_d + \beta_n = 1$. This utility function is homothetic, unlike those typically used in models of structural change. We can demonstrate urbanization without industrialization without using non-homotheticities in demand, and so in our baseline model exclude them. After the main results, we show that non-homotheticities can be incorporated, and we find that they exaggerate the effects. We note that resources do not enter the utility function directly for consumers in our model economy; they will be produced only as a source of export earnings.

[18]Non-tradables also include manufactured goods that are produced locally and not traded internationally, for example "African" processed foods, clothing and furniture in Africa. These (home) goods differ from standardized manufactured goods such as vehicles, home appliances, computer hardware or equipment, that can be produced anywhere.

[19]As noted in footnote 2, it is self-evident that agricultural export crops such as cocoa, coffee and tea are produced in rural areas; it is perhaps less obvious that minerals and other resources are produced in rural areas, but in the data it is difficult to find examples of mining that takes place in heavily urbanized areas.

[20]This type of urbanization is a manifestation of the Balassa/Samuelson effect. Higher productivity in a tradable sector, resources, leads to an increase in the price of non-tradable goods. Here we focus on the associated shift of labor towards the non-tradable sector, which in this case implies an increase in urbanization as well.

Individuals earn an income m. The budget constraint for a consumer is given by:

$$p_f c_f + p_d c_d + p_n c_n = m, \tag{4}$$

where p_j is the price of good j. Given the log-linear utility, the optimal choice for individuals is for the expenditure share on good j to equal its weight in the utility function, β_j,

$$p_j c_j = \beta_j m. \tag{5}$$

The income of individuals is made up of four components: wages, resource rents, capital rents, and land rents. Wages are denoted by w. Assuming for now that productive assets are divided equally among individuals in the economy, the representative individual will earn a return ω_r on R/L units of the resource, a return ω_k on K/L units of capital, and a return ω_x on X/L units of land. Income is therefore

$$m = w + \omega_r \frac{R}{L} + \omega_k \frac{K}{L} + \omega_x \frac{X}{L}. \tag{6}$$

We will discuss below the implications of inequality in resource rent earnings, but given the log-linear utility the aggregate expenditure share on each good would still be β_j.[21]

3.2 Production, Factor Payments, and Trade

There are three domestic sectors producing each of the goods. Production is described by

$$Y_d = A_d K^{\alpha} L_d^{1-\alpha} \tag{7}$$
$$Y_f = A_f X^{\alpha} L_f^{1-\alpha} \tag{8}$$
$$Y_n = A_n L_n \tag{9}$$

where $A_j \in (f, d, n)$ is productivity in sector j, and L_j is the labor used in that sector. Tradable goods are produced using capital, K, while food goods are produced using land, X. Non-tradables use only labor. The value of α is assumed to be identical between the tradable and food sectors for simplicity.

We assume that the tradable and non-tradable sectors both operate exclusively in urban areas, while food production is a rural activity. Therefore the urbanization rate, u, is the sum of the fraction of workers in the tradable and non-tradable sectors:

$$u = \frac{L_d}{L} + \frac{L_n}{L}. \tag{10}$$

We do not explicitly model the increasing returns or agglomeration economies that determine productivity in urban sectors, or explain why tradables and non-tradables are located in urban areas. Rather, we focus on the static allocation of labor across the sectors, explaining urbanization through the broader process of structural change. Although not all tradable and non-tradable activity takes place in urban areas, our employment data for more than 40 countries in the 2000s shows that around 75% of manufacturing and service activities are urban-based. Allowing for some fraction of tradable and non-tradable work to be done in rural areas would not materially change our results.

We also do not explicitly model the accumulation of capital, nor do we endogenize the levels of productivity in our baseline model. In the next section we consider the long-run consequences of urbanization without industrialization, and at that point discuss how the model changes when capital accumulation or endogenous productivity is incorporated.

In addition to the three basic sectors, we introduce a resource sector that produces a good that can be sold

[21] Alternatively, one can think of the β_j values as representing aggregate expenditure shares consistent with heterogenous individuals with different preferences and wealth, or as representing aggregate expenditure shares consistent with a central government that earns the resource rents and makes decisions regarding how to spend those. Changing the β_j shares will alter the ultimate labor allocation in the economy, but not change our results regarding the influence of resources on those allocations.

internationally, but has no domestic market. It has a production function of

$$Y_r = A_r R^\gamma L_r^{1-\gamma}, \tag{11}$$

where A_r is total factor productivity, R is the size of the resource base, and L_r is the amount of labor used in the sector. We purposely define the elasticity with respect to resources, γ , to differ from α. The value of γ is a way of parametrically distinguishing between different types of resources. As γ goes to one, the output of the resource sector becomes like "manna from heaven," and no labor effort is required to extract it. This would be the case for resources like oil or diamonds, where the labor force required for production is very small relative to the population. As γ gets closer to α, labor is more important for the extraction of the resource, consistent with the production of cash crops.

3.3 Equilibrium

The economy is assumed to face world markets for the resource good, the tradable good, and food. Their prices are exogenous to the economy, and given by p_r^*, p_d^*, and p_f^*, respectively. The price of non-tradable goods is p_n and is determined endogenously. The sectors are all assumed to operate competitively, so that the stocks of resources, capital, and land all earn their marginal products,

$$\begin{aligned} \omega_r &= \gamma p_r^* A_r \left(\frac{L_r}{R}\right)^{1-\gamma} \\ \omega_k &= \alpha p_d^* A_d \left(\frac{L_d}{K}\right)^{1-\alpha} \\ \omega_x &= \alpha p_f^* A_f \left(\frac{L_f}{X}\right)^{1-\alpha}. \end{aligned} \tag{12}$$

Labor is assumed to be mobile between sectors so that wages are equalized,

$$w = p_n A_n = (1-\alpha) p_d^* A_d K^\alpha L_d^{-\alpha} = (1-\alpha) p_f^* A_f X^\alpha L_f^{-\alpha} = (1-\gamma) p_r^* A_r R^\gamma L_r^{-\gamma}. \tag{13}$$

Labor mobility establishes several conditions regarding the relationships between the the fraction of labor engaged in the food, tradable, and resource sectors.

$$\begin{aligned} \frac{L_f/L}{L_d/L} &= \frac{X}{K}\left(\frac{p_f^* A_f}{p_d^* A_d}\right)^{1/\alpha} \\ \frac{(L_d/L)^\alpha}{(L_r/L)^\gamma} &= \frac{(1-\alpha) p_d^* A_d (K/L)^\alpha}{(1-\gamma) p_r^* A_r (R/L)^\gamma} \\ \frac{(L_f/L)^\alpha}{(L_r/L)^\gamma} &= \frac{(1-\alpha) p_f^* A_f (X/L)^\alpha}{(1-\gamma) p_r^* A_r (R/L)^\gamma}. \end{aligned} \tag{14}$$

While the possible difference between γ and α complicates the second two relationships, the conditions are straightforward. Labor allocations between these three sectors depend on the relative productivity of the different sectors. If the world price or productivity of a sector rises, then its fraction of the labor force rises relative to the other two. In particular, note that an increase in either p_r^*, A_r, or R will increase the relative size of the resource labor force. To establish the size of these sectors relative to the non-tradable sector requires further conditions, as the price of non-tradables in endogenous. Given that non-tradables are by definition only produced domestically, it must be that

$$\beta_n m L = p_n Y_n. \tag{15}$$

The other three goods can be produced domestically and also imported or exported to the world market. Assuming balanced trade yields the following condition

$$(\beta_f + \beta_d)mL = p_r^* Y_r + p_d^* Y_d + p_f^* Y_f. \tag{16}$$

This states simply that total expenditure on food and tradable goods must be equal to the total value of production in the tradable sectors. To solve for the fraction of labor engaged in non-tradable production, divide (15) by (16), yielding

$$\frac{\beta_n}{\beta_f + \beta_d} = \frac{p_n Y_n}{p_r^* Y_r + p_d^* Y_d + p_f^* Y_f}. \tag{17}$$

Using the definitions of the production functions, and the fact that wages are equalized between sectors, this can be re-written as

$$\frac{\beta_n}{\beta_f + \beta_d} = \frac{L_n}{L_r/(1-\gamma) + L_d/(1-\alpha) + L_f/(1-\alpha)}. \tag{18}$$

Given that $L = L_n + L_d + L_f + L_r$, this can be transformed to

$$\frac{L_n}{L} = \frac{\beta_n}{1-\alpha(\beta_d + \beta_f)} \left(1 + \frac{\gamma - \alpha}{1-\gamma} \frac{L_r}{L}\right), \tag{19}$$

which gives the level of L_n as a positive function of the level of L_r. From this expression one can begin to see how resources will influence urbanization and structural change. Anything that raises the fraction of labor engaged in resource production will increase non-tradable employment. If there are no resources in the economy, then $L_r/L = 0$, and the model reduces to the typical result that the labor share depends on the expenditure share for non-tradables.[22]

3.4 Urbanization without Industrialization

Consistent with the empirical regularities documented earlier, in our model an increased stock of natural resources (or an increased price for those resources on the world market) will generate urbanization without industrialization. When resource labor productivity goes up (whether through p_r^*, A_r, or R), then L_r/L will rise relative to both L_f/L and L_d/L, as seen in (14). This is a classic Rybczynski effect. The fall in L_d/L implies a fall in industrialization in the economy. The non-tradable sector responds differently precisely because it is non-tradable. The increased productivity in resources represents a real increase in earnings, and so individuals demand more of each of the consumed goods. The only way to provide more non-tradable goods is to increase the fraction of workers in that sector, which is what equation (19) captures. With labor flowing into non-tradables, it must be that the price p_n is rising as well to ensure that the wage remains identical to the alternatives. When resource productivity increases the economy can increase its consumption of food and tradables through imports, and so those sectors can shrink relative to resources and non-tradables. Under plausible conditions that we document below, the increase in L_n/L will outweight the fall in L_d/L, and overall the urbanization rate will increase following an increase in resource productivity. Hence we have urbanization without industrialization, and as this urbanization is driven by increased demand for non-tradable goods, we have "consumption cities". This is all presented more formally in the following proposition and corollary.

Proposition 1. *Given the labor market equilibrium conditions given in (14) and (19), and an increase in the price of the resource (p_r^*), the productivity of the resource sector (A_r), or the size of the resource base (R), it will be true that:*

- *(A) L_r/L increases*

[22] The leading fraction $\beta_n/(1-\alpha(\beta_d+\beta_f))$ reflects the expenditure share on non-tradables, β_n, but is adjusted by the term in the denominator because the labor elasticity of production differs between sectors. As there are not diminishing returns to labor in non-tradables, the economy will tend to put more labor in that sector in equilibrium.

- *(B) L_n/L increases*
- *(C) L_f/L and L_d/L decrease*
- *(D) The ratio of non-tradable to tradable employment - L_n/L_d - will increase*
- *(E) The price of non-tradable goods, p_n, increases*

Proof. (A) follows from the labor market conditions in (14), the relationship of non-tradable to resource labor in (19), and the adding up constraint $L_f + L_d + L_r + L_n = 1$. Using (14) and (19), one can write the adding up constraint in terms of only L_r. This is an implicit function determining L_r. Using the implicit function theorem, the derivative $\partial L_r/\partial A_r > 0$. The partial derivative with respect to p_r^* and R follows from the same function. (B) follows directly from (19) and part (A). (C) follows by noting that if both L_n/L and L_r/L increase, then the sum $L_f/L + L_d/L$ must decrease. From (14) the ratio of L_f/L_d does not change when A_r, p_r^*, or R increases, so both L_f/L and L_d/L must actually fall. (D) follows from parts (B) and (C). (E) can be seen from the equalization of wages between non-tradables and tradables. Given that L_d/L falls, it must be that the wage paid in the tradables sector rises. The wage in the non-tradables sector is $p_n A_n$, so the only way for this wage to rise to keep the labor market in equilibrium is for p_n to rise. □

The proposition establishes the shift in labor allocations that take place with higher productivity in the resource sector (whether through an increase in the endowment, actual productivity, or the world price). This change in labor allocations does not involve industrialization: labor is actively moving *out* of tradable good production. However, the overall effect on the urbanization rate is ambiguous, given that L_n/L is rising. This proposition contains elements of the typical "Dutch Disease" description of resource-exporters. In those models, the focus is the relative productivity effect, and the transfer of labor out of tradables and into resources. However, the Dutch Disease models generally ignore the effect of the increased income from resources on the allocation of labor into alternative sectors. These models do not typically focus on urbanization, and as such they do not emphasize the implications for urbanization of increases in resource productivity. The next corollary establishes that urbanization in the economy increases with resource productivity as long as the initial fraction of labor in tradables is sufficiently small.

Corollary 1. *If the following condition holds:*

$$\frac{L_d}{L_f} < \frac{\gamma - \alpha}{1-\gamma} \frac{\beta_n}{1 - \alpha(\beta_d + \beta_f)} \tag{20}$$

then an increase in p_r^*, A_r, or R will result in a net increase in the urbanization rate u.

Proof. See appendix □

When resource productivity rises, labor is pulled out of both the food and tradable sectors. As the ratio of L_d/L_f must remain constant, the absolute change in L_d depends on how much tradable labor there is to begin with. The condition in the corollary states that so long as L_d is sufficiently small compared to L_f then the loss of labor in tradables will not offset the rise of labor in non-tradables, and urbanization will increase. Practically, for countries that have little to no tradable sector to begin with, i.e. countries whose urbanization rate is close to 0, increasing resources will increase urbanization. On the contrary, Dutch Disease models are applicable for countries who are already industrialized and urbanized.

Note that the degree of urbanization following an increase in resource production depends on the size of γ relative to α. See the expression for L_n/L in equation (19) to see this explicitly. For economies with resources characterized by a large γ, such as oil, a relatively small change in the labor share in resources will produce a large shift towards non-tradable work. The reason is that there are two effects at work when resource productivity increases. First, the change in relative productivity induces labor to move into resource production. Second, the increased income due to the productivity improvement raises demand for non-tradable goods, which pulls labor out of the other sectors. When γ approaches α, the first effect offsets the second, and there is no net change in labor in non-tradables. When γ approaches one, then a very small shift of labor into resources is sufficient to equalize wages across sectors, and so on net the second effect dominates the first.

Last, it is worth considering an economy without any resources as a comparison. If we set $R = 0$, then the resource sector is shut down completely, and $L_r/L = 0$. From (19) the fraction of labor in the non-tradable sector is given by $L_n/L = \beta_n/(1 - \alpha(\beta_d + \beta_f))$, which is fixed by the expenditure shares. For the non-resource economy, the only way that urbanization proceeds is for the ratio of tradable labor to food labor, L_d/L_f, to increase. This occurs, from (14), only if A_d increases relative to A_f.[23] Without resources, the process of urbanization is thus entirely coincident with the process of industrialization. Urbanization driven entirely by changes in relative productivity leads to what we call "production cities". Within countries that do not have significant natural resource exports we see just such a relationship.

3.5 Subsistence Constraints

Incorporating a subsistence constraint for food consumption, and thus introducing a non-homotheticity of the kind common in models of structural transformation, is straightforward. Let $\bar{c}_f$ be the subsistence requirement for individual food consumption, and utility be given by:

$$U = \beta_f \ln(c_f - \bar{c}_f) + \beta_d \ln c_d + \beta_n \ln c_n. \tag{21}$$

This leads to an income elasticity of demand for food that is less than one. The budget constraint for individuals can now be written in the following manner:

$$p_f(c_f - \bar{c}_f) + p_d c_d + p_n c_n = m - p_f \bar{c}_f, \tag{22}$$

where the term on the right is now *surplus* income. The preferences are such that individuals will consume a fraction β_j of their surplus income on good j, as before. The difference for food is that individuals consume fraction β_f of their surplus income on *surplus* food, $(c_f - \bar{c}_f)$. So total expenditures on food are $\beta_f(m - p_f\bar{c}_f) + p_f\bar{c}_f$.

Combining these preferences with the production structure outlined above, we have similar conditions regarding total expenditures and total production of the non-traded good,

$$\beta_n(m - p_f\bar{c}_f)L = p_n Y_n. \tag{23}$$

Again, the other three goods are internationally tradable, and balanced trade dictates the following relationship

$$(\beta_f + \beta_d)(m - p_f\bar{c}_f)L + p_f\bar{c}_f L = p_r^* Y_r + p_d^* Y_d + p_f^* Y_f. \tag{24}$$

Solving these together as before yields a relationship between L_n/L and L_r/L,

$$\frac{L_n}{L} = \frac{\beta_n}{1 - \alpha(\beta_d + \beta_f)}\left(1 + \frac{\gamma - \alpha}{1 - \gamma}\frac{L_r}{L} - \frac{p_f\bar{c}_f}{p_n A_n}\right). \tag{25}$$

The relationship is similar to what we found without the subsistence constraint. However, there is now an additional term - the fraction $p_f\bar{c}_f/p_n A_n$ - that will act to determine the size of the non-tradable sector. This additional term will exaggerate the effect of resources on the fraction of labor in the non-tradable sector. Mechanically, when resource productivity rises the fraction L_r/L will go up, as already established. The Balassa-Samuelson effect dictates that p_n will rise as well. As p_f is fixed, that means that the additional term in (25) falls in absolute value. Given that it enters the equation negatively, this results in an additional increase in L_n/L. More intuitively, when resource productivity rises individuals in the economy have become richer. The subsistence constraint ensures that the income elasticity for food is less than one, and hence the additional income is spent disproportionately on non-food goods. Note that this effect will arise no matter the source of the income gain. Increases in tradable or food productivity

[23] However, with non-homothetic preferences, any increase in food productivity A_f should also drive urbanization.

will increase the fraction of labor in non-tradables, as in typical models of structural change.

3.6 Inequality in Distribution and Urban Bias

In the baseline model we assumed log-linear preferences, and hence all individuals spend the same fraction of their income on each good. Practically, this means that the distribution of resource rents (or of income in general) does not influence the allocation of labor across sectors.

However, it is a near certainty that resource rents are concentrated on a small number of individuals, whose preferences differ from the average – either because of non-homotheticity or because of pure differences in preferences. For example, rich people may receive disproportionate shares of resource rents and may prefer to spend the money on housing services and personal services. Alternatively, although we do not attempt to model a government sector formally, we could imagine that governments receive all the rents from certain resources (e.g., minerals) and spend these rents on the provision of non-tradable public services in urban areas. (This would be consistent with a political economy of "urban bias," for example.) We could represent this urban-biased government, in a highly reduced form, as a single rent-earning agent who chooses to consume her income in the form of non-tradable services.

To allow for this in the model, consider the following modification. Let there be a class of individuals that earn wages, capital returns, and land returns as before. These individuals have preferences over the three goods as in the baseline model, with weights β_f, β_d, and β_n.

In addition, there is some group for that earns wages, capital returns, and land returns as before. However, this group also earns all of the resource rents in the economy. This group has a set of preferences that is log-linear, but with weights θ_f, θ_d, and θ_n. The idea is that these individuals will, due to their resource rents, prefer more urban goods. Additionally, they are likely to disproportionately spend their income on non-tradable goods such as government or personal services. So presumably $\theta_n > \beta_n$.[24]

Let the group of resource owners be a fraction λ of the total population, and hence the non-resource owners are a fraction $1-\lambda$. With these two groups, the condition relating expenditures and production in the non-tradable sector is

$$\hat{\beta}_n \left(wL + \omega_k K + \omega_x X \right) + \theta_n \omega_r R = p_n Y_n, \tag{26}$$

where $\hat{\beta}_n = \beta_n(1-\lambda) + \theta_n \lambda$ is simply the weighted average of the two expenditure shares. In a similar manner, the condition for the food and tradable sectors, given balanced trade, is

$$(\hat{\beta}_f + \hat{\beta}_d) \left(wL + \omega_k K + \omega_x X \right) + (\theta_f + \theta_d) \omega_r R = p_r^* Y_r + p_d^* Y_d + p_f^* Y_f. \tag{27}$$

Here, $\hat{\beta}_f$ and $\hat{\beta}_d$ are defined similarly to $\hat{\beta}_n$, as the weighted average of the expenditure shares of the two different groups. These conditions can be solved together similar to before, yielding the following relationship between non-tradable labor and resource labor,

$$\frac{L_n}{L} = \frac{\hat{\beta}_n}{1-\alpha(\hat{\beta}_d + \hat{\beta}_f)} \left(1 + \frac{\gamma - \alpha}{1-\gamma} \frac{L_r}{L} \right) + \frac{1-\alpha}{1-\alpha(\hat{\beta}_d + \hat{\beta}_f)} \frac{\gamma}{1-\gamma} (\theta_n - \hat{\beta}_n) \frac{L_r}{L}. \tag{28}$$

Again, the relationship present here is similar to the baseline model, but the expenditure shares are the $\hat{\beta}_j$ terms, reflecting the weighted average of expenditure shares of the two types of people. This simply reflects the heterogeneity in preferences. The second term on the right hand side of (28) reflects the fact that one group of people has a disproportionate share of the resource income. The key part of this new term is $(\theta_n - \hat{\beta}_n)$, which is the difference in the expenditure share of resource-owners and the weighted average across all individuals. Assuming that resource-owners prefer non-tradable goods more than the average, then anything that raises L_r/L will have an even stronger effect on L_n/L than in our baseline model. Simply, the only reason L_r/L will rise is if the productivity of the resource sector increases, and this

[24] This is also a crude method of capturing non-homotheticities, where the resource-owners spend less of their income on staple goods like food, and more on luxuries such as personal services.

implies that the rents accruing to resource-owners are increasing as well. As they demand non-tradables more than the average person, this skews demand towards non-tradable goods and L_n/L rises.[25]

The implication of (28) is that the increase in urbanization following a positive shock to resource productivity depends on the degree of inequality as well as the difference in preferences across groups. The difference $\theta_n - \hat{\beta}_n$ is maximized when λ goes to zero, or there is a vanishingly small group of people who earn the resource rents. Hence, inequality in the earning of resource rents, along with an "urban bias" in the preferences of the resource rent owners, will exaggerate the urbanization effects of resources. However, note that an urban bias in the preferences of resource rent owners is not necessary for resources to drive urbanization, as the baseline model shows.

4. IMPLICATIONS FOR URBANIZATION AND INDUSTRIALIZATION

The static model we have laid out shows how urbanization can occur without industrialization in resource-exporters. The model has several other implications that distinguish these resource-exporters from those following the "typical" path of urbanization with industrialization. Here we establish that these implications are consistent with the observed data.

4.1 Urbanization, Income and Trade

Figure 5 displays several comparative static results from the model. The statics are for variation in the size of the resource endowment. Panel (A) shows what we have already established above, that urbanization rates rise with the share of resource exports relative to GDP. As seen in the introduction and section 2, there is a significant correlation between the two in the data. That correlation is driven entirely by mineral resources as opposed to cash crops. The clear relationship demonstrated in figure 5 is due in part to a high value of γ, which would be consistent with mineral resources that do not require an intense amount of labor. Cash crops would have a different, less pronounced, relationship between resources and urbanization, due to a smaller value of γ. In combination, this can explain the lack of any significant relationship between cash crops and urbanization in the data.[26]

Panel (B) shows that, *ceteris paribus*, a greater share of resource exports in GDP is also associated with higher income per capita. Increasing the endowment of resources increases the income of a country, and this increased income is one of the driving forces of urbanization, as explained above. Panels (A) and (B), taken together, indicate that urbanization and income per capita are positively correlated even for countries that urbanize due to increased resource endowments. The data confirm that the cross-sectional relationship between resources and urbanization operates through income effects. In table 3 we display regressions confirming this. In column (1) we show that both resource-exporters and industrial countries are relatively wealthier than other countries. Column (2) replicates our earlier result that natural resource exports are positively related to urbanization (see column (3) of Table 1). In column (3) we control for GDP per capita, and as can be seen the independent effect of resources is both insignificant and falls to almost zero.[27] The implication of this result is that urbanization is driven by income per capita; whether this income per capita comes from industrialization or resources is not relevant. Note that in column (2), the positive effect of manufacturing and services on urbanization is also statistically zero. Column (2)

[25]Note that this set-up nests our baseline model. If there is no inequality, or $\lambda = 1$, then θ_n will be identical to $\hat{\beta}_n$, and the second term in (28) goes to zero. Alternatively, if both groups have identical preferences, then regardless of the distribution of resource rents θ_n will be equal to $\hat{\beta}_n$.

[26]This can also explain why significant cash crop exporters of the past, such as the cotton, sugar, and tobacco plantations of the Americas, or the western African traders of salt, gold, and ivory, did not urbanize to the extent we see in modern times. Even with high prices for those goods at the time, the low value of γ would have limited the impact on urbanization. As the number of producers of those cash crops expanded over time the relative price dropped, further limiting the urbanization that is associated with those goods. The consumption cities of modern times rely on mineral exports, and differ from the consumption cities of the past in that the global demand for their products is high while their production costs are relatively low (a high p_r^* for a low γ).

[27]As explained in footnote 11, there are a number of reasons why we use the average share of natural resource exports in GDP in 1960-2010 instead of the same share for the year 2010 only. Likewise, we must use average GDP per capita in 1960-2010, as GDP per capita in 2010 imperfectly captures the effect of natural resource exports in 1960-2010 on urbanization in 2010.

shows that resource-exporters do not have a fundamentally different relationship between urbanization and income per capita than typical developing countries.

If urbanization is just a story of income per capita growth, then why have we focused so much on the role of resources? The answer is that the source of the income per capita growth has implications for the type of urbanization that occurs. As discussed earlier, resource-dependent economies develop through "consumption cities", where urbanization rises due to the surplus income generated. One aspect of these cities is that they necessitate increasing imports of both food and industrial goods and services, as those sectors are shrinking (or not developing) due to the resource sector's comparative advantage. This can be seen in our model in figure 5 panel (C), which plots food imports and tradable imports as a share of GDP against resource productivity. Imports of both are increasing as fractions of GDP as resource exports become a larger fraction of GDP. We can see this increased import activity in the data as well. Table 3 shows in column (4)-(8) the results of regressions of various types of imports as a share of GDP on our measures of economic structure, as well as income per capita and the urbanization rate itself. As can be seen in column (4), the greater the share of resource exports in GDP, the higher food imports tend to be. The effect of a higher manufacturing and services share is smaller in estimated value. An F-test for the equality of the coefficients on resources and manufacturing/services (shown in the second panel) shows strong evidence that the coefficients are statistically different. This result holds if we consider staple food imports instead (see column (5)). In column (6) the dependent variable is manufacturing imports as a share of GDP. Resource-exporters import more manufactured goods than industrial countries, but not significantly so (the F-test is only significant at 14%). Industrial countries may also import more manufactured goods from other industrial countries to diversify their consumption of such goods. Lastly, resource-exporters import significantly more (tradable) services than industrial countries, for the same economic conditions (see column (7)).

4.2 Sectoral Composition of Cities

Another aspect of urbanization without industrialization is the workforce composition of consumption cities. When resource productivity rises, this shifts labor out of the tradable sector but increases demand for urban non-tradables. Hence consumption cities are composed mainly of non-tradable workers. The patterns of employment predicted by the model can be seen clearly in panel (D) of figure 5. The solid line shows the fraction of workers in the food sector, which steadily declines as resource productivity rises - this is the counterpart of the increasing imports of food seen in panel (C). There has been no increase in food productivity, so food demand must be met by increased imports as workers leave rural areas. Those workers are finding their way, almost exclusively, into the non-tradable sector. There is some small increase in the share working in the resource sector. The exact size of the shift into the resource sector depends on the size of the γ parameter, so in different situations the shift into resources may be larger or smaller than what we have depicted here. However, what is unambiguous is that the composition of urban workers is becoming almost entirely skewed towards non-tradables. The gray dashed line at the bottom of panel (D) is the share engaged in tradable production. Taken together with the rise in non-tradable workers, it follows mechanically that urban areas are growing larger but not industrializing.

First, we have data that corroborates this dominance of non-tradable workers in the cities of resource-exporters. As described in the Online Data Appendix, we use IPUMS census, labor force survey and household survey data to recreate the sectoral composition of urban areas for as many countries as possible in 2000-2010. For each country, we know the urban employment shares of 11 sectors.[28] We focus on urban tradables, i.e. "manufacturing" (*Manuf.*), and "finance, insurance, real estate and business services" (*FIRE*) as an imperfect proxy for tradable services. Figure 6 shows the relationship between the share of urban tradables in total urban employment (%) and the contribution of natural resource exports to GDP (%) for 87 countries in 2000-2010. These countries represent 95% of the whole sample's population. As expected,

[28]We use data for the most recent year. When no data could be found for the period 2000-2010, we use data for the 1990s. Similarly to McMillan & Rodrik (2011), the 11 sectors are: "agriculture", "mining", "public utilities", "manufacturing", "construction", "wholesale and retail trade, hotels and restaurants", "transportation, storage and communications", "finance, insurance, real estate and business services", "government services", "education and health" and "personal and other services".

we find a strong negative relationship between urban tradables employment and natural resource exports. In column (1) of Table 4 we verify that this result holds when we include area fixed effects, the same controls as in Table 1, as well as GDP per capita and the urbanization rate.[29] The urban employment share of urban tradables is significantly lower in resource-exporters than in industrial countries for the same economic conditions (see the F-test in the second panel).

The highly industrial countries in our sample (e.g, those countries whose share of manufacturing and services in GDP is above 70%) and the heavy resource-exporters (e.g., those countries whose share of natural resource exports in GDP is above 20%) are all highly urbanized, with urbanization rates around 60% on average for both groups. In the highly industrial countries, urban tradables account for 30% of the urban workforce, against 10% in the heavy resource-exporters. When examining other sectors, we find that the gap (20 percentage points) is mostly explained by the shares of "commerce and personal services" and "government services" being relatively higher in the resource-exporters (+ 16 and 2 percentage points respectively).[30] In column (2) and (3) of Table 4 we verify that the labor shares of these sectors are significantly higher in resource-exporters than in industrial countries for the same economic conditions. The F-tests confirm that this is indeed the case. The result for the commerce sector is in line with the model, as resource-exporters import a larger share of their food and tradables consumption. Their cities serve as distribution stations for imported goods that are then dispatched to the rest of the country. Additionally, resource rents create shops and restaurants for the wealthy, but also for those who cater for the needs of the wealthy and so on (see footnote 3 on Angola). The results for government services are also in line with the model: the government may receive resource rents that it could spend on the provision of non-tradable public services (or the hiring of additional government employees).

Second, the fact that countries use different urban definitions could affect the urban employment share of urban tradables. A restrictive urban definition would mechanically exclude small agriculturally oriented towns, while a narrow urban definition would only select large cities with a strong manufacturing sector. We verify that the results of columns (1)-(3) hold when we use the same type of data for the largest city only of 84 countries. Column (4) shows that the urban employment share of tradables is significantly lower in resource-exporters than in industrial countries, when using this alternative sample.

We also verify that these results on the compositional mix of cities are robust to using the urban labor share of skilled workers as an alternative measure of urban tradables. We use IPUMS census, labor force survey and household survey data to recreate the occupational composition of urban areas for more or less the same countries as before.[31] We focus on skilled workers, i.e. "professionals" and "technicians and associate professionals". In column (5) we regress the share of skilled workers in all urban areas on the same variables as before. While the occupational effects are less precisely estimated than the sectoral effects, cities in resource-exporters appear to have relatively fewer skilled workers than cities in industrial countries for the same income level (see the F-test). Interestingly, we also find that cities in resource-exporters have relatively more "service workers and shop and market salesmen" and "clerks" (not shown but available upon request). These two results seem to be in line with the results of column (2) and (3) respectively, the fact that these cities have larger commerce, personal service, and government sectors.

Third, an alternative explanation is that the productivity level of non-tradables is systematically higher in resource-exporters, and so the "consumption cities" we observe are not directly the result of resources, but just reflet relative productivity differences. Due to poor comparable data on urban wages in the developing world, we cannot directly address this question.[32] As an alternative, for 111 countries of our sample, we

[29]For example, Kuwait and Japan have similar per capita incomes and urbanization rates, but Kuwaiti cities have a lower employment share of tradables (11% vs. 33%). Other pairs of countries for which we corroborate this hypothesis are: Saudi Arabia vs. South Korea and Taiwan; Gabon and Libya vs. Mexico, Chile and Malaysia ; and Angola vs. China and The Philippines.

[30]The "commerce and personal services" sector consists of "wholesale and retail trade, hotels and restaurants", "transportation, storage and communications" and "personal and other services". We lump them together to capture the whole commerce sector.

[31]We use data for the most recent year. When no data could be found for the period 2000-2010, we use data for the 1990s. The 9 occupations are (armed forces are excluded from the analysis): "legislators, senior officials and managers", "professionals", "technicians and associate professionals", "clerks", "service workers and shop and market sales", "skilled agricultural and fishery workers", "crafts and related trades workers", "plant and machine operators and assemblers" and "elementary occupations".

[32]Gollin, Lagakos & Waugh (2011) use household survey data to show that the value added per worker in developing countries

calculated manufacturing and service productivity for the most recent year available in 2000-2010. In column (6) the dependent variable is manufacturing productivity. We do not find any significant difference between resource-exporters and industrial countries (see the F-test), although the point estimate is higher in the latter countries. In column (7) the dependent variable is service productivity. The service sector appears to be relatively *less* productive in resource-exporters than in industrial countries for the same economic conditions. The results of columns (6) and (7) would suggest that cities in resource-exporters would have a tendency towards more manufacturing employment if relative productivity were all that mattered. Yet we see resource-exporters with a higher share of workers in services, and in particular in low productivity non-tradable services. McMillan & Rodrik (2011) shows that labor productivity is three times higher in the FIRE sector than in "wholesale and retail trade, hotels and restaurants" and "community, social, personal and government services" for the world in 2005 (see their Table 2). These results should be taken with some caution. Obviously, it is partly because tradable sector productivity is low in resource-exporters that they have a comparative advantage in resource exports. These results are useful as another robustness test of the results based on actual employment data.

Finally, we did not take any stand on the distribution of resource rents, and so the model does not have any explicit predictions regarding either the type of non-tradable employment in urban areas, or on which cities (primate or otherwise) will be particularly affected by resource rents. However, we are able to offer several additional pieces of data regarding the relationship between resource rents and the composition of urban employment. In table 4, columns (2) and (3) indicate that the employment effect of natural resources acts primarily through commerce and personal services, and only marginally through increased government employment.

Similarly, we see no tendency towards urban primacy being driven by natural resource exports. We regressed the population share of the largest city (or alternatively the top 5 cities) in 2010 on natural resoure exports, while also controlling for manufacturing and services share of GDP and the urbanization rate. The results (shown in Appendix Table 5) show that there is no significant effect of natural resource exports on primacy once we include area fixed effects. Resource exporters do not appear to concentrate the urban population more highly than in other countries. Neither this result nor the prior one give any information on who precisely earns the resource rents in an economy, but they do indicate that the main effect of those rents is to increase spending on commerce and personal services across all the urban areas of the economy. There is no evidence of a systematic tendency for a increased concentration of government employees in the primate city.

5. URBANIZATION AND LONG-RUN GROWTH

It is commonly assumed that urban agglomerations are centers of productivity growth, both in developed and developing countries. Greater urbanization should therefore lead to faster growth. This expected relationship has been embedded into growth models to describe the divergence in output per capita across countries. However, growth is not strongly affected by urbanization *per se* in cross-country regressions.[33] The question then is, how we can reconcile the micro-evidence, which indicates large agglomeration economies, and the macro-evidence, which does not show any growth effect of urbanization?

Most of the literature presumes that urban areas are essentially identical across countries in their economic structure. But perhaps agglomeration effects on productivity are more pronounced in manufacturing than in non-tradable services. The underlying assumption of the agglomeration literature is that cities are "production cities", with a mix of tradable good production (often manufacturing) and non-tradable production (often services). However, as we have documented, for a large group of countries urban

is still relatively higher in the non-agriculture sector than in agriculture. But they do not directly investigate whether the urban wage is relatively higher in some countries than in others. Data from McMillan & Rodrik (2011) indicate that mining productivity is not necessarily lower in developing countries than in developed countries. But their data set does not tell us whether manufacturing and service productivity is lower in resource-exporters than in industrial countries with a similar income level.

[33]We also test this non-result by regressing economic growth in 2000-2010 (1960-2010) on urbanization in 2000 (1960), while simultaneously controlling for initial per capita GDP in 2000 (1960) and adding area (or region) fixed effects and the same controls as before. We find that the coefficient of the urbanization rate variable is nil.

areas are skewed towards non-tradable production in "consumption cities". In this case, cities are not all the same. Agglomeration effects might be present for certain sectors, but a regression including both "consumption" and "prouction" cities would give inconclusive results on urbanization and growth.

5.1 Mechanisms

There are several lines of research that suggest production cities will have greater long-run productivity growth than consumption cities:

- *Manufacturing convergence*: There is evidence of unconditional convergence in labor productivity in manufacturing sectors across countries, as in Rodrik (2011). If a country does not have an appreciable manufacturing sector, then regardless of its urbanization level, this convergence in productivity levels will have only a minimal impact on living standards.

- *Low non-tradable productivity growth*: More broadly, Duarte & Restuccia (2010) document that labor productivity growth in services (generally non-tradable) was much slower than manufacturing labor productivity growth across a sample of countries in the post-war era. In their panel, labor productivity growth in manufacturing averaged 4.0% per year while productivity growth in services was only 1.3%. Timmer & Vries (2007) find that non-market services contributed very little to growth in developing countries in 1950-2005, while manufacturing was the dominant source of growth.

- *Trade competition*: Recent research suggests that tradable goods have a greater tendency towards productivity growth than non-tradables. Galdon-Sanchez & Schmitz (2002) document that the threat or actual presence of competition is key to productivity improvements. Tradable goods face global competitors that non-tradable goods do not, and so the incentives for productivity improvement are greater. Reallocations of inputs from low- to high-productivity firms, as well as exit of firms with the lowest productivity, appears to be a significant source of the productivity advantage for the tradable sector (Pavcnik, 2002; Bustos, 2011).

- *Incentives for human capital*: Galor & Mountford (2008) suggest that tradable goods are likely to use human capital more intensely than non-tradable goods. If so, then with production cities, individuals will be incentivized to invest more in child quality, perhaps lowering the fertility rate and raising education levels. This will generate a difference relative to consumption cities, where the incentives remain to have larger families with low education levels. Using U.S. data, Glaeser, Kerr & Kerr (2012) find that resource-rich cities had bigger firms in the past, which led to a dearth of entrepreneurial capital across several generations. Likewise, resource booms in poor countries may increase rent-seeking activity and limit entrepreneurship (Baland & Francois, 2000). Glaeser & Resseger (2010) also show that the connection between city size and productivity does not hold for the less skilled cities in the U.S. today. Our "consumption cities" are also less skilled and less productive.

- *Agglomeration economies*: Agglomeration economies that operate within industries – localization economies – and agglomeration economies that operate across industries – urbanization economies – could be stronger in manufacturing and tradable services than in non-tradable services (e.g., trade and transportation, or the government sector). Most of the research has focused on estimating causal effects for manufacturing subsectors or hi-tech services in developed countries (see Glaeser & Gottlieb (2009) for a recent survey of the literature). Rather unfortunately, little is known for those cities of the developing world that are characterized by a low employment share of these sectors.

- *Political reforms:* another potential mechanism is that "production cities" of manufacturing and tradable services may have a larger urban middle-class (e.g., in Asia) than "consumption cities" where the resource rent is appropriated by an urban elite (e.g., Africa). The urban elite could block any economic reform that would be welfare-improving both at the urban and national level (see Lipton (1977) and Bates (1981) for a discussion of many examples in resource-exporters).

5.2 Numerical Simulations

Regardless of the exact source, it appears reasonable to suppose that the tradable goods sector is a source of greater potential productivity growth than the non-tradable sector. Having a high urbanization rate will not necessarily drive further productivity improvements if the cities are made up of mainly non-tradable sector workers, as in resource-exporting economies. The possibility that the urban tradable sector is a source of endogenous productivity growth, whatever the precise channel, ultimately implies that resources may slow down long-run growth despite being positive for income and undoubtedly welfare-increasing in the short run. Intuitively, a large resource endowment shifts labor away from the tradable sector, slowing down subsequent productivity growth in that sector. In contrast, an economy that starts without a resource endowment may be poor, but will maintain a slightly larger tradable goods sector, allowing for faster growth in tradable productivity. That growth will pull more workers into the tradable sector (and urban areas) and accelerate the growth of tradable productivity. Eventually, the economy with these production cities may overtake the resource-rich economy. To see this more formally, let productivity growth in the tradable sector be described by a simple reduced-form endogenous growth function of

$$\frac{\dot{A}_d}{A_d} = g\left(\frac{L_d}{L}\right)^{\phi} \tag{29}$$

where g is a fixed growth rate of tradable productivity, but this is modified by the number of people engaged in tradable work, L_d/L. The parameter ϕ dictates how important the size of the tradable workforce is to raising productivity. This is similar in form to what Lucas (2009) used, but where he entered the share of workers in urban areas into productivity growth, we limit the effect to only the tradable sector workers. The effect of this is easiest to see in a simulation of the model. Consider two economies that are identical except for their initial resource endowment. One begins with an endowment five times larger, leading it to have a relatively high urbanization rate, made up of primarily non-tradable workers. Both share the same value of g, the latent growth rate in tradable sector productivity. The initial conditions are such that both economies have very small tradable sectors to begin with. However, the one without resources will begin with a small advantage in L_d/L because labor is not being pulled out to the resource sector.

As can be seen in panel (A) of figure 7, the resource-rich economy begins with higher urbanization, thanks to the forces we have outlined previously. That urbanization, though, comes from consumption cities, and so is not generating faster growth in tradable productivity. Over time, the resource-poor economy, which has a slightly larger tradable goods sector, begins to see appreciable productivity growth in that sector, and this translates to increasing urbanization through production cities. Roughly half-way through the simulation the urbanization rate in the resource-poor economy passes that of the resource-rich one. Eventually, tradable productivity growth accelerates in the resource-rich economy as well, and it shifts from consumption cities to production cities.

This pattern is repeated in panel (B), which plots the log of income per capita. Again, the resource-rich economy enjoys a higher standard of living early on, which is reflected in the urbanization rate of panel (A). However, as the productivity improvements continue faster in the resource-poor economy, it eventually overtakes the resource-rich economy in income per capita. The resource-rich economy will experience its own acceleration of growth once tradable sector productivity growth begins to accelerate, but this is delayed compared to the resource-poor economy. Ultimately, while urbanization and income per capita are positively correlated within each economy, and across economies, the type of urbanization that takes place matters for long-run outcomes. Urbanization without industrialization, as occurs in the resource-rich economy, does not necessarily provide a productivity bump, and thus need not lead to faster economic growth. In fact, resource-rich economies may find themselves overtaken by resource-poor economies as the latter continue to accumulate higher tradable sector-productivity.

One note is that allowing for the non-tradable sector to experience endogenous growth will not change this overall pattern. Because it is non-traded, productivity changes in the non-tradable sector are translated directly into price declines in the non-tradable good. This does not induce any change in the allocation of labor across sectors, and hence there is no effect on urbanization or on measured income per capita.

5.3 Discussion on the Evolution of Consumption Cities into Production Cities

The theory indicates that resource-exporters will have consumption cities, while resource-poor countries will have production cities if there is productivity growth in manufacturing or industrial services. It is perfectly conceivable that consumption cities could become production cities over time. The rent could be invested, instead of consumed, and the private and public investments made could increase productivity in the tradables sector and change the country's comparative advantage. How much time will it take for these cities to become production cities and what are the constraints on their evolution?

For example, many areas were or are still resource-rich in developed countries, such as the United States, Canada or Australia. Within the United States, ten out of the twenty-five largest cities were founded as consumption cities according to our typology. Gold rushes led to the growth of cities such as San Francisco (from 1848), Denver (1858) and Seattle (1896). Giant oil discoveries also explain why Texan cities have been among the fastest-growing cities in the 20th century. There is no better example of our theory than Houston: While it was the 85th largest city in 1900 before oil was discovered in 1901, it is now considered as the 4th largest agglomeration in the country. These consumption cities industrialized in the twentieth century and are now highly specialized in tradable services. As shown by Michaels (2011), resource production can promote long-term development when institutions are strong. Campante & Glaeser (2009) also documents how human capital and political stability can explain the divergent path of originally similar cities, as exemplified by Buenos Aires and Chicago over the past century. Work by Buera & Kaboski (2012) examines the transformation of economies from low-skilled service work to high-skilled service work as demand for specialized services increases with high levels of income, a potential source of the transition from "consumption" to "production" cities.

A few developing resource-exporters have managed to diversify and industrialize their economy, for example Indonesia (oil) and Malaysia (oil) in Asia, Chile (copper) and Mexico (oil) in Latin America, Dubai (oil) in the Middle-East, and Mauritius (sugar) and South Africa (diamonds and gold) in Africa. Their cities have become (or are becoming) production cities over time, as shown by their employment share of manufacturing and tradable services. Why only some countries have managed to transform their cities does not have an obvious answer. It could simply be a question of time. Or it could be due to resource-exporters having poor institutions and a low stock of human capital that constrain productivity growth in the tradables sector. However, even if a resource-exporting developing country has the "right" institutions, it must be able to compete with developing countries that already have a strong comparative advantage in that sector (e.g. China). All these conditions make it difficult for these cities in resource-exporters to industrialize. As the goal of this paper is to describe the possible emergence of these consumption cities, and not their endogenous evolution in the longer run, we leave these issues aside for future research.

6. CONCLUSION

This paper documents several new facts regarding the process of industrialization and urbanization in developing economies, showing that these two concepts are not synonymous. In particular, countries that are rich in natural resources have experienced urbanization without industrialization. We develop a model of structural change that is able to capture both the typical pattern of urbanization and industrialization seen across much of developing Asia and Latin America and the Caribbean (and Europe and North America before) as well as urbanization without industrialization seen in the Africa and the Middle-East.

Our model is consistent with several additional facts. First, urbanization is linked to income per capita growth, regardless of the source of the income per capita. Second, countries that have urbanized without industrializing have done so by importing large portions of their food and tradable good production. Finally, resource endowments create "consumption cities" by increasing surplus income and shifting workers away from the tradable sector. The composition of urban employment is skewed towards local retail and personal services. Countries that lack large resource endowments instead urbanize in "production cities", driven by the substitution of labor towards the tradable good sector - manufacturing and tradable services such as finance.

This work suggests that urbanization, per se, is not necessarily conducive to long-run growth and development. The benefits of urbanization are generally centered on the presence of industrial sectors that are open to trade. By urbanizing through consumption cities, resource-exporters may not be able to reap the benefits of urban agglomeration economies. Despite their initial wealth, resource-exporters could well be (and have already been, in some cases) surpassed by initially poor resource-poor countries. The source of urbanization appears to be an important factor in future development.

This paper leaves several open questions. The first is why most resource-exporting developing 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. We do not attempt to model this directly. A second question that we leave unanswered is whether consumption cities will necessarily evolve into production cities over time, as most of them did in the United States, Canada or Australia. Our model does not allow for this, and we view it as an important question that warrants further study.

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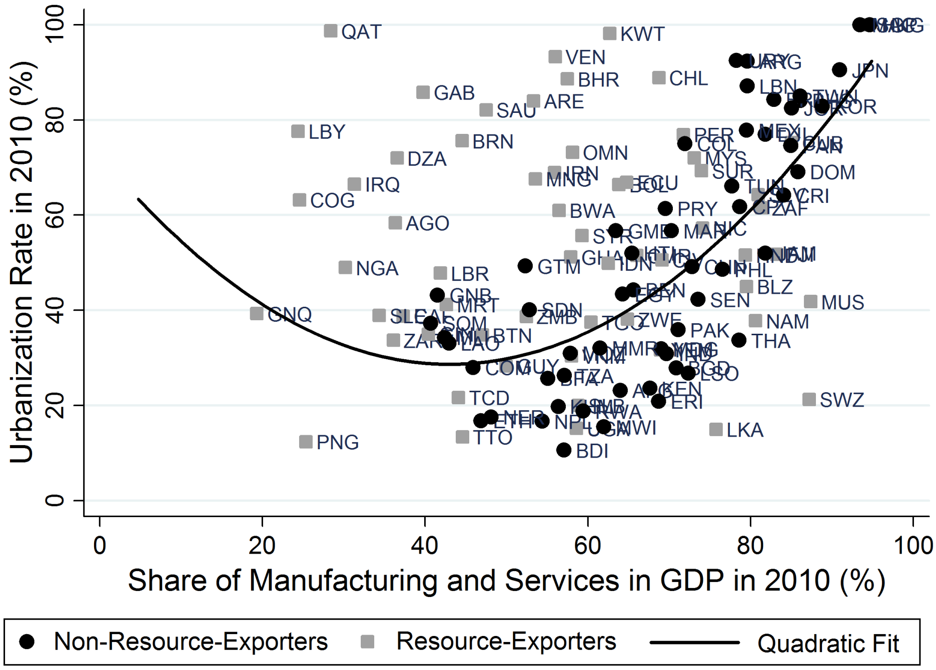
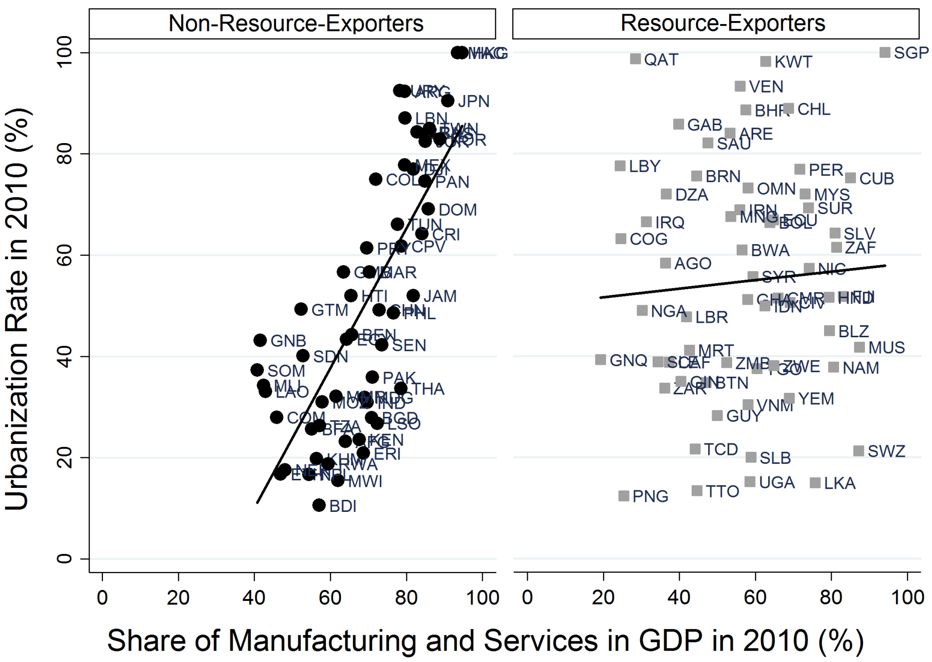
FIGURES

Figure 1: Urbanization and Industrialization for Entire Sample of Non-Resource-Exporting and Resource-Exporting Countries



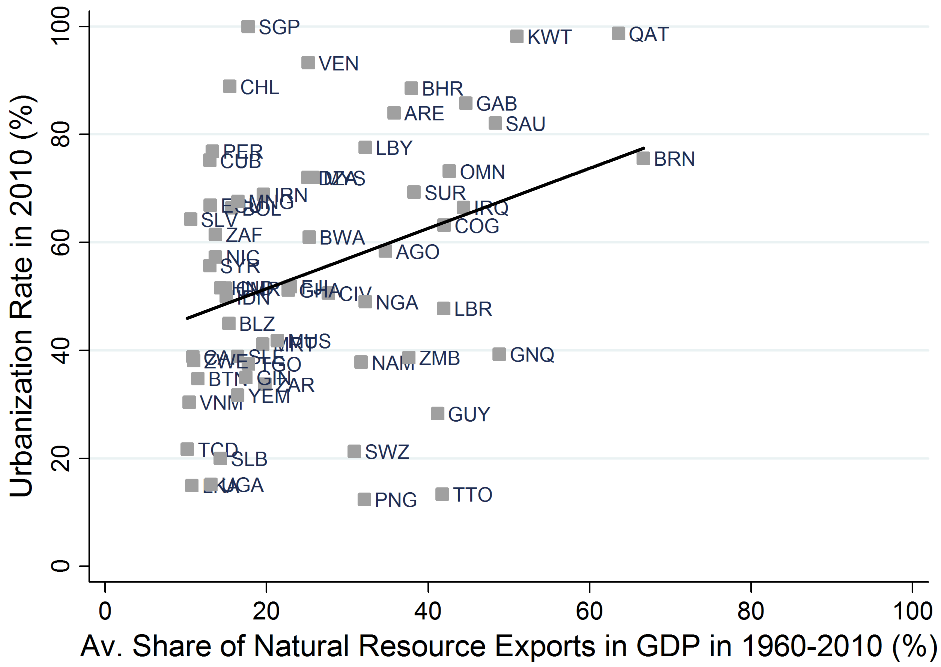
Notes: This figure shows the relationship between the urbanization rate (%) and the share of manufacturing and services in GDP (%), our measure of industrialization, for 116 countries across four areas in 2010: Africa (N = 46), Asia (27), Latin American and the Caribbean (26) and Middle-East and North Africa (17). We include services to capture industrial services such as finance, even with we also capture non-industrial services then. The sample is split into two groups, depending on the average share of natural resource exports in GDP in 1960-2010 (%). A country is defined as "non-resource-exporting" if this share is below 10% (56) and as "resource-exporting" if this share is above 10% (60). See Online Data Appendix for data sources and construction of variables.

Figure 2: Urbanization and Industrialization Separately for Non-Resource-Exporting and Resource-Exporting Countries



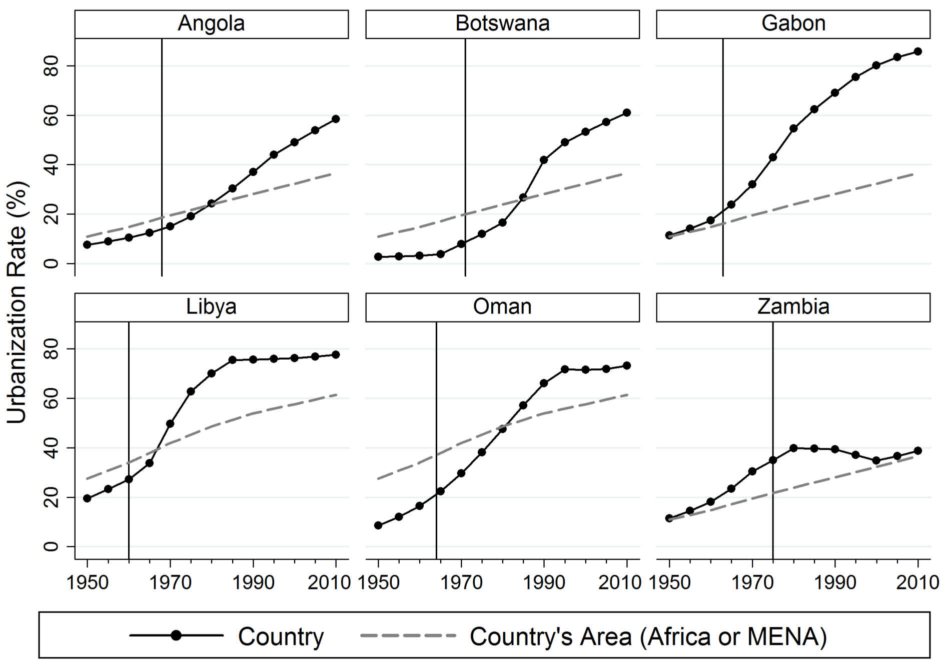
Notes: This figure shows the relationship between the urbanization rate (%) and the share of manufacturing and services in GDP (%) separately for 56 non-resource-exporting countries and 60 resource-exporting countries in 2010 (see the footnote of figure 1). The solid line is a linear fit for the data. See Online Data Appendix for data sources and construction of variables.

Figure 3: Urbanization and Natural Resource Exports for Resource-Exporting Countries



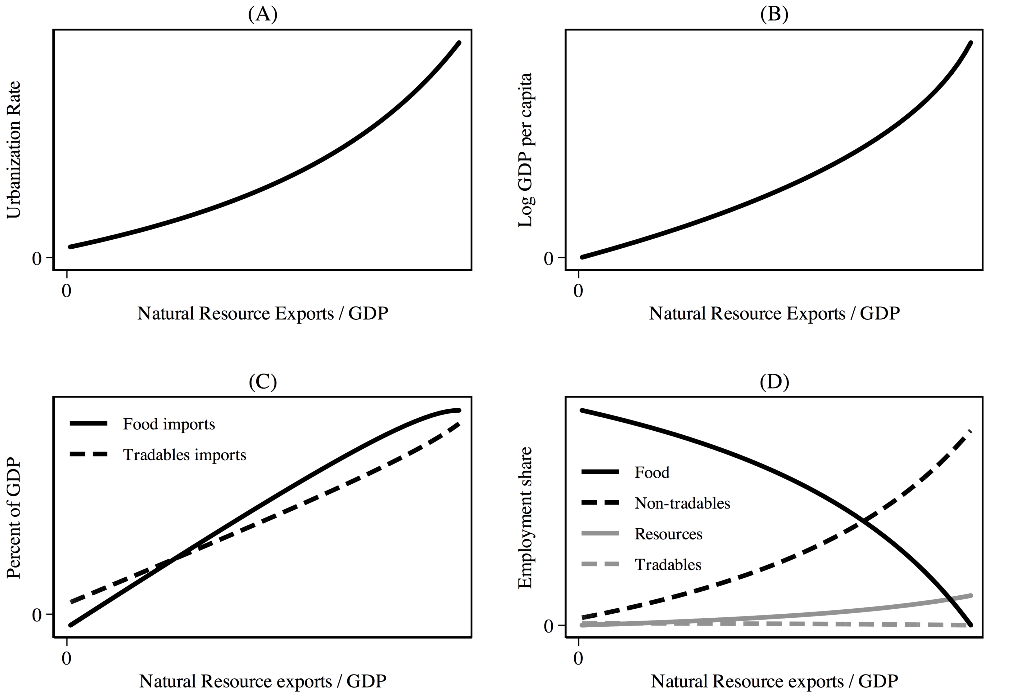
Notes: This figure shows the relationship between the urbanization rate (%) in 2010 and the average share of natural resource exports in GDP (%) in 1960-2010 for 60 resource-exporting countries (see the footnote of figure 1). The solid line is a linear fit for the data. See Online Data Appendix for data sources and construction of variables.

Figure 4: Urbanization and Resource Discovery for Six Resource-Exporting Countries, 1950-2010



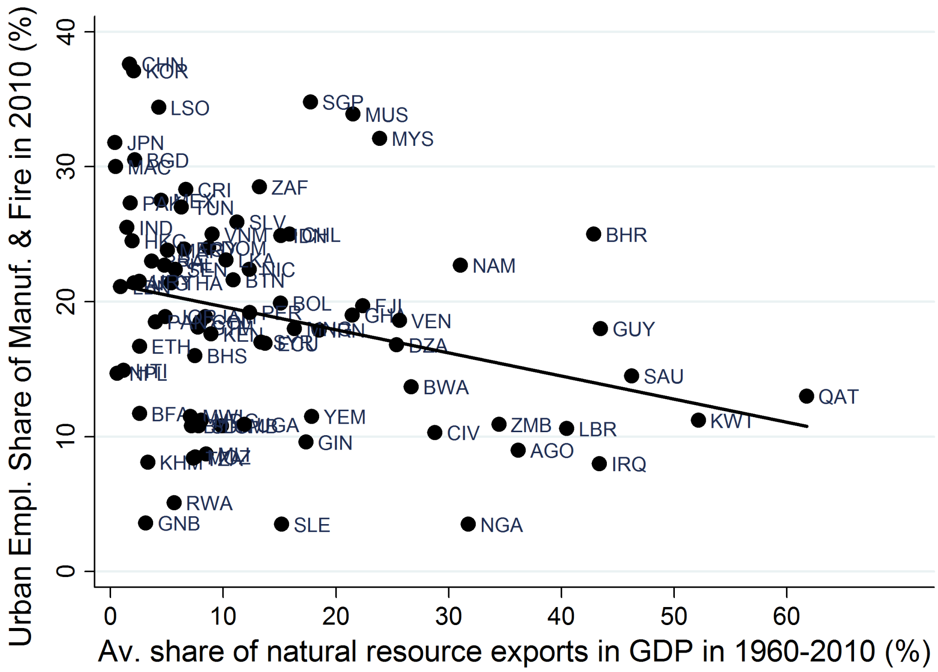
Notes: This figure shows the evolution of the urbanization rates for six resource-exporting countries and their respective area (Africa or MENA) every five years from 1950-2010. For all countries except Zambia, the solid line indicates the main year of discovery of the country's chief primary export: Angola (oil; 1968), Botswana (diamonds; 1971), Gabon (oil; 1963), Libya (oil; 1960) and Oman (oil; 1964). The objective of this figure is to show that these countries urbanized relatively faster than their area, after their main natural resource was discovered. For Zambia, the solid line indicates the year of the slump in copper prices (1975), the country's chief primary export. This example illustrates the role of commodity prices in altering the urbanization patterns of resource-exporting countries. See Online Data Appendix for data sources and construction of variables.

Figure 5: Comparative Statics on the Share of Natural Resource Exports in GDP



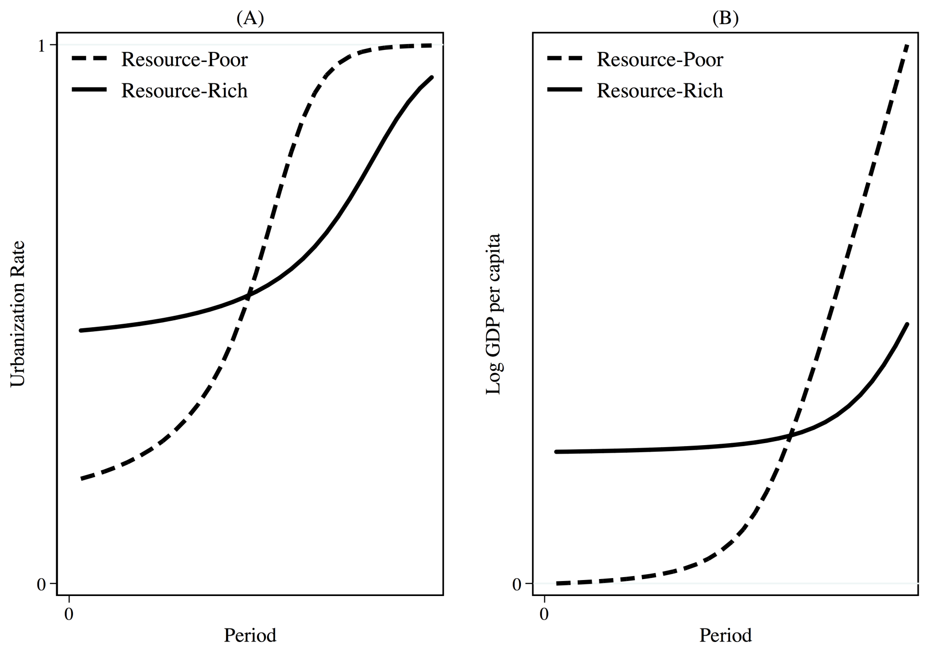
Notes: The panels represent various outcomes in our static model at different levels of resource productivity, $p_r^* A_r (R/L)^\gamma$, from an initial value of 0.15 to a value of 305.5. The value of $\gamma = 0.95$, and the value of $\alpha = 0.3$ in the tradables and food sectors. Productivity in food is set to $A_f (X/L)^\alpha = 16$, while tradables productivity is set to $A_d (K/L)^\alpha = 4$. Preferences are $\beta_n = 0.4$, $\beta_d = 0.4$, and $\beta_f = 0.2$. The subsistence constraint is $\bar{c}_f = 15$. The simulation is run using the assumption that all resource rents are distributed evenly across the population.

Figure 6: Natural Resource Exports and the Sectoral Composition of Urban Areas



Notes: This figure shows the relationship between the employment share of "manufacturing" and "finance, insurance, real estate and business services" (*Manuf. & FIRE*) in total urban employment around 2010 (%) and the average share of natural resource exports in GDP in 1960-2010 (%) for 87 countries. We use census and labor force survey data for the closest year to the year 2000 to estimate this share. We posit that it captures urban tradables, thus using *FIRE* as a proxy for tradable services. The solid line is a linear fit for the data. See Online Data Appendix for data sources and construction of variables.

Figure 7: Comparative Development with Endogenous Productivity Growth



Notes: Both panels are based on a simulation of our model that incorporates endogenous growth in tradable sector productivity, as described in the text. The parameters of the model are as follows. The elasticity of resource output with respect to R is set to $\gamma = 0.95$. Baseline growth in tradable productivity is $g = 0.2$, while the parameter governing the effect of L_d/L on tradable productivity growth is $\phi = 0.8$. Growth of productivity in all other sectors is set to zero. The resource-rich economy has an initial stock of resources equal to 20, while the resource-poor economy has a stock of resources equal to 4. Initial food sector productivity is $A_f(X/L)^\alpha = 16$ in both economies, while the subsistence constraint is set to $\bar{c}_f = 15$. Initial tradable productivity is set to $A_d(K/L)^\alpha = 4$ in both economies. $\alpha = 0.3$. Setting non-tradable productivity is not necessary to solve the model. Preferences are dictated by $\beta_n = 0.4$, $\beta_d = 0.4$, and $\beta_f = 0.2$. The simulation is run using the assumption that all resource rents are distributed evenly across the population.

TABLE 1: MULTIVARIATE CROSS-SECTIONAL ANALYSIS, MAIN STYLIZED FACT

Dependent Variable:	Urbanization Rate in 2010 (%)				
	(1)	(2)	(3)	(4)	(5)
Natural Resource Exports	1.77***	1.32***	0.99***	1.02***	0.85**
(% of GDP, Average in 1960-2010)	(0.28)	(0.22)	(0.14)	(0.24)	(0.18)
Manufacturing & Services	1.38***	1.03***	0.59***	0.46**	0.38***
(% of GDP, in 2010)	(0.22)	(0.27)	(0.14)	(0.17)	(0.12)
Area Fixed Effects (4)	N	Y	Y	Y	Y
Controls	N	N	Y	Y	Y
Control for Initial Conditions (1960)	N	N	N	Y	Y
Region Fixed Effects (13)	N	N	N	N	Y
Observations	116	116	116	116	116
R-squared	0.48	0.63	0.85	0.92	0.95

Notes: Robust standard errors are reported in parentheses; * p<0.10, ** p<0.05, *** p<0.01. The sample consists of 116 countries across four areas: Africa (N = 46), Asia (27), Latin America and the Caribbean (26) and Middle-East and North Africa (17). The dependent variable is the urbanization rate (%) in 2010. All regressions are population-weighted. Columns (2)-(5) include area fixed effects. Columns (3)-(5) include the following controls at the country level: (i) Urban definition: four dummies for each type of definition (*administrative*, *threshold*, *threshold and administrative*, and *threshold plus condition*) and the value of the population threshold to define a locality as urban when this definition is used; (ii) Rural push factors: rural density (1000s of rural population per sq km of arable area) in 2010, population growth in 1960-2010 (%), the number of droughts (per sq km) since 1960 and a dummy equal to one if the country has experienced a conflict since 1960; (iii) Urban pull factors: a dummy equal to one if the country was mostly autocratic since 1960 and the primacy rate (%) in 2010; and (iv) Other controls: area (sq km), population (1000s), a dummy equal to one if the country is a small island (< 50,000 sq km) and a dummy equal to one if the country is landlocked. Column (4) also controls for initial conditions, i.e. the urbanization rate (%) and the share of natural resource exports in GDP (%) in 1960. Column (5) also include thirteen region fixed effects (e.g., Western Africa, Eastern Africa, etc.). See Online Data Appendix for data sources and construction of variables.

TABLE 2: MULTIVARIATE PANEL ANALYSIS, MAIN STYLIZED FACT

Dependent Variable:	Urbanization Rate at Period t (%)				
	(1)	(2)	(3)	(4)	(5)
Natural Resource Exports	0.16**	0.17**	0.14*	0.18***	0.15**
(% of GDP, at Period t-1)	(0.07)	(0.08)	(0.07)	(0.06)	(0.06)
Manufacturing & Services x Time Trend t	0.00	0.00	-0.00	0.00	0.00
(% of GDP, in 2010)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Manufacturing Exports	0.35*	0.35	0.27*	0.23	0.08
(% of GDP, at Period t-1)	(0.21)	(0.23)	(0.15)	(0.15)	(0.11)
Country and Period Fixed Effects (112; 5)	Y	Y	Y	Y	Y
Area-Period Fixed Effects (4 x 5)	N	Y	Y	Y	Y
Time-Varying Controls	N	N	Y	Y	Y
Initial Conditions (1960) x Time Trend t	N	N	N	Y	Y
Region-Period Fixed Effects (13 x 5)	N	N	N	N	Y
Observations (112 x 5)	560	560	560	560	560
Adj. R-squared	0.95	0.95	0.96	0.97	0.98

Notes: Robust standard errors clustered at the country level are reported in parentheses; * p<0.10, ** p<0.05, *** p<0.01. The sample consists of 112 developing countries for the following years: [1960, 1970, 1980, 1990, 2000, 2010]. The dependent variable is the urbanization rate (%) at period t. The main variable of interest, the share of natural resource exports in GDP (%), is estimated at period t-1, so we lose one round of data. The share of manufacturing and services in GDP (%) is only available for the year 2010, so we interact it with a time trend t. We include the share of manufacturing exports in GDP (%) at period t-1 to control for industrial booms. All regressions are population-weighted. Columns (2)-(5) include area-period fixed effects. Columns (3)-(5) include the following time-varying controls at the country level: (i) Rural push factors: rural density (1000s of rural population per sq km of arable area) at period t-1, population growth (%) between t-1 and t, the number of droughts (per sq km) between t-1 and t and a dummy equal to one if the country has experienced a conflict between t-1 and t; (ii) Urban pull factors: a dummy equal to one if the country was mostly autocratic in the previous decade (e.g., 1960-1969 for the year 1970) and the primacy rate (%) at period t-1; and (iii) Other control: population (1000s) at period t. Column (4) also controls for initial conditions, i.e. the urbanization rate (%) and the share of natural resource exports in GDP (%) in 1960, times a time trend t. Column (5) also include region-period fixed effects (e.g., Western Africa, Eastern Africa, etc.). See Online Data Appendix for data sources and construction of variables.

TABLE 3: MULTIVARIATE CROSS-SECTIONAL ANALYSIS, OTHER STYLIZED FACTS

Dependent Variable:	**Log GDP Per Cap. (PPP, cst 2005$, Av. in 1960-2010)**	**Urban. Rate (%, 2010)**		**Imports (% of GDP, 2000-10)**			
				Food	**Staple Food**	**Manuf.**	**Services**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Natural Resource Exports	0.06***	0.99***	0.10	0.12***	0.09**	0.46**	0.24***
(% of GDP, Average in 1960-2010)	(0.01)	(0.14)	(0.15)	(0.04)	(0.03)	(0.20)	(0.05)
Manufacturing & Services	0.04***	0.59***	-0.00	0.07**	0.05**	0.24	0.05
(% of GDP, in 2010)	(0.01)	(0.14)	(0.11)	(0.03)	(0.02)	(0.15)	(0.05)
Log GDP Per Capita			15.2***	-1.42*	-1.15*	5.74	0.77
(PPP, cst 2005$, Av. in 1960-2010)			(1.92)	(0.75)	(0.60)	(4.21)	(1.32)
Urbanization Rate				0.00	-0.00	-0.39*	-0.08
(% of GDP, in 2010)				(0.02)	(0.02)	(0.21)	(0.07)
F-test [p]: Natural Resource Exports	7.4***	11.8***	0.7	5.1**	4.3**	2.2	21.5***
– Manufacturing & Services = 0	[0.01]	[0.00]	[0.41]	[0.03]	[0.04]	[0.14]	[0.00]
Area Fixed Effects (4), Controls	Y	Y	Y	Y	Y	Y	Y
Observations	116	116	116	112	112	110	112
R-squared	0.82	0.85	0.92	0.59	0.59	0.46	0.54

Notes: Robust standard errors are reported in parentheses; * p<0.10, ** p<0.05, *** p<0.01. The sample consists of 116 countries across four areas: Africa (N = 46), Asia (27), Latin America and the Caribbean (26) and Middle-East and North Africa (17). All regressions are population-weighted and include area fixed effects and the same country-level controls as in Table 1. We do not control for initial conditions in 1960 and we do not add region fixed effects. Column (1) uses income as the dependent variable (*Log GDP Per Cap.*). Column (2) displays the main results from column (3) of Table 1. Column (3) controls for income. In column (4)-(7) we test that the average shares of food, staple food, manufacturing and service imports in GDP (%) are higher in resource-exporters than in industrial countries for the same income level and the same urbanization rate in 2000-2010. We use the average shares in 2000-2010 due to their sensitivity to fluctuations in world prices. The F-test indicates whether the relationship between urbanization, income and trade is different in resource-exporters than in industrial countries for the same economic conditions. See Online Data Appendix for data sources and construction of variables.

TABLE 4: MULTIVARIATE CROSS-SECTIONAL ANALYSIS, OTHER STYLIZED FACTS

Dependent Variable:	Urban Employment Share (%, 2000-10)					Log GDP Per Worker (PPP cst 2005$, 2000-10)	
Sector:	**Manuf. & FIRE**	**Commerce & Pers.Serv.**	**Govt Serv.**	**Manuf. & FIRE**	**Skilled Workers**	**Manuf.**	**Services**
Cities:	*All*	*All*	*All*	*Largest*	*All*		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Natural Resource Exports	-0.37**	0.41**	0.14	-0.39**	-0.07	0.01	-0.02***
(% of GDP, Average in 1960-2010)	(0.14)	(0.15)	(0.09)	(0.15)	(0.13)	(0.01)	(0.01)
Manufacturing & Services	0.15	0.05	0.00	0.11	0.11	0.03***	0.01**
(% of GDP, in 2010)	(0.10)	(0.12)	(0.06)	(0.10)	(0.09)	(0.01)	(0.00)
Log GDP Per Capita	1.60	-4.79**	0.59	1.41	3.40**	0.73***	0.88***
(PPP, cst 2005$, Av. in 1960-2010)	(2.01)	(2.21)	(1.01)	(2.69)	(1.70)	(0.19)	(0.11)
Urbanization Rate	0.11	0.06	-0.01	-0.05	-0.05	-0.00	-0.01
(% of GDP, in 2010)	(0.08)	(0.10)	(0.05)	(0.12)	(0.07)	(0.01)	(0.01)
F-test [p]: Natural Resource Exports	32.2***	10.1***	4.9**	14.3***	2.9*	2.2	20.9***
– Manufacturing & Services = 0	[0.00]	[0.00]	[0.03]	[0.00]	[0.09]	[0.14]	[0.00]
Area Fixed Effects (4), Controls	Y	Y	Y	Y	Y	Y	Y
Observations	87	82	82	84	82	111	111
R-squared	0.90	0.83	0.70	0.83	0.44	0.81	0.91

Notes: Robust standard errors are reported in parentheses; * p<0.10, ** p<0.05, *** p<0.01. The main sample consists of 116 countries across four areas: Africa (N = 46), Asia (27), Latin America and the Caribbean (26) and Middle-East and North Africa (17). All regressions are population-weighted and include area fixed effects and the same country-level controls as in Table 1. We do not control for initial conditions in 1960 and we do not add region fixed effects. We control for income (*Log GDP Per Capita*) and urbanization (*Urbanization Rate*). We use census and labor force survey data to examine the urban employment composition of 87 countries for the most recent year available (in 2000-2010 mostly). In columns (1)-(3) the dependent variables are the urban employment shares of "manufacturing" and "finance, insurance, real estate and business services" (*Manuf. & FIRE*), "wholesale, retail trade, hotels and restaurants", "transportation, storage and communications" and "personal and other services" (*Commerce & Pers.Serv.*) and "government services" (*Govt Serv.*). In columns (4) and (5) we verify that the result of column (1) is robust to using the largest city only or the urban share of *Skilled Workers*, defined as the labor share of "professionals" and "technicians and associate professionals". The F-test shows whether cities in resource-exporters are significantly different from cities in industrial countries for the same economic conditions. In columns (6)-(7) the dependent variable is log GDP per worker (PPP cst 2005$) in the manufacturing and service sectors at the national level in 2000-2010. The F-test indicates whether manufacturing or service productivity is significantly lower in resource-exporters than in industrial countries for the same economic conditions. See Online Data Appendix for data sources and construction of variables.

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APPENDIX 1: THEORY

Proof of Corollary 1

Beginning with the adding up constraint, $L_r/L + L_d/L + L_f/L + L_n/L = 1$, one can use the labor conditions in (14) and (19) to write this entirely in terms of L_d/L,

$$\frac{(L_d/L)^{\alpha/\gamma}}{\Omega_{dr}^{1/\gamma}} + \frac{L_d}{L} + \beta + \beta\frac{\gamma-\alpha}{1-\gamma}\frac{(L_d/L)^{\alpha/\gamma}}{\Omega_{dr}^{1/\gamma}} + \Omega_{fd}\frac{L_d}{L} = 1 \tag{30}$$

where $\beta = \beta_n/(1-\alpha(\beta_f+\beta_d))$, $\Omega_{dr} = p_d^* A_d (K/L)^\alpha / p_r^* A_r (R/L)^\gamma$, and $\Omega_{fd} = p_f^* A_f (X/L)^\alpha / p_d^* A_d (K/L)^\alpha$. Using the implicit function theorem, the following is the derivative of L_d/L with respect to Ω_{dr},

$$\frac{\partial L_d/L}{\partial \Omega_{dr}} = \frac{\frac{L_r/L}{\gamma}\frac{L_d/L}{\Omega_{dr}}\left(1+\beta\frac{\gamma-\alpha}{1-\gamma}\right)}{\frac{\alpha}{\gamma}\left(L_r/L + \frac{\gamma}{\alpha}L_d/L + \frac{\gamma}{\alpha}L_f/L + L_n/L - \beta\right)}. \tag{31}$$

Similarly, one can write the adding up constraint in terms of L_r/L, and get the following derivative

$$\frac{\partial L_r/L}{\partial \Omega_{dr}} = \frac{-\frac{L_r/L}{\alpha}\frac{L_d/L}{\Omega_{dr}}\left(1+\Omega_{fd}\right)}{\left(L_r/L + \frac{\gamma}{\alpha}L_d/L + \frac{\gamma}{\alpha}L_f/L + L_n/L - \beta\right)}. \tag{32}$$

The derivative of L_n/L with respect to Ω_{dr} is

$$\frac{\partial L_n/L}{\partial \Omega_{dr}} = \beta\frac{\gamma-\alpha}{1-\gamma}\frac{\partial L_r/L}{\partial \Omega_{dr}}. \tag{33}$$

Note that the derivative of L_d/L is positive, while that of L_r/L is negative. For an increase in R (or A_r and p_r^*), Ω_{dr} will fall, and so L_d/L will fall and L_r/L will rise. Thus L_n/L will rise as well. Comparing the partial derivatives in (31) and (33), the reaction of L_n/L to any change in Ω_{dr} will be larger in absolute value than the reaction of L_d/L so long as

$$\Omega_{fd} > \frac{1-\gamma}{\beta(\gamma-\alpha)}. \tag{34}$$

Given that Ω_{fd} can also be expressed as L_f/L_d, this yields the condition given in the corollary. So long as this holds, it will be that L_n/L changes by more than L_d/L in response to Ω_{dr}.

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APPENDIX 2: DATA SOURCES

This appendix describes in details the data we use in our analysis. The main sources and the summary statistics for the main variables are reported in Appendix Table 1.

Spatial Units:

We assemble data for 116 countries from 1950 to 2010.[34] The list of countries is reported in Appendix Table 4. These countries belong to four areas: Africa (N = 46), Asia (N = 27), Latin America and the Caribbean (LAC, N = 26) and Middle-East and North Africa (MENA, N = 17). We also classify them into 13 regions: Central Africa (N = 8), Eastern Africa (N = 17), Western Africa (N = 16) for Africa, East Asia (N = 7), Pacific Islands (= 3), South Asia (N = 7) and South-East Asia (N = 10) for Asia, Caribbean (N = 6), Central America (N = 8) and South America (N = 12) for the LAC region, and Middle-East (N = 12) and North Africa (N = 5) for the MENA region. We do not include developed countries, as well as Eastern European and Central Asian countries due to the lack of data before 1991.[35]

Urbanization and Population:

We use WUP (2011) to study urbanization rates for 116 countries in 1950-2010. The urbanization rate is defined as the share of the urban population in total population (%). The 116 countries use four different types of urban definition for their most recent census: (i) "administrative": cities are administrative centers of territorial units (e.g., provinces, districts, "communes", etc.), (ii) "threshold": cities are localities whose population is superior to a population threshold of X inhabitants (e.g., 10,000, 5,000 or 2,500), (iii) "administrative or threshold": cities are either administrative centers or localities whose population is superior to a population threshold, and (iv) "threshold with condition": cities are localities whose population is superior to a population threshold and whose a large share of the labor force is engaged in non-agricultural activities. We create indicator variables for each definition. For each country using a population threshold, we know the threshold and use it as a control in our regression analysis. WUP (2011) also reports total population for each country every year in 1950-2010. From WB (2013), we know the share of the largest city in the urban population, the primacy rate, for all years in 1960-2010. From Wikipedia (2013), we know the population of the five largest cities for the most recent year.

Natural Resource Exports:

Natural resource exports consist of fuel, mineral, cash crop and forestry exports. We use USGS (2013) and WB (2013) to estimate the share of fuel and mineral exports in total merchandise exports (%) for the 116 countries every ten years in 1960-2010.[36] We use FAO (2013) to obtain the export shares of cash crops and forestry for the 116 countries every ten years in 1960-2010. We deliberately exclude food crops in our analysis. Lastly, we use Maddison (2008) and WDI (2013) to obtain the share of merchandise exports in GDP for the 116 countries every ten years in 1960-2010. Knowing the share of merchandise exports in GDP (%), we can easily reconstruct the contribution of natural resource exports to GDP (%). We use Maddison (2008) and WB (2013) to estimate log GDP per capita for each country every ten years in 1960-2010 (in constant 2005 international $ using purchasing power parity rates). Knowing GDP per capita, we can estimate the value of natural resource exports (constant 2005 international $) every ten years in 1960-2010. We use three variables in our analysis: the average share of natural resource exports in GDP (%) in 1960-2010, the share of natural resource exports in GDP (%) for each year available, and

[34] We consider most countries of Africa, Asia (incl. the Middle-East) and Latin America whose area is above 500 sq km. East Timor and North Korea are not included in the analysis given the lack of data.

[35] We include Asian developed countries in our analysis, such as Brunei Darussalam, Hong Kong, Japan, Macao, South Korea, Singapore and Taiwan. Similarly, we also include the developed countries of the MENA region, such as Kuwait, Qatar and United Arab Emirates. These countries are wealthier than Italy now, but they were relatively poor and unurbanized in 1960. Our analysis is focused on the developing world, which traditionally included Africa, Asia (incl. the Middle-East) and Latin America.

[36] The cash crops we include in our analysis are: cocoa, coffee, cotton, groundnuts, rubber, sisal, sugar and tea. We do not include food crops that are also exported as cash crops by developed or middle-income countries, such as maize, rice, soja or wheat. Fuel and mining exports mostly include: aluminium, bauxite, chrome, copper, diamonds, gold, gypsum, iron, lead, manganese, natural gas, nickel, petroleum, potassium, silver, tin, titanium and zinc.

the average value of natural resource exports (constant 2005 international $) in 1960-2010. For almost all resource-exporters, we create an indicator variables whose value is one if commodity X = [oil & gas, diamonds, gold, copper, other mineral product, cocoa, coffee, sugar] is the country's main primary export in 1960-2010. Other commodities such as cotton or tea are not dominant for more than one country in the sample of resource-exporters. For the same countries, we use Wikipedia (2013) and various sources that we do not cite to create a post-discovery indicator whose value is one at period t-1 if the country's main natural resource was already "discovered" then. We then use UNCTAD (2013) to obtain the world price index (base year = 2000) of the country's main commodity at period t-1.

Manufacturing and Service GDP and Employment:
We use WB (2013) to estimate the contributions of manufacturing and services to GDP for the 116 countries in 2010. We also calculate the value of manufacturing and service GDP in 2010 (constant 2005 international $). Using the same source and ILO (2013), we reconstruct the employment share of the manufacturing and service sectors for the 116 countries for the most recent year in 2000-2010. When the data was not reported by WB (2013) and ILO (2013), we used census and/or labor force survey reports available on the website of the statistical institute of the country to fill the missing gaps. We then use Maddison (2008) and WB (2013) to estimate log GDP per capita in 2010 (in constant 2005 international $ using purchasing power parity rates). Using the GDP and employment shares of manufacturing and services in 2000-2010, we can estimate log GDP per worker for each sector for the same period.

Manufacturing Exports:
We use FAO (2013), USGS (2013) and WB (2013) to estimate the share of manufacturing exports in merchandise exports for the 116 countries every ten years in 1960-2010. Knowing the share of merchandise exports in GDP (%), we can easily reconstruct the contribution of manufacturing exports to GDP (%). We use two variables in our analysis: first, the average share of manufacturing exports in GDP (%) in 1960-2010, and, second, the share of manufacturing exports in GDP (%) for each year available.

GDP and Imports:
We have GDP per capita every ten years in 1960-2010. The main variable used in our analysis is average log GDP per capita in 1960-2010 (constant 2005 international $). We use WB (2013) to estimate the average share of merchandise imports in GDP (%) for the 116 countries in 2000-2010. We use the average share instead of the share for the most recent year to control for year-specific changes in international commodity prices (i.e. world food prices or fuel prices). Using the same source we estimate the structure of merchandise imports for each country in 2000-2010. There are five import categories: "food", "agricultural raw materials", "fuels", "ores and metals" and "manufacturing". For each of these categories, we calculate its average share in GDP (%) in 2000-2010. We also use FAO (2013) to estimate the share of staple food imports in GDP (%) for the 116 countries in 2000-2010. We classify as staple foods all the foodstuffs that appear at least once in the top 20 imports of "net food import developing countries" (using FAO's classification of countries) in 2000-2010.[37] WB (2013) also reports the value of service imports for most recent years. We calculate the share of service imports (%) for the 116 countries in 2000-2010.

Urban Employment:
Data on the urban employment structure in selected countries in 2000-2010 was recreated using various sources, as described for each country in Appendix Table 6.[38] We use five different sources of data. Our two main data sources are IPUMS (2013), the International Public-Use Microdata Series, and ILO (2013), the International Organization of Labor. We complement these data sets with data from the published reports of population and housing censuses, labor force surveys and household surveys. For each country for which data is available, we estimate the employment shares of all urban areas for the following 11

[37]These foodstuffs are: barley, cake of soybeans, chicken meat, flour of wheat, food preparations not elsewhere classified, maize, beef and veal, milk skimmed dry, milk whole dried, palm oil, rice, sheep meat, soybean oil, soybeans, sugar raw centrifugal, sugar refined and wheat. Although cassava, plantain, sorghum, sweet potatoes and yams are staple crops in Africa, they are not imported because they are produced locally. Thus we do not include them in our analysis of staple food imports.

[38]We used data for the most recent available year in 2000-2010. When data was not available for the most recent period, we used data for the period 1990-1999.

sectors: “agriculture”, “mining”, “public utilities”, “manufacturing”, construction”, “wholesale and retail trade, hotels and restaurants”, “transportation, storage and communications”, “finance, insurance, real estate and business services”, “government services”, “education and health” and “other services”. We also estimate the same labor shares for the largest city of each country, when the data is available. Lastly, we use the same sources to estimate the employment shares of all urban areas for the following 9 occupations (armed forces are excluded from the analysis because data is missing for many countries): “legislators, senior officials and managers”, “professionals”, “technicians and associate professionals”, “clerks”, “service workers and shop and market sales”, “skilled agricultural and fishery workers”, “crafts and related trades workers”, “plant and machine operators and assemblers” and “elementary occupations”.

Additional Controls:

We use various sources to reconstruct a range of (time-invariant or time-varying) controls at the country-level. The sources of the population and definition variables are described above. Country area (sq km) is obtained from WB (2013). We create two indicators whose value is one if the country is a small island or if the country is landlocked. From Wikipedia (2013), we obtain a list of all the island countries and landlocked countries in the world. An island country is “small” if its area is smaller than 50,000 sq km. CRED (2013) reports the number of droughts experienced by each country every year. We use two variables: the number of droughts (per sq km) since 1960, and the number per droughts (per sq km) for each decade (e.g., 1960-1969 for the 1960s). Rural density is defined as the ratio of rural population (1000s) to arable area (sq km) at period t-1. The arable area of each country is reported by FAO (2013). Population growth is calculated as the annual percentage change in country population (%) between t-1. We use the Polity IV data series to calculate the average combined polity score for each country between t-1 and t (Polity IV 2013a). We create an indicator whose value is one if the average polity score is lower than -5, the threshold for not being considered as autocratic. The Polity IV data series also include a measure of political violence for each country from 1964 to date. We create an indicator whose value is one if the country has ever experienced an interstate or civil conflict between t-1 and t (Polity IV 2013b).

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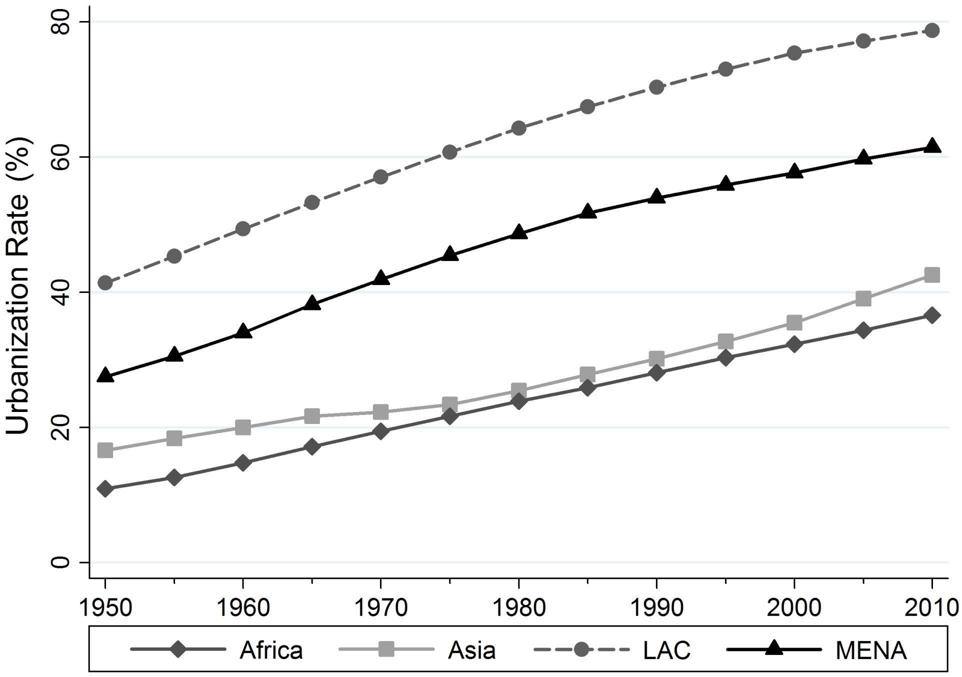
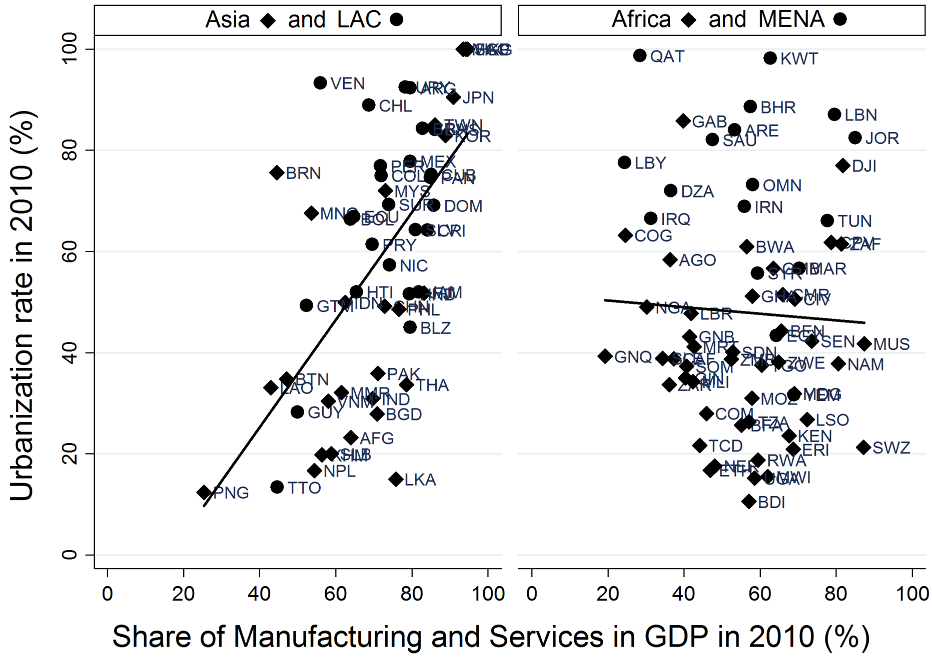
APPENDIX 3: FIGURES AND TABLES

Appendix Figure 1: Urbanization Rates for Africa, Asia, Latin America and the Middle-East, 1950-2010



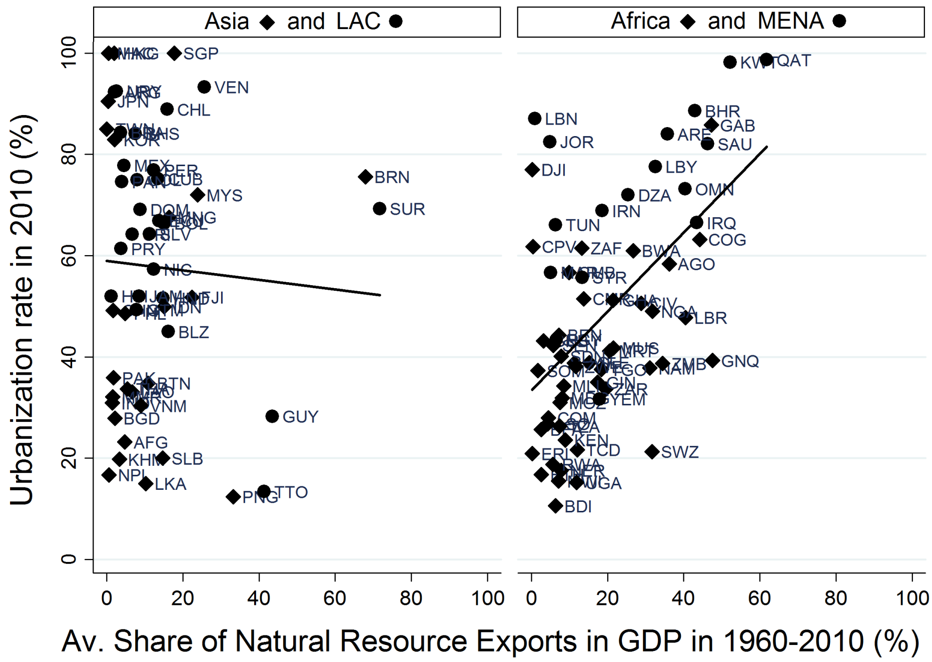
Notes: This figure shows the urbanization rate for four regions in 1960-2010: Africa (N = 46), Asia (27), Latin American and the Caribbean (LAC) (26) and Middle-East and North Africa (MENA) (17). Regional urbanization rates are estimated using country population as weights. See Online Data Appendix for data sources and construction of variables.

Appendix Figure 2: Urbanization and Industrialization in Asia and LAC vs. Africa and MENA



Notes: This figure shows the relationship between the urbanization rate (%) and the share of manufacturing and services in GDP (%) in 2010 for 27 Asian countries and 26 Latin American and Caribbean (LAC) countries vs. 46 African countries and 17 Middle-Eastern and North African (MENA) countries. Asian and African countries are represented by black diamonds. LAC and MENA countries are represented by black circles. The solid line is a linear fit for the data. See Online Data Appendix for data sources and construction of variables.

Appendix Figure 3: Urbanization and Natural Resource Exports in Asia and LAC vs. Africa and MENA



Notes: This figure shows the relationship between the urbanization rate in 2010 (%) and the average share of natural resource exports in GDP in 1960-2010 (%) for 27 Asian countries and 26 Latin American and Caribbean (LAC) countries vs. 46 African countries and 17 Middle-Eastern and North African (MENA) countries. Asian and African countries are represented by black diamonds. LAC and MENA countries are represented by black circles. The solid line is a linear fit for the data. See Online Data Appendix for data sources and construction of variables.

APPENDIX TABLE 1: SUMMARY STATISTICS OF MAIN VARIABLES AND DATA SOURCES

	Mean	Std.Dev.	Obs	Main Sources
Panel A: Dependent Variables				
Urbanization Rate [c,t], %	41.2	25.4	696	*World Urbanization Prospects: 2011 Revision*
GDP Per Capita [c,t], 2005$ PPP	7,449	18,300	696	Maddison (2008); *World Development Indicators* 2013
Share of Food Imports in GDP [c,2000-10], %	5.3	3.8	112	*World Development Indicators 2013*
Share of Staple Food Imports in GDP [c,2000-10], %	3.0	3.1	112	*World Development Indicators 2013*
Share of Manufacturing Imports in GDP [c,2000-10], %	21.1	10.0	110	*World Development Indicators 2013*
Share of Service Imports in GDP [c,2000-10], %	9.6	6.0	112	*World Development Indicators 2013*
Urban Empl. Share of Manuf. and FIRE [c,2000-10], %	19.4	8.4	87	Population Census; Labor Force and Household Surveys
Urban Empl. Share of Trade & Pers.Serv [c,2000-10], %	42.5	7.9	82	Population Census; Labor Force and Household Surveys
Urban Empl. Share of Government Serv. [c,2000-10], %	7.8	4.4	82	Population Census; Labor Force and Household Surveys
Empl. Share of Manuf. & FIRE in Largest City [c,2000-10], %	22.0	9.2	84	Population Census; Labor Force and Household Surveys
Urban Empl. Share of Skilled Workers [c,2000-10], %	20.7	8.8	82	Population Census, Labor Force and Household Surveys
GDP Per Worker of Manufacturing [c, 2000-10], 2005$ PPP	9.3	1.1	111	*World Development Indicators 2013*; *ILOSTAT 2013*
GDP Per Worker of Services [c, 2000-10], 2005$ PPP	9.1	1.0	111	*World Development Indicators 2013*; *ILOSTAT 2013*
Panel B: Main Regressors				
Share of Natural Resource Exports in GDP [c,t], %	19.0	17.4	686	*FAOSTAT 2013*; *USGS Bureau of Mines Minerals Yearbook 1963-2010*; *World Development Indicators 2013*
Share of Manufacturing and Services in GDP [c,2010], %	62.6	17.7	116	*World Development Indicators 2013*
Share of Manufacturing Exports in GDP [c,t], %	5.9	11.1	686	Same sources as for natural resource exports
Panel C: Control Variables				
Indicators for Each Type of Urban Definition [c,2000-10]	_	_	_	*World Urbanization Prospects: 2011 Revision*
Pop. Threshold to Define a Locality as Urban [c,2000-10]	3,862	3,286	61	*World Urbanization Prospects: 2011 Revision*
Population [c,t], Thousands	32,726	127,240	696	*World Urbanization Prospects: 2011 Revision*
Area [c], Thousand Sq Km	671	1,306	116	*World Development Indicators 2013*
Small Island Country Indicator [c]	0.09	0.29	116	*Wikipedia - List of Island Countries 2013*
Landlocked Country Indicator [c]	0.19	0.39	116	*Wikipedia - Lanlocked Country 2013*
Number of Droughts [c,t], per Sq Km	0.002	0.023	688	*EM-DAT: International Disaster Database 2013*
Rural Density [c,t], Thousands per Sq Km of Arable Land	0.57	1.31	696	*FAOSTAT 2013*
Population Growth [c,t], Annual Rate (%)	1.30	1.09	696	*World Urbanization Prospects: 2011 Revision*
Conflict Indicator [c,t]	0.71	0.46	696	*Polity IV: Major Episodes of Political Violence 1946-2010*
Autocracy Indicator [c,t]	0.28	0.45	696	*Polity IV: Polity IV Annual-Time Series 1800-2011*
Primacy Rate [c,t], (%)	39.3	20.4	696	*World Development Indicators 2013*

Notes: Panel A - For our main dependent variable, the cross-sectional regressions are run on a sample of 116 countries for the year 2010. When using panel data, regressions are run on a sample of 112 countries from 1960 to 2010 = [1960, 1970, 1980, 1990, 2000, 2010]. See Online Data Appendix for a full description of data sources and construction of variables.

APPENDIX TABLE 2: MULTIVARIATE CROSS-SECTIONAL ANALYSIS, ROBUSTNESS

Dependent Variable:	Urbanization Rate in 2010 (%)								
	(1) *Africa MENA*	(2) *Asia LAC*	(3) *Drop China India*	(4) *No Pop. Weight.*	(5) *Ctrl Mfg Exports*	(6) *Nat.Res. Exports 2010*	(7) *Mining Crops*	(8) *Mining Crops Africa*	(9) *Resource Specific Effects*
Natural Resource Exports	0.67***	0.91***	0.96***	0.38**	0.60***				-1.05
(% of GDP, Av. in 1960-2010)	(0.23)	(0.28)	(0.13)	(0.16)	(0.11)				(0.71)
Manufacturing & Services	0.23	0.80**	0.58***	0.48***		0.74***	0.75***	0.41**	0.73***
(% of GDP, in 2010)	(0.20)	(0.36)	(0.12)	(0.14)		(0.19)	(0.14)	(0.16)	(0.16)
Manufacturing Exports					0.76**				
(% of GDP, Av. in 1960-2010)					(0.30)				
Natural Resource Exports						0.75***			
(% of GDP, in 2010)						(0.74)			
Fuel & Mining Exports							1.21***	0.87***	
(% of GDP, Av. in 1960-2010)							(0.17)	(0.21)	
Cash Crop & Forestry Exports							-0.19	0.70**	
(% of GDP, Av. in 1960-2010)							(0.43)	(0.34)	
Oil-Gas Indicator x Natural									2.05***
Resource Exports (% of GDP, Av.)									(0.65)
Copper Indicator x Natural									1.56**
Resource Exports (% of GDP, Av.)									(0.63)
Diamonds Indicator x Natural									1.30*
Resource Exports (% of GDP, Av.)									(0.70)
Gold Indicator x Natural									1.24**
Resource Exports (% of GDP, Av.)									(0.59)
Other Min. Indicator x Natural									1.18*
Resource Exports (% of GDP, Av.)									(0.69)
Cocoa Indicator x Natural									1.38**
Resource Exports (% of GDP, Av.)									(0.57)
Coffee Indicator x Natural									0.46
Resource Exports (% of GDP, Av.)									(0.58)
Sugar Indicator x Natural									-0.37
Resource Exports (% of GDP, Av.)									(0.65)
Area Fixed Effects (4), Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y
Observations	63	53	114	116	116	116	116	46	116
R-squared	0.84	0.91	0.81	0.58	0.83	0.84	0.87	0.86	0.88

Notes: Robust standard errors are reported in parentheses; * p<0.10, ** p<0.05, *** p<0.01. The main sample consists of 116 countries across four areas: Africa (N = 46), Asia (27), Latin America and the Caribbean (26) and Middle-East and North Africa (17). The regression is the same model as in column (3) of Table 1. The dependent variable is the urbanization rate (%) in 2010. All regressions except in column (4) are population-weighted. Columns (1)-(9) include area fixed effects and the same country-level controls as in Table 1. We do not control for initial conditions in 1960 and we do not add region fixed effects. In column (1) we restrict the sample to African and MENA countries. In column (2) we restrict the sample to Asian and LAC countries. In column (3) we drop China and India because of their population size. In column (4) regressions are not population-weighted. In column (5) industrialization is measured by the average share of manufacturing exports in GDP in 1960-2010 (%) instead of the share in 2010 (%). In Column (6) we use the share of natural resource exports in GDP in 2010 instead of the average share in 1960-2010. In column (7) natural resource exports are split into fuel and mining exports and cash crop and forestry exports (i.e., their average shares in GDP from 1960-2010). In column (8) we estimate the same regression model as in column (7) for African countries only. In column (9) we interact the average share of natural resource exports in GDP in 1960-2010 (%) with indicator variables whose value is one if commodity X = [oil & gas, diamonds, gold, copper, other mineral product, cocoa, coffee, sugar] is the country's main primary export in 1960-2010, for resource-exporters only. Other commodities such as cotton or tea are not dominant in more than one country in the sample of resource-exporters. See Online Data Appendix for data sources and construction of variables.

APPENDIX TABLE 3: MULTIVARIATE CROSS-SECTIONAL ANALYSIS, ROBUSTNESS

Dependent Variable:	**Urbanization Rate in 2010 (%)**				
	(1)	(2)	(3)	(4)	(5)
Log Value of Natural Resource Exports	6.07***	3.45***	2.37**	3.29**	2.67**
(PPP, cst 2005$, Average in 1960-2010)	(1.00)	(1.19)	(1.00)	(1.32)	(1.29)
Log Value of Manufacturing & Services	12.24***	13.75***	9.78***	5.54***	4.46**
(PPP, cst 2005$, in 2010)	(1.60)	(2.20)	(1.94)	(2.02)	(2.00)
Area Fixed Effects (4)	N	Y	Y	Y	Y
Controls	N	N	Y	Y	Y
Control for Initial Conditions (1960)	N	N	N	Y	Y
Region Fixed Effects (13)	N	N	N	N	Y
Observations	116	116	116	116	116
R-squared	0.74	0.81	0.89	0.93	0.95

Notes: Robust standard errors are reported in parentheses; * p<0.10, ** p<0.05, *** p<0.01. The sample consists of 116 developing countries across four areas: Africa (N = 46), Asia (27), Latin America and the Caribbean (26) and Middle-East and North Africa (17). The dependent variable is the urbanization rate (%) in 2010. The main variable of interest is the average log value of natural resource exports in 1960-2010, expressed in constant 2005 PPP USD. All regressions are population-weighted. Columns (2)-(5) include area fixed effects. Columns (3)-(5) include the same country-level controls as in Table 1. Column (4) also controls for initial conditions, i.e. the urbanization rate (%) and the share of natural resource exports in GDP (%) in 1960. Column (5) also include thirteen region fixed effects (e.g., Western Africa, Eastern Africa, etc.). See Online Data Appendix for data sources and construction of variables.

APPENDIX TABLE 4: MULTIVARIATE PANEL ANALYSIS, INVESTIGATION OF CAUSALITY

Dependent Variable:	Nat. Resource Exports (% of GDP, at Period t)	Col.(2)-(8): Urbanization Rate at Period t (%)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Instrumentation:			*Post-Discov.*		*Comm. Price*		*Both*	
Urbanization Rate	0.01							
(%, at Period t-1)	(0.13)							
Natural Resource Exports		-0.02						
(% of GDP, at Period t)		(0.07)						
Natural Resource Exports			0.55***	0.33**	0.55***	0.30**	0.55***	0.33***
(% of GDP, at Period t-1)			(0.12)	(0.14)	(0.14)	(0.14)	(0.09)	(0.12)
Manufacturing & Services x Time Trend t	-0.01***	-0.00	0.00	0.01	0.01	0.01	0.01*	0.01*
(% of GDP, in 2010)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Manufacturing Exports	-0.08	0.26*	0.29**	0.52***	0.29**	0.51***	0.29**	0.52***
(% of GDP, at Period t-1)	(0.35)	(0.15)	(0.13)	(0.16)	(0.13)	(0.16)	(0.13)	(0.16)
First Stage Regression:			*Dep. Var.: Natural Resource Exports (% GDP, Period t-1)*					
Post-Discovery Indicator			27.94***	33.98***			26.23***	32.80***
(at Period t-1)			(3.45)	(6.89)			(3.69)	(7.12)
Main Commodity Price Index					0.06***	0.05*	0.06***	0.04
(Base Period = 2000, at Period t-1)					(0.03)	(0.03)	(0.02)	(0.03)
Country and Period Fixed Effects (112; 5)	Y	Y	Y	Y	Y	Y	Y	Y
Area-Period Fixed Effects (4 x 5), Controls	Y	Y	Y	Y	Y	Y	Y	Y
Sample of Resource-Exporters	–	–	–	Y	–	Y	–	Y
Kleibergen-Paap rk Wald F stat	–	–	65.7	24.3	11.5	3.4	35.6	11.4
Observations (112 x 5)	560	560	560	300	560	300	560	300
Adj. R-squared	0.86	0.96	0.97	0.97	0.97	0.97	0.97	0.97

Notes: Robust standard errors clustered at the country level are reported in parentheses; * $p<0.10$, ** $p<0.05$, *** $p<0.01$. The sample consists of 112 developing countries for the periods: [1960, 1970, 1980, 1990, 2000, 2010]. In column (1), the dependent variable is the average share of natural resource exports in GDP in 1960-2010 (%). In columns (2)-(8), the dependent variable is the urbanization rate (%) at period t. The main variables of interest, the share of natural resource exports in GDP (%) and the urbanization rate (%), are estimated at period t-1, so we lose one round of data. The share of manufacturing and services in GDP (%) is only available for the year 2010, so we interact it with a time trend t. We include the share of manufacturing exports in GDP (%) at period t-1 to control for industrial booms. All regressions are population-weighted, include area-period fixed effects and the same time-varying controls as in Table 2. In columns (3) and (4), the instrument is a post-discovery indicator whose value is one at period t-1 if the country's main commodity was already "discovered" then. In columns (5) and (6), the instrument is the world price index of the country's main commodity at period t-1. In columns (7) and (8) we use both. In columns (4), (6) and (8) we restrict the sample to resource-exporters only. See Online Data Appendix for data sources and construction of variables.

APPENDIX TABLE 5: MULTIVARIATE CROSS-SECTIONAL ANALYSIS, URBAN PRIMACY

Dependent Variable:	Primacy Rate in 2010 (%)					Primacy Rate (5 Largest Cities) in 2010 (%)				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Natural Resource Exports	0.43	0.26	-0.15	0.14	0.31	0.74*	0.50	-0.15	0.09	0.39
(% of GDP, Average in 1960-2010)	(0.26)	(0.18)	(0.14)	(0.24)	(0.14)	(0.39)	(0.33)	(-0.28)	(0.33)	(0.36)
Manufacturing & Services	0.02	0.33	0.01	0.11	0.23	0.05	0.42	-0.02	0.07	0.19
(% of GDP, in 2010)	(0.20)	(0.21)	(0.13)	(0.15)	(0.14)	(0.27)	0.28	(0.19)	(0.22)	(0.21)
Urbanization Rate	0.01	-0.12	-0.06	-0.21*	-0.39***	-0.01	-0.19	-0.10	-0.17	-0.47***
(%, in 2010)	(0.15)	(0.24)	(0.09)	(0.12)	(0.14)	(0.19)	0.28	(0.13)	(-0.21)	(0.18)
F-test [p]: Natural Resource Exports	2.6	0.1	1.1	0.0	0.2	4.4**	0.1	0.3	0.0	0.6
– Manufacturing & Services = 0	[0.11]	[0.76]	[0.31]	[0.86]	[0.66]	[0.04]	[0.81]	[0.61]	[0.94]	[0.46]
Area Fixed Effects (4)	N	Y	Y	Y	Y	N	Y	Y	Y	Y
Controls	N	N	Y	Y	Y	N	N	Y	Y	Y
Control for Initial Conditions (1960)	N	N	N	Y	Y	N	N	N	Y	Y
Region Fixed Effects (13)	N	N	N	N	Y	N	N	N	N	Y
Observations	113	113	113	113	113	113	113	113	113	113
R-squared	0.08	0.30	0.78	0.79	0.85	0.11	0.28	0.81	0.81	0.87

Notes: Robust standard errors are reported in parentheses; * p<0.10, ** p<0.05, *** p<0.01. The sample consists of 116 countries across four areas: Africa (N = 46), Asia (27), Latin America and the Caribbean (26) and Middle-East and North Africa (17). In columns (1)-(5), the dependent variable is the primacy rate (%) in 2010. In columns (6)-(10) the dependent variable is the share of the five largest cities in the urban population (%) in 2010. All regressions are population-weighted and control for urbanization in 2010. Columns (2)-(5) and (7)-(10) include area fixed effects. Columns (3)-(5) and (8)-(10) include the same controls as in Table 1. Columns (4) and (9) also controls for initial conditions, i.e. the urbanization rate (%) and the share of natural resource exports in GDP (%) in 1960. Columns (5) and (10) also include thirteen region fixed effects (e.g., Western Africa, Eastern Africa, etc.). The F-test shows whether the primacy rate is significantly higher in resource-exporters than in industrial countries for the same urbanization rate. See Online Data Appendix for data sources and construction of variables.

APPENDIX TABLE 6: Urban Employment Source Information by Country

Country	Code	Year	Main Sources
Algeria	DZA	2010	Labor Force Survey (Report)
Angola	AGO	1993	Labor Force Survey (ILO), Labor Force Survey (Report)
Argentina	ARG	2001	Population and Housing Census (IPUMS), Labor Force Survey (ILO)
Bahamas	BHS	2003	Labor Force Survey (Report)
Bahrain	BHR	2002	Labor Force Survey (ILO)
Bangladesh	BGD	2011	Population and Housing Census (Report), Labor Force Survey (Report)
Benin	BEN	2002	Questionnaire des Indicateurs de Base du Bien-Etre
Bhutan	BTN	2010	Population and Housing Census (Report)
Bolivia	BOL	2001	Population and Housing Census (IPUMS)
Botswana	BWA	2006	Labor Force Survey (Report)
Brazil	BRA	2000	Population and Housing Census (IPUMS)
Brunei Darussalam	BRN	2001	Labor Force Survey (ILO)
Burkina-Faso	BFA	2006	Population and Housing Census (Report), Enquete Prioritaire
Cambodia	KHM	2008	Population and Housing Census (IPUMS)
Chile	CHL	2002	Population and Housing Census (IPUMS)
China	CHN	2003	Statistical Yearbook (Report)
Colombia	COL	2005	Population and Housing Census (IPUMS), Labor Force Survey (ILO)
Costa Rica	CRI	2000	Population and Housing Census (IPUMS)
Côte d'Ivoire	CIV	2002	Enquete de Niveau de Vie des Menages
Cuba	CUB	2002	Population and Housing Census (IPUMS)
Dominican Republic	DOM	2002	Population and Housing Census (Report)
Ecuador	ECU	2001	Population and Housing Census (IPUMS)
Egypt	EGY	2006	Population and Housing Census (IPUMS)
El Salvador	SLV	2007	Population and Housing Census (IPUMS)
Ethiopia	ETH	2009	Labor Force Survey (ILO), Labor Force Survey (Report)
Fiji	FJI	2005	Labor Force Survey (Report)
Gabon	GAB	2005	Labor Force Survey (Report)
Gambia	GMB	1993	Household Economic Survey
Ghana	GHA	2000	Population and Housing Census (IPUMS)
Guatemala	GTM	2012	Labor Force Survey (Report)
Guinea	GIN	1996	Population and Housing Census (IPUMS)
Guinea-Bissau	GNB	1994	Inquerito Ao Consumo E Orcamentos Familiares
Guyana	GUY	2002	Population and Housing Census (Report)
Haiti	HTI	2003	Population and Housing Census (Report)
Hong Kong	HKG	2000	Labor Force Survey (ILO)
India	IND	2004	Population and Housing Census (IPUMS)
Indonesia	IDN	2005	Population and Housing Census (IPUMS)
Iran	IRN	2006	Population and Housing Census (IPUMS)
Iraq	IRQ	1997	Population and Housing Census (IPUMS)
Jamaica	JAM	2001	Population and Housing Census (IPUMS)
Japan	JPN	2005	Labor Force Survey (Report)
Jordan	JOR	2004	Population and Housing Census (IPUMS)
Kenya	KEN	2002	Labor Force Survey (Report)
Kuwait	KWT	2005	Labor Force Survey (ILO)
Lebanon	LBN	2007	Labor Force Survey (Report), Labor Force Survey (ILO)
Lesotho	LSO	2008	Labor Force Survey (Report)

Country	Code	Year	Main Sources
Liberia	LBR	2010	Labor Force Survey (Report)
Macao	MAC	2001	Labor Force Survey (ILO)
Madagascar	MDG	2002	Population and Housing Census (Report)
Malawi	MWI	2008	Population and Housing Census (IPUMS)
Malaysia	MYS	2000	Population and Housing Census (IPUMS)
Mali	MLI	1998	Population and Housing Census (IPUMS)
Mauritius	MUS	2000	Population and Housing Census (Report)
Mexico	MEX	2000	Population and Housing Census (IPUMS)
Mongolia	MNG	2006	Labor Force Survey (Report), Population and Housing Census (IPUMS)
Morocco	MAR	2004	Population and Housing Census (IPUMS)
Mozambique	MOZ	2005	Labor Force Survey (Report)
Namibia	NAM	2000	Labor Force Survey (Report)
Nepal	NPL	2001	Population and Housing Census (IPUMS)
Nicaragua	NIC	2005	Population and Housing Census (IPUMS)
Nigeria	NGA	2005	General Household Survey
Pakistan	PAK	2009	Labor Force Survey (Report), Population and Housing Census (IPUMS)
Panama	PAN	2000	Population and Housing Census (IPUMS)
Paraguay	PRY	1994	Labor Force Survey (ILO)
Peru	PER	2007	Population and Housing Census (IPUMS)
Philippines	PHL	2000	Population and Housing Census (IPUMS)
Qatar	QAT	2004	Labor Force Survey (ILO)
Republic of Korea	KOR	2001	Labor Force Survey (ILO)
Rwanda	RWA	2002	Population and Housing Census (IPUMS)
Saudi Arabia	SAU	2004	Labor Force Survey (ILO)
Senegal	SEN	2004	Population and Housing Census (IPUMS)
Sierra Leone	SLE	2004	Population and Housing Census (IPUMS)
Singapore	SGP	2007	Labor Force Survey (ILO)
South Africa	ZAF	2007	Population and Housing Census (IPUMS)
Sri Lanka	LKA	2010	Labor Force Survey (Report)
Sudan	SDN	2008	Population and Housing Census (IPUMS)
Syria	SYR	2003	Labor Force Survey (Report)
Taiwan	TWN	2010	Population and Housing Census (Report)
Tanzania	TZA	2002	Population and Housing Census (IPUMS)
Thailand	THA	2000	Population and Housing Census (IPUMS)
Tunisia	TUN	2004	Population and Housing Census (Report)
Uganda	UGA	2002	Population and Housing Census (IPUMS)
UAE	ARE	2001	Labor Force Survey (ILO)
Uruguay	URY	2000	Labor Force Survey (ILO), Population and Housing Census (IPUMS)
Venezuela	VEN	2001	Population and Housing Census (IPUMS)
Viet Nam	VNM	2009	Population and Housing Census (IPUMS)
Yemen	YEM	2004	Population and Housing Census (Report)
Zambia	ZMB	2008	Labor Force Survey (Report)

Notes: This table displays the main sources of information for the urban employment composition for each country for which we have data, for the most recent year in 2000-2010. When data is not available for the most recent period, we use data for the period 1990-1999. Our two main data sources are IPUMS, the International Public-Use Microdata Series, and ILO, the International Organization of Labor. We complement these data sets with data from the published reports of population and housing censuses, labor force surveys and household surveys. The countries for which urban employment data is missing are: Afghanistan (AFG), Belize (BLZ), Burundi (BDI), Cameroon (CMR), Cape Verde (CPV), Central African Republic (CAR), Chad (TCD), Comoros (COM), Congo (COG), Democratic Republic of the Congo (ZAR), Djibouti (DJI), Equatorial Guinea (GNQ), Eritrea (ERI), Honduras (HND), Laos (LAO), Libya (LBY), Mauritania (MRT), Myanmar (MMR), Niger (NER), Oman (OMN), Papua New Guinea (PNG), Solomon Islands (SLB), Somalia (SOM), Suriname (SUR), Swaziland (SWZ), Togo (TGO), Trinidad and Tobago (TTO) and Zimbabwe (ZWE).