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Agglomeration, Urbanization and Employment growth in Ghana

Evidence from an Industry-District Panel

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Abstract

In this paper the impact of various agglomerative forces on employment growth in Ghanaian manufacturing is investigated, using data from two firm censuses, as well as population census and trade data. The study is the first to use nationally representative firm data that covers the formal and informal economy to investigate the impact of agglomerative forces on employment growth in an African economy. African economies are rapidly urbanizing, but this has not been accompanied by growth in manufacturing. A lack of agglomeration economies is one possible explanation for slow manufacturing growth and the attendant premature deindustrialization. The paper follows Combes (2000) in examining the importance of agglomeration economies on employment growth in Ghanaian manufacturing, finding that there is no evidence that population density is associated with faster employment growth. Other agglomeration economies do seem to play a role, although not always in the manner anticipated.

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Agglomeration, Urbanization and Employment growth in Ghana: Evidence from an industry-district panel

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1 Introduction

Recent GDP growth in many African countries has been impressive. But this growth has partially been driven by high commodity prices. To avoid a reliance on high global commodity prices policy makers thus wish to diversify away from commodities and into manufacturing, following the path of East Asian countries. But Rodrik (2016) has argued that African economies have experienced premature deindustrialization, a peaking of manufacturing shares at levels of GDP much below other countries experienced as they transformed from agriculture to manufacturing to services-based economies. The phenomenon of premature deindustrialization is not a foregone conclusion, and thus it is still important to examine potential opportunities for manufacturing growth in Africa.

A number of challenges to manufacturing growth in Africa exist. The traditional explanations include bad business and investment climates, lack of access to credit and resulting low levels of investment. Explanations for the more recently discussed phenomenon of premature deindustrialization include that is has become difficult to industrialize for those countries late to the process, for example because of first mover advantages, the increasing sophistication of manufacturing and the extent of global value chains in which buyers have substantial market power (World Bank, 2018). High relative labor costs are also an important contributor to a lack of competitiveness of manufacturing in sub-Saharan African (Ceglowski et al 2015).

One further potential explanation for low manufacturing growth and premature deindustrialization that has not been much explored is that African firms have been unable to take advantage of the benefits of agglomeration that come with urbanization (Jedwab, 2013), or that these benefits are much lower in African economies than elsewhere in the developing world (Collier et al 2018).

Agglomeration effects are the benefits that accrue from firms being located close to other firms and workers, and these represent a potentiality important externality that policy makers may be interested in encouraging (Combes and Gobillion, 2015). Agglomeration effects include physical spillovers, where transport costs for a firm are lowered by the presence of another firm, intellectual spillovers, flows of ideas across firms or industries, or labor market pooling, where workers choose to locate in areas with high concentrations of firms. In this paper we look for the effects of various forms of agglomeration economies for Ghanaian manufacturing, since the lack of such economies is one possible explanation for premature industrialization (Collier et al, 2018, Jedwab, 2013).

To undertake this analysis this we use data from two firm censuses collected by the Ghana Statistical Service (GSS). These are the National Industrial Census (NIC) of 2003 and the Integrated Business Establishment Survey (IBES) of 2014. We create a district-industry panel using 110 districts and 13 industries and examine how district, industry and district-industry characteristics affect employment growth. We also merge into the industry-district panel data from the population census, spatial information about each district and administrative data on imports and exports for each industry.

The rest of the paper proceeds as follows. Section 2 describes the state of manufacturing in Africa and Ghana, and the literature on agglomeration economies and their measurement. Section 3 discusses the firm census data, as well as the other sources of data, that we use. Section 4 provides a description of the changes in Ghanaian manufacturing, whilst in section 5 we examine the effects of agglomeration and other factors on employment growth. Section 6 concludes.

2 Literature Review

2.1 The state of African manufacturing

The overall performance of Manufacturing in sub-Saharan Africa has not been good. The share of manufacturing in GDP for the continent as a whole has declined slightly over the last 30 years from around 11% in 1985 to 10% in 2010 (World Bank, 2018).

Several explanations have been put forward for the poor performance of African manufacturing. These include the lack of access to finance and the resultant lower levels of investment, high input and trade logistics costs (Dihn et al 2012) and more generally a business environment and investment climate that is not conducive to enterprise performance (Bigsten and Soderbom, 2006, Aterido and Hallward-Driemeier, 2012).

This poor performance means that African economies have not managed to shift resources and people away from agriculture and towards manufacturing. Instead, Rodrik (2016) characterizes many countries, including most of sub-Saharan Africa, as having experienced premature deindustrialization. This is a phenomenon in which the peak of the share of manufacturing in total GDP reaches its maximum at much lower levels of GDP than was the case for countries that industrialized earlier, both advanced economies and most South East Asian economies.

It is also important to be aware of what is meant by manufacturing employment in the African context. Policy makers are looking to grow access to relatively high paying wage jobs. But the vast majority of employment in manufacturing in most African economies is in own account work. This pays on average much less than wage employment or self-employment when the own employs others (Falco et al 2011).

Manufacturing in Ghana

The state of Ghanaian manufacturing is similar to the sub-Saharan picture presented above. Whilst GDP growth between 2003 and 2012 was 7.5% per annum, the growth in manufacturing GDP was around 3.3%. These trends meant that manufacturing's share of total GDP declined from 9.8% in 1990 to around 6.9% in 2012 (Davies and Kerr, 2018).

Ghana has several sources of manufacturing firm-level data, which have led to a substantive body of research using firm-level data. Firm-level analysis using Ghanaian data has been made possible by the publicly available RPED firm panel surveys conducted by the World Bank and the Centre for the Study of African Economies at the University of Oxford between 1991 and 2002. More recently a Project for Enterprise Development in Low Income Countries (PEDL) funded project has resulted in the 1987 and 2003 firm censuses being put into the public domain, whilst the authors are working on a follow-up PEDL-funded project to put the 2014 firm census into the public domain and document the differences and similarities between the 1987, 2003 and 2014 censuses, as well as the 1962 census for which microdata does not exist. We discuss this further in section 3.

The paper closest to ours is Lall et al (2009), who investigate the effects of infrastructure, human capital, existing agglomeration and other factors on the location decisions and productivity of Ghanaian manufacturing firms, using the 1987 and 2003 industrial censuses and changes across regions between the two censuses. Lall et al (2009) find that there was a pattern of de-concentration of manufacturing away from the dominant districts (Accra and Ashanti, which contains the 2nd largest city Kumasi) between 1987 and 2003. In doing so the authors take the firm censuses at face value. We discuss below that these censuses were actually not comparable in a number of important ways. The main concern about the results from the Lall et al (2009) paper is that the de-

concentration finding is simply due to better coverage of rural areas in the 2003 census than in the 1987 census, a fact documented by Kerr and McDougall (2019). There are also comparability issues between the 2003 and 2014 firm censuses that we use in this paper. We document these below and also describe how we address them.

The sources of firm-level data mentioned above have also been used to answer several other questions about manufacturing in Ghana. These include the relationship between productivity and firm exit (Frazer 2005), the effects of credit constraints (Bigsten and Soderbom 2006) and the contributions of growth and selection to the evolution of the firm size distribution in Ghana (Sandefur 2010, Davies and Kerr, 2018). A recent paper by Cirera et al (2017) uses the 2003 Ghana firm census (as well as census data from three other African countries) and the method of Hsieh and Klenow (2009) to estimate the cost of misallocation of resources, finding that improved allocation of resources to more productive firms would raise total productivity by around 75% in Ghanaian manufacturing. There has been little work in Ghana, or for African economies more broadly, examining the role of agglomeration economies. We review this small literature after introducing the key ideas in the agglomeration economies literature in the next section.

2.2 Agglomeration and Economic Geography

Urbanization has traditionally been associated with agglomeration, the benefits of firms locating near other firms and workers. Agglomeration is an idea with a long history in economics, dating back to the work of Adam Smith and then Alfred Marshall (Duranton, 2016). Duranton and Puga (2004) classify agglomeration effects as either sharing, matching and learning effects. Combes and Gobillion (2015) emphasize that which of these three channels is driving any agglomeration effects is almost never investigated in the agglomeration literature, but the overall effect can be, both because this is what is important for policy makers and because it is very difficult to separate out which channel is actually driving agglomeration economies.

Despite this limitation it is possible to make some progress in unpacking the role of agglomeration economies. Combes and Gobillion (2015) distinguish between urbanization economies and localization economies when estimating the benefits of agglomeration. Urbanization economies are the positive externalities from firms locating in a particular area, irrespective of the industry the firm is in, for example due to the density of firms or individuals or the level of general human capital in an area. Localization economies are the externalities arising from the characteristics within a location of a specific industry, such as the level of competition of the firms in an industry in a specific location or the degree to which a location's employment is concentrated in a particular industry.

Empirical analysis examining the role of agglomeration economies began with Glaeser et al (1992), who examined the impact of several localization and urbanization economies on city employment growth in the US. The authors found that sectoral diversity mattered for employment growth in US cities, where diversity was measured as the sectoral concentration of employment, excluding the sector for which the value is being created. Duranton and Puga (2001) formalized the idea that diversified cities would generate innovation and growth. Positive effects of diversity imply that urbanization economies are important in explaining employment growth. In contrast, Henderson et al (1995) also using data on US cities, found that specialization mattered for economic growth, where specialization is measured as the share of employment in each sector relative to its share at the national level. Since specialization is a localization economy, ie it is not a characteristic of a specific sector, this meant that localization economies were found to be more important by Henderson et al (1995).

Combes (2000) investigated a number of possible localization and urbanization economies in French "*zones d'emploi*", including diversity and specialization discussed in the previous paragraph, in an attempt to examine the relative importance of urbanization and localization economies. The other variables he used to test for urbanization and localization agglomeration economies were competition, average firm size and employment density. Competition is the extent of within-sector competition, measured by the Herfindahl index of the shares of employment of firms in the same industry and locality, which is a localization economy. Combes (2000) also used average firm size as a measure of within-firm scale economies. He argues that if scale economies are external to firms then only city size should matter and not the average size of plants in the industry-district. The final agglomeration economy examined in this paper is the most obvious and most widely used test of urbanization economies - the effect of employment density in the locality. We include all these measures in our empirical analysis of agglomeration economies in Ghana.

Testing for Agglomeration Economies

The possibility of agglomeration economies is most often tested for by examining the effect of agglomeration on productivity, either by using firm-level data, such as value added per worker or average earnings in the firm, or individual level data, usually earnings. But the effects of agglomeration on employment growth are often studied, and this is what we undertake below, following a substantial literature reviewed in Combes and Gobillion (2015).

The Modifiable Area Unit Problem

Whilst the literature testing for agglomeration economies initially used data from cities, with Glaeser et al (1992) being the path-breaking contribution, there is also a substantial literature examining possible agglomeration economies for entire countries or several countries together (Combes and Gobillion, 2015), although the trend has generally been towards smaller spatial units or using individual firm or worker data. In this paper we use 110 districts, corresponding to administrative boundaries, covering the entirety of Ghana. Using data aggregated from firms for areas rather than firms themselves implies the possibility of what is called the Modifiable Area Unit Problem (MAUP). This refers to the negative influences that the use of discrete spatial boundaries can have on the conclusions drawn from empirical analysis. Auvray & Agha (2018) discuss the MAUP and consider two effects: the zoning effect and the scale effect. The zoning effect is that the particularities of a border are arbitrary and can spuriously influence growth measures in specific locations. Auvray & Agha (2018) used simulations to show that the division of one total area into x number of subareas of equal size can lead to substantially different results for measuring spatial concentration depending on the shapes of the areas.

The second MAUP effect is the scale effect. Auvray & Agha (2018:7) note that for a given area, empirical results are affected by the level of geographic aggregation. Briant et al (2010) notes that MAUP is more of a concern in testing for agglomeration economies when the size of the geographical areas is large. Briant et al (2010: 291) describe the Zones de Emploi regions in France "fairly small", with an average size of around 1500 square kilometers and find that the MAUP is less of a concern when dealing with smaller areas. The average size of the Ghanaian districts we use in this paper is around 50% larger than the French regions and thus the MAUP may not be too much of a concern. Briant et al (2010) also note that the MAUP is less of concern when the independent and dependent variables are aggregated in the same way, as is done in our empirical analysis below. The districts we use are also of a similar size to the areas used in much of the research in this literature, so the general conclusion is the MAUP may not be a serious concern. We discuss the size of the districts used further in our description of the data we use below.

2.3 Agglomeration in African economies

Ghana, along with the rest of the African continent, has urbanized very rapidly. 9% of the Ghanaian population lived in urban areas in 1931 (Songsore, n.d.) and this increased to 51% by the time of the 2010 population census. The World Bank estimates that the urban population of Ghana increased by 3.5 times between 1984 and 2014 (World Bank, 2015). It is thus expected that the benefits of agglomeration would be evident in Ghana and other African economies that are rapidly urbanizing, as they have been evident in the recent experiences of many Asian economies (eg Au and Henderson (2006) on Chinese cities). East Asian economies have shifted from a primarily agricultural base to a manufacturing-based economy and then to a services-based economy, ie they have undergone structural transformation. However, a number of studies have demonstrated that there has been no structural transformation in African economies (McMillan and Rodrik, 2011), despite levels of urbanization similar to those in Asia. This has been argued to be because of low levels of agricultural and manufacturing productivity (Jedwab, 2013). Increasing urbanization without industrialization suggests that urbanization has not been accompanied by a growth in productivity generated by agglomeration across the continent.

Jedwab (2013) argues that urbanization in Ghana and Ivory Coast has been driven by the formation of consumption cities, cities that have evolved due to the production of resource export commodities (cocoa in the two countries he studied). In Jedwab's stylized model resource exports generate a surplus which is spent on urban goods and services, drawing people into cities and creating urbanization without either an increase in agricultural yields from a green revolution or increased productivity in manufacturing. This is thus a model in which urbanization does not lead to agglomeration economies, although the absence of agglomeration economies is not tested directly.

Collier et al (2018) test for agglomeration economies in cities using a firm-level dataset constructed from the World Bank Enterprise Surveys from 111 cities in 51 low- and middle-income countries. They do this by testing whether city size and population density affect productivity, wages, firm size and city employment. City size and density, proxies for agglomeration economies, are found to increase productivity, wages, firm size and employment, but these benefits are not as great in African cities as they are for cities in Latin America and Asia. This is some evidence that African cities are not generating agglomeration economies as they grow rapidly.

As far as we are aware there are no other studies examining both urbanization and localization economies in African economies. Duranton (2016) examines urbanization economies in Colombia but notes that examining localization economies in developing countries is hard since much employment is informal and often not measured, which is why his paper only examines urbanization economies. Collier et al (2018) note that whilst a strength of their study is the range of countries, the study uses the World Bank Enterprises Surveys (WBES), which are limited to formal sector firms with more than 4 employees.

The Ghanaian firm censuses we use in this paper covered all non-household-based firms with a permanent location, as well as household-based firms with a sign advertising the firm, whether formal or informal. Since the informal sector is such a large part of the economy in Ghana and almost all African economies our data are arguably a more useful source of data to test for agglomeration economies than the data of Collier et al (2018), which covered the formal sector only. The coverage of formal and informal firms means that we can examine both urbanization economies and also localization, which Duranton (2016) notes is usually impossible because of the lack of detailed sectoral information due to coverage being limited to formal sector firms only.

Despite the collection of data from firms of all sizes we limit our study to firms with 5 or more persons engaged because of comparability issues across the two firm censuses that we use (see Kerr and McDougall (2019) for more detail). Since informal firms are included the data we use still covers a much larger fraction of employment than the WBES. Of the firms and workers surveyed in the 2003 NIC firm data that we use, only around 14% of firms employing 52% of total workers would have been eligible for the WBES, by reporting being registered with the Registrar General's department.

3 Data used in the Study

3.1 Ghanaian Firm Census Data

This study uses data from two firm censuses undertaken by the Ghana Statistical Service (GSS) to create a district-industry panel to estimate agglomeration economies in Ghanaian manufacturing. The two censuses used are the National Industrial Census (NIC) of 2003 and the Integrated Business Establishment Survey (IBES) of 2014. Both were collected at the plant level[3] and include data collected on economic activity, employment and location in phase 1. As discussed above, the censuses covered all non-household-based firms with a fixed location, and firms located in houses if these had a sign indicating the presence of a firm, whether formal or informal.

For the analysis below, we create a panel of district-industries using the 110 districts in Ghana in 2003 and 13 sub-sectors within manufacturing. Average district size is 2200km^2 whilst median size is 1350 km^2. The standard deviation is roughly 2500, ie there is substantial variation in sizes of districts. The means are equivalent to circles with radii of 27 and 21km respectively. This makes the district mean 50% larger than the mean area of the "*zones d'emploi*" used in Combes (2000) and 100% larger than the mean of the Colombian municipalities used by Duranton (2016), although the mean is 50% smaller than the mean of the Indian districts used in Lall et al (2004).

Both firm censuses subsequently collected much more detailed production data from a nationally representative sample of the firms identified in each census (this sample was called phase two). This production data could be used to explore possible productivity effects of agglomeration but unfortunately is not representative at the district level, as the phase 2 sample was stratified across the 10 regions, sectors and several firm-size categories only, but not districts. Since we thus do not have a reliable district-level measure of productivity, we instead study possible effects of agglomeration on employment growth. Because the age of the firm was also asked in phase 1 of the censuses we can also examine the extent to which the location decisions of new firms are influenced by agglomeration forces.

Adjustments and improvements to the firm census data were undertaken for this paper. The NIC and IBES were collected using different industry classification codes, and some districts were split between the censuses. Thus, harmonization of the industrial classifications and districts was required. To harmonize the districts, we matched the IBES districts to the list of districts previously used in the 2003 NIC. This required combining (aggregating) those 2014 districts that had been created by the splitting up of any 2003 districts into a number of smaller (disaggregated) parts. In order to harmonize industry codes, we ensured that both NIC and IBES were matched to ISIC (revision 4) 4-digit activity codes.

In separate research we have undertaken on the comparability of the Ghana manufacturing firm census data, we have found that there are a number of comparability issues between the 2003 and

[3] We use 'plant' and 'firm' interchangeably in this paper.

2014 censuses that would, without addressing them, make it impossible to estimate employment growth in Ghana over this period (Kerr and McDougall, 2019). The main issues we identified are differences in coverage of rural and urban areas, differences in the enumeration of associations and differences in coverage of the smallest firms.

In Kerr and McDougall (2019) we showed that the 2014 IBES enumerated a total number of own account workers that was around 5% of own account workers enumerated in the 2010 population census. The number is "only" 5% because the smallest firms did not qualify for the firm census (which excluded household-based firms unless there was a sign indicating the presence of a firm in the household dwelling). But this same percentage was only 0.5% in the 2003 NIC. This means that the 2014 IBES covered a dramatically higher fraction of own account workers than 2003. The fraction of small firms covered also increased (Kerr and McDougall, 2019). To ameliorate this issue, we limit our main analysis to firms with 5 or more persons engaged. Persons engaged includes working proprietors, employees, unpaid family workers and apprentices, as a large fraction of Ghanaians working in manufacturing are not employees in the sense that the word is used in developed countries.

The 2014 census covered rural areas much better than the 2003 census (Kerr and McDougall, 2019). The 2003 NIC survey documentation notes that in rural areas only firms on the initial list of firms obtained prior to the census (likely obtained from tax records or the 1987 census) were enumerated, although enquiries were made of other firms in the vicinity. It is thus likely that rural areas would experience higher "employment" growth between 2003 and 2014, simply because coverage of rural firms was better in 2014. We ameliorate this issue in two ways. Firstly, we limit our analysis to firms with 5 or more persons engaged, as discussed above, since we think that the enumeration of larger firms was more comparable between 2003 and 2014 in both urban and rural areas. Secondly, in our regression analysis of the determinants of employment growth we include a control for the proportion of firms in each district in 2003 in rural areas.

Both NIC and IBES lacked information that could be used to classify firm locations as urban or rural. This classification is useful for discussions about economic development, as discussed above; it was therefore necessary to obtain a measure of whether a firm was based in an urban or rural area. This information is not typically obtained in a firm census or survey, despite being common in household surveys and population censuses. The solution undertaken in Kerr and McDougall (2019) was to use an urban/rural classification at the enumerator area level from the Ghanaian 2010 population census, data given to us by the Ghana Statistical Service. We then matched enumerator areas in this data to the firms in NIC/IBES based on the detailed location data collected in the firm censuses, which we have access to, such as the region, district, town and suburb. In this way firms were given a geotype depending on their location. The matching process resulted in the successful matching and classification of 94% of firms in NIC and 98.5% of firms in IBES as either urban or rural.[4] We use this variable in our analysis below.

3.2 Other sources of data

We also use two other sources of data which we merge into the industry-district panel created from the firm censuses. The first is administrative data on imports and exports in each of the 13 industries. This is obtained from the Atlas for Economic Complexity. [5] The Atlas data were collected

[4] Note that for both NIC (2003) and IBES (2014) it was necessary to use population census data from 2010 are there is no data from closer years available.

[5] The data are available for download on the Atlas website: https://intl-atlas-downloads.s3.amazonaws.com/index.html

using 6-digit HS product codes (1992 revision). Using Atlas trade data requires matching HS 1992 to ISIC revision 4, using the relevant correspondence table provided on the World Trade Integrated Trade Solutions website.[6] This table matches the 6-digit HS (revision 1992) codes to ISIC (revision 2) 4-digit codes. We then move from revision 2 to revision 4 of the ISIC.

The second source of data is the population census data. The 2000 population census data (undertaken 3 years before the 2003 NIC) was obtained from IPUMS, which gives a number of other characteristics of each district, including measures of the overall size of the potential market locally (proxied by the total number of individuals in wage and self-employment in each district) and measures of human capital in each district. The data also includes the size of each district, which we use to compute employment density, an urbanization economy that may contribute to local employment growth. We can also use the IPUMS population census data to obtain spatial information on the distance of the centroid of each district from both Kumasi and Accra, which we believe are reasonable measures of transport costs to large markets and (for Accra) export markets. This data is created using the GIS information contained in the IPUMS release of the 2000 population census.

We also have district-level population census data for 1984 and 1970. These are based on the census microdata but are not publicly available. They were obtained from Lasse Møller-Jensen at the University of Copenhagen and were used in Møller-Jensen and Knudsen (2008).

4 Descriptive Analysis

Before investigating the determinants of local growth in Ghana we describe employment growth in Ghana, the distribution of the localization and urbanization measures that we use in our growth regression analysis and the population and trade data.

4.1 Ghanaian firm census data

Firm level data

Table 1 shows the employment and firm numbers and shares of each of the 10 regions in Ghana in the 2003 and 2013 censuses. Greater Accra and Ashanti, which contains the second city of Kumasi, dominated manufacturing employment in 2003, accounting for 58%. The 2000 population census indicates that these two regions had a population share of only 34%, so that employment is heavily concentrated in these two regions, relative to their population shares. By 2014 Greater Accra had increased its share of total employment to 43%, whilst Kumasi's share shrank by one third. The shares of total employment in the five northern/central/eastern regions increased whilst southern regions' shares generally declined, other than Greater Accra. These patterns are broadly repeated when looking at the firm numbers and shares of firms. Kumasi's share of firms again declined whilst the smaller regions increased. Greater Accra's share stayed constant, suggesting that Greater Accra had a much larger average firm size.

The increasing concentration of employment in the firm censuses in greater Accra shown in Table 1 is important, since agglomeration economies may be a part of the explanation for this pattern. This is not the pattern shown in Lall et al (2009), who used the 1987 and 2003 censuses to show deconcentration away from Accra and Kumasi. Above we noted that the deconcentration result is likely to be due to comparability issues in these two firm censuses, which we have discussed in Kerr and McDougall (2019). We think the 2003 and 2014 firm censuses are more comparable, and in this

[6] Available at https://wits.worldbank.org/product_concordance.html.

period, there was increasing concentration in Accra, and this was large enough to offset a small decline in the proportion in Kumasi, resulting in an increasing share of manufacturing employment in the two most urban areas in Ghana.

Table 2 shows employment and firm numbers and shares in 2003 and 2013 for each of the 13 manufacturing industries used in the empirical analysis. Food, wearing apparel, wood and furniture manufacturing were the only industries with more than a 10% share of total employment in 2003. In 2013 the shares of wood and furniture making fell by 50% and 66% respectively. This reflects a general decline in these industries.

Table 3 shows the share of total manufacturing employment in Greater Accra in each manufacturing sub-industry for 2003 and 2014. In 2003 the share was higher than 40% in 7 out of 13 industries, despite Greater Accra's population share in 2000 being only 15%. In 2003 the industries in which Greater Accra did not have the largest share of employment were textiles, leather, furniture making and wood products. In wood and paper products Ashanti and Western region account for 80% of employment whilst they accounted for of 40% of employment in furniture making. It is of interest that these two industries were the only ones in which there was a decline in total employment between 2003 and 2014. In textiles Volta and Eastern region accounted for 40% of employment, whilst in leather Eastern region accounted for 72% of total employment. This suggests that whilst employment is concentrated in Greater Accra in many industries, this is not true in some industries, particularly the largest in 2003, wearing apparel and wood products.

In 2014 the share of total employment in Greater Accra was greater than 40% in 8 of 13 industries and increased in 11 of the 13 industries. The share decreased only in beverages and wearing apparel. The only industries in which Greater Accra did not have the largest share were again textiles, leather, wood, and not in wearing apparel, where Kumasi had the largest share. The region with the largest share of employment in furniture making became Greater Accra in 2014. This analysis suggests that the general trend was towards an increasing share of total manufacturing employment in Greater Accra, the most urbanized and most densely populated region in Ghana. The regression analysis below sheds further light on the processes that have contributed to this trend.

Industry-district panel data

The above descriptive analysis used the firm level data on regions and manufacturing subsectors to provide a broad overview of the changes in manufacturing in Ghana between 2003 and 2014. In this section we provide some descriptive statistics at the district and subsector level, since this is the unit of analysis in the regression work below.

Table 4 shows the 10^{th} percentile, median and 90^{th} percentile growth rates for each manufacturing subsector across all districts. Growth rates are calculated (in this table only) as suggested by Davis and Haltiwanger (1995):

$$\text{Emp growth} = emp_{t}\text{-}emp_{t-1})/((\ emp_{t}+emp_{t-1})/2).$$

This is one way of avoiding very large growth rates having a disproportionate effect, but still making the resulting growth rates easily interpretable, which is not so easy when using the dependent variable used in the regressions. The growth rates calculated in this manner are bounded by -2 and 2. The median for all industry-districts is 0.4, whilst the minimum is -1.83 and the maximum is 1.96. Table 4 shows that growth rates generally vary substantially within each industry across districts, even in industries that were shown in Table 2 above to have either grown or shrunk substantially. The two sectors shown to have shrunk- wood and furniture making, have median growth rates of 0

and -0.56 respectively. The median district growth rate is also negative for Electrical and leather manufacturing industries.

5 Determinants of Employment Growth in Ghana

5.1 Key local determinants of employment

In our analysis below, we explore the extent of agglomeration economies on employment growth in Ghana, following Glaeser (1992) and Combes (2000), amongst many others. The previous section suggested some important trends in Ghanaian manufacturing- especially the growing dominance of Greater Accra and the decline in particularly wood and furniture, which were two industries not concentrated in Accra. We seek to explain these patterns through the lens of agglomeration economies. We test for localization and urbanization economies using several measures. These are specialization, competition (localization economies) and population density, average plant size and diversity (urbanization economies).

We also add in human capital in the district-industry in the 2003 NIC, using the proportion of skilled workers in each industry-district to test for human capital externalities. We use distance from Accra and Kumasi as a proxy for transport costs to larger markets, and, in the case of Accra, to export markets. We use the level of imports in the industry to control for external competition, which is assumed to affect all industries equally, after controlling for transport costs proxied by distance.

Combes (2000) argued that employment growth as well competition, diversity, average size and specialization within *zones d'emploi* -industries should all be normalized using the level for the country as a whole in each industry, which he terms normalization, and which allows comparison across sectors. This was undertaken in the original Glaeser et al (1992) paper for some but not all variables, which Combes (2000) remedied. We now describe each of the urbanization and localization economies variables and their normalizations.

In examining the determinants of employment growth, we use a normalized measure of employment growth in an industry-district between the 2003 and 2014 firm censuses as our dependent variable, following Combes (2000),

$$\mathrm{Y_{d,i}} = \log\left(\frac{emp_{d,i,2014}}{emp_{d,i,2003}}\right) - \log(\frac{emp_{d,2014}}{emp_{d,2003}}) \ ,$$

Where d is the district and i is the industry. As Combes (2000) notes, the normalization is done because the aim is to explain why employment growth in an industry in a particular district is higher than the national growth rate in that industry, and not to explain growth in that district-industry.

The obvious measure of the extent of agglomeration economies is the extent to which employment density impacts employment growth. In our analysis employment density is the density of total employment (actually persons engaged- which includes those recorded in the firm census as working proprietors, unpaid workers or apprentices) in each district,

$$density_d = \frac{emp_d}{area_d},$$

where emp_d is total persons engaged across all industries in the district and the area of each district is obtained from the IPUMS 2000 population census data.

Similar normalizations to that undertaken for the dependent variable are undertaken for the key independent variables. Diversity is the sectoral concentration of employment, excluding the sector for which the value is being created, in each industry-district. If diversity is an important determinant of employment growth in a sector-industry this is an example of the importance of urbanization economies. The basis of this measure is the inverse of a Herfindahl index of across industry concentration in each district, excluding the district for which the measure is created (Combes, 2000), again normalized,

$$div_{d,i} = \frac{\frac{1}{\sum_{\substack{i'=1 \\ i' \neq i}}^{I} (emp_{i',d}/(emp_d - emp_{d,i}))^2}}{\frac{1}{\sum_{\substack{i'=1 \\ i' \neq i}}^{I} (emp_{i'}/(emp - emp_i))^2}},$$

where I is the total number of industries (in our analysis this is 13).

Specialization is the extent to which a particular industry in a district has a higher share of total employment in that district, relative to that industry's share of total employment in the entire country,

$$spe_{d,i} = \frac{emp_{d,i}/emp_d}{emp_i/emp}$$

Competition is the extent to which production in a particular industry-district is concentrated in only a few firms, again relative to the situation in that industry for the whole country. It is measured using a version of a Herfindahl index, normalized again,

$$comp_{d,i} = \frac{\frac{1}{\sum_{j \in i}^{I} (emp_{i,d,j}/emp_{d,i})^2}}{\frac{1}{\sum_j (emp_{i,j}/(emp - emp_i))^2}}$$

where $emp_{i,d,j}$ and $emp_{i,j}$ are the employment of firm j in industry i located in district d and the whole of Ghana respectively.

To measure the extent of within-firm scale economies we use the average firm size in an industry-district, again following Combes (2000) and normalizing using the average firm size in that industry for the whole country,

$$size_{i,d} = \frac{emp_{d,i}/num_{d,i}}{emp_i/num_i}$$

Variables used in regression analysis

Table 5 provides a brief descriptive summary of the dependent and all the independent variables used in the regression analysis below. It should be noted that in the regressions the logs of almost all variables are used, but levels are included here to aid interpretation. All independent variables are for 2003 and the dependent variable is the growth in employment in a district-industry between 2003 and 2014.

The first set of independent variables are the two urbanization economies we can examine, employment density and diversity. The next set are the localization economies specialization, firm size and competition. We also include the proportion of skilled workers in an industry district to examine the possibility of human capital externalities. Combes and Gobillion (2015) note that the human capital externalities literature does not often also control for local economic structure but with the data we have we are able to control for both.

Other controls include the distance to Accra and Kumasi, as measures of transport costs for exporting and to large markets. We also include the proportion of firms in rural areas within the district, as 2014 is likely to have covered rural areas better. To take account of the overall state of each industry we control for the log of exports and imports in each industry.

A general conclusion from Table 5 is that there is substantial variation in most of the independent variables. All the independent variables measuring agglomeration have standard deviations larger than the means. The average number of persons employed per square kilometer is 100 the standard deviation is 3 times the mean and there are also large variations in the literacy rates and proportions of the adult population that are literate. In the next section we examine the effects of these independent variables in 2003 on employment growth between 2003 and 2014.

5.2 Determinants of Employment growth

Our regression has as a dependent variable the *change* in employment between 2003 and 2014 in an industry-district, whilst the independent variables are the 2003 characteristics of an industry-district. We seek to explain the growth in employment by the characteristics of industry-districts in 2003:

$$\mathrm{Y_{d,i}} = \beta_0 + \beta_1 density_d + \beta_2 div_{d,i} + \beta_3 spe_{d,i} + \beta_4 comp_{d,i} + \beta_5 size_{i,d} + \beta_6 skilled_{i,d} + \boldsymbol{\beta_7 dist_d} + \boldsymbol{\alpha W_i} + \epsilon_{i,d}$$

Skilled is the proportion of skilled workers in the firms in each industry-district, ie this is a test of human capital externalities. Dist is a vector of the two distance variables- distance to Accra and distance to Kumasi. We used the inverse hyperbolic sin function since distance is then zero for industries in Accra and Kumasi and so a log transformation is not possible. W is a vector which contains the level of exports and imports in each industry.

Table 6 shows the OLS regression results. In column 1 we control only for population density, one of the standard ways of testing for agglomeration economies. The effect is small, negative but not statistically significant. In the other columns we gradually add in further regressors. Looking across the other regressions as we add in further independent variables the coefficients on population density are positive, small (between 0.02 and 0.04) but never statistically significant. As a comparison Collier et al (2018) used average wages as their dependent variable and firm-level data for developing countries, finding an elasticity with respect to density of between 0.06 and 0.08 across 51 countries. When we experimented with employment density from either the population or firm census we obtain very similar results- coefficients are small and not statistically significant.

One response to these results is that the regressions should mechanically imply and find that density leads to employment growth. The argument is that with large scale migration to Accra and other more urban districts with higher density there is mechanically going to be more employment growth in those areas, and thus it is surprising that our results do not find this. But in limiting our analysis to firms with 5 or more persons engaged in the firm censuses we believe we mitigate this concern. In using the firm census data we are asking whether increased density resulted in employment growth

outside the smallest firms. This means that we are asking whether increased density resulted in job growth in larger firms, the kinds of firms that would be growing and creating employment if there were benefits from agglomeration.

The other reason for including firms with 5 or more persons engaged is that jobs in these firms are the kinds of jobs policy makers would be wanting to generate- they pay more and are more stable than own account work or employment in a very small firm. We have not used the enterprise surveys because in surveying only formal firms they exclude the vast majority of employment in Ghana. Our cutoff of 5 persons engaged means, for example, that the 2014 firm census captured 63% of the employees who reported being employed in the population census around the same time.

The second urbanization economy we can investigate is the impact of industrial diversity in a location. We cannot reject the hypothesis that there is no effect of diversity on district-industry employment growth across all specifications. Combes and Gobillion's (2015) summary of the effects of diversity is that there is no robust effect on employment growth, so our finding is perhaps not surprising, despite the headline findings of the importance of diversity, beginning with Henderson et al (1995).

Besides the general characteristics of an area, the characteristics of particular industries within an area have also been found to be important determinants of growth and productivity in the agglomeration literature. Table 6 shows the effects of specialization, competition and average firm size in an industry-district on employment growth. The main results across the regressions are that these characteristics all have large, statistically significant and *negative* effects on employment growth in an industry district normalized by that industry's growth rate.

The negative impact of specialization is counter-intuitive. Combes (2000: 341) found a similar result for France and noted that "explanations of the negative effect of specialization can hardly be found in the agglomeration forces presented above." Combes and Gobillion (2015) summarize the literature estimating the effects of specialization on productivity (rather than employment growth) as finding positive effects of specialization but note that for employment negative effects have been found. This result is thus surprising but not unusual.

Competition is also estimated to have a negative effect on employment growth across all regressions, but this result is less surprising. Combes and Gobillion (2015) note that more competition can have negative effects if it lowers the prices of the products sold by firms, which is a dispersive force and leads firms to locate away from areas of higher competition. The negative, large and statistically significant effect of average firm size shown in Table 6 indicates that industry-districts with smaller average firm size grew faster. This result was also found by Glaeser et al (1992) and Combes (2000). Combes (2000) interprets this as the absence of internal economies of scale, though he is cautious about this conclusion since he did not estimate a production function. Glaeser et al (2010) interpret this as part of the benefits of entrepreneurship since smaller firms are assumed to be newer and more entrepreneurial.

The final agglomeration force we can examine is the extent of human capital externalities. Human capital in our analysis is measured by the proportion of skilled production workers in each industry-district. Across all regressions there does not seem to be any evidence of human capital externalities.

5.3 Endogeneity Concerns

The initial papers using the growth regressions undertaken above (Glaeser et al, 1992, Henderson et al 1995 and Combes, 2000) did not address possible endogeneity issues. It is likely that in a cross section there are unobserved factors correlated with 2003 characteristics and employment or that there is a problem with reverse causality (Combes and Gobillion, 2015). For example local amenities, such as transport infrastructure, that we have not controlled for might attract firms and increase employment, but also lead to increased density. Using employment growth rather than its level, as the dependent variable, which has been undertaken in this paper, partly mitigates these concerns as it is more plausible to think that amenities are not correlated both with density and *growth* in employment than that they are not correlated with both density and the level of employment.

But we do acknowledge that there are endogeneity concerns. The concern that has been addressed in the literature is instrumenting current population density with historical values (Combes and Gobillion 2015, Collier et al 2018). We have obtained district population totals from the 1970 census (Møller-Jensen and Knudsen, 2008). Table 7 shows the IV regressions when we instrument population density for 2000 using the 1970 values. The instrument is always very strong, but the estimated coefficients are, like in OLS, fairly small and never statistically significant. It would be better to use population values from further back in time, but we currently do not have access to such data by district in Ghana.

Other endogeneity concerns have been addressed in other papers using system GMM or firm-level panel data. System GMM requires at least 3 time periods. We could use the 1987 firm census data, but we have concerns about the coverage of firms in the more rural districts because it is clear from the data that the coverage of firms in rural areas was limited (Kerr and McDougall, 2019).

6 Conclusion

In most African economies manufacturing output and employment is growing, but the rate of growth is slower than that of other sectors, resulting in declining shares of GDP, and what Rodrik (2016) has called premature industrialization. A number of possible explanations for this situation have been put forward including a lack of a business and investment climate suited to firm growth and a lack of access to credit, as well as more recent explanations such as first mover advantages, the increasing sophistication of manufacturing and the extent of global value chains in which buyers have substantial market power.

Agglomeration has been shown to be a source of growth in many developed and developing countries but there is some evidence that agglomeration economies are weaker in African economies than they are in other parts of the world (Collier et al, 2018).

In this paper we have investigated the impact of various agglomerative forces that have been identified in the literature, using data from two Ghanaian firm censuses. The study is, to our knowledge, the first to use nationally representative firm data including both the formal and informal sectors to investigate the impact of agglomerative forces on employment growth in an African economy. We followed Combes (2000) in examining the importance of both urbanization and localization economies, which was possible with the Ghanaian firm census data we have made use of.

We have shown that Accra, the largest district and the most densely populated in Ghana, has increased its share of manufacturing employment. This would suggest that agglomeration economies are present and contributing to employment and productivity growth. But our main

finding is that there is no evidence that density plays a role in generating employment growth in Ghana. Other urbanization and localization economies, including specialization and diversity, do seem to play a role but not always in the manner that was expected.

African policy makers see many possible benefits resulting from the current increase in urbanization, but our results do not suggest that this has been a major driver of employment growth in Ghana. Further empirical analysis using data from other African economies could be conducted to determine whether our finding of a lack of evidence that population density, the most commonly tested agglomeration economy, plays a role in generating employment growth.

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8 Tables

Table 1: Employment and firms by Region

Region	2003	2013	2003	2013	2003	2013	2003	2013
	Employment	Employment	Emp %	Emp %	Firm num	Firm num	Firm %	Firm %
Western	25141	22531	14.8	8.4	890	1620	8.5	8.9
Central	9751	12565	5.7	4.7	868	1205	8.3	6.6
Greater Accra	56522	116804	33.3	43.4	2485	4240	23.6	23.2
Volta	6063	10723	3.6	4.0	535	1145	5.1	6.3
Eastern	12582	15266	7.4	5.7	942	1286	9.0	7.0
Ashanti	41243	43591	24.3	16.2	3114	3819	29.6	20.9
Brong Ahafo	8788	19047	5.2	7.1	594	1632	5.6	8.9
Northern	5137	17315	3.0	6.4	546	1982	5.2	10.8
Upper East	3177	6869	1.9	2.6	385	806	3.7	4.4
Upper West	1583	4217	0.9	1.6	159	555	1.5	3.0
All	169987	268928	100	100	10518	18290	100	100

Table 2: Employment and firm numbers and shares by manufacturing subsector

Sector	2003	2013	2003	2013	2003	2013	2003	2013
	Employment	Employment	Emp %	Emp %	Firm num	Firm num	Firm %	Firm %
Food	23900	50161	14.1	18.7	755	2157	7.2	11.8
Beverages	5842	19258	3.4	7.2	350	619	3.3	3.4
Textiles	6766	9823	4.0	3.7	240	558	2.3	3.1
Wearing apparel	35157	56432	20.7	21.0	4197	7775	39.9	42.5
Leather	2736	3782	1.6	1.4	256	440	2.4	2.4
Wood and paper	33608	24815	19.8	9.2	582	763	5.5	4.2
Printing	3138	6915	1.8	2.6	225	560	2.1	3.1

Chemicals, pharma, rubber	14699	26709	8.6	9.9	203	371	1.9	2.0
Non-metallic metals	6619	10803	3.9	4.0	508	969	4.8	5.3
Metal products	14347	29352	8.4	10.9	989	2295	9.4	12.5
Electrical, machinery, transport	2841	6566	1.7	2.4	207	250	2.0	1.4
Furniture	18602	10321	10.9	3.8	1897	1192	18.0	6.5
Other manuf.	1370	13991	0.8	5.2	107	341	1.0	1.9
Other manuf.	169987	268928	100	100	10518	18290	100	100

Table 3: Greater Accra share of total Employment by manufacturing subsector in 2003 and 2014

Sector	**2003**	**2003**	**2003**	**2014**	**2014**	**2014**
	Accra Emp	**Total Emp**	**Accra Share**	**Accra Emp**	**Total Emp**	**Accra Share**
Food	9946	23900	41.6	23933	50161	47.7
Beverages	2772	5842	47.4	8345	19258	43.3
Textiles	1547	6766	22.9	2701	9823	27.5
Wearing apparel	8293	35157	23.6	9285	56432	16.5
Leather	66	2736	2.4	487	3782	12.9
Wood and paper	1505	33608	4.5	2637	24815	10.6
Printing	2202	3138	70.2	4953	6915	71.6
Chemicals, pharma, rubber	12536	14699	85.3	22786	26709	85.3
Non-metallic metals	3562	6619	53.8	6447	10803	59.7
Metal products	7665	14347	53.4	16307	29352	55.6

Electrical, machinery, transport	1057	2841	37.2	5118	6566	77.9
Furniture	4357	18602	23.4	2746	10321	26.6
Other manuf.	613	1370	44.7	11059	13991	79
All	56522	169987	33.3	116804	268928	43.4

Table 4: Industry employment growth rates across sectors

Industry	10th Percentile	Median	90th Percentile
Food	-0.43	1.09	1.74
Beverages	-0.67	0.91	1.68
Textiles	-1.20	0.21	1.72
Wearing apparel	-0.31	0.66	1.36
Leather	-1.06	-0.18	0.91
Wood and paper	-1.10	0.00	1.64
Printing	-0.68	0.11	0.94
Chemicals, pharma, rubber	-0.51	0.94	1.64
Non-metallic metals	-0.67	0.36	1.43
Metal products	-0.51	0.76	1.58
Electrical, machinery, transport	-1.55	-0.35	1.10
Furniture	-1.33	-0.56	0.74
Other manuf.	-0.82	0.83	1.59
All	-0.94	0.40	1.57

Table 5: Description of Independent variables

Variable	Mean	Standard Deviation	Minimum	Maximum
Employment growth (normalised)	0.03	1.22	-4.50	3.90
Specialisation	1.56	2.04	0.01	22.53
Competition	0.09	0.19	0.00	2.44
Firm size	0.89	2.47	0.07	53.42
Diversity	0.47	0.26	0.02	1.27
Employment Density	101.15	315.59	5.15	2500.53
Distance to Accra	253.28	168.33	37.18	623.09
Distance to Kumasi	198.68	123.17	0.00	474.17
rural proportion	0.36	0.20	0.04	1.00
Mean years of education	3.50	1.40	0.79	6.53
Proportion literate	0.49	0.19	0.13	0.81
Industry exp to imp ratio	0.60	0.96	0.04	3.26
log(industry imports in USD)	18.29	1.46	16.26	20.61
log(industry exports in USD)	16.75	2.12	13.47	20.10

Table 6: OLS regressions for Employment growth

	(1)	(2)	(3)	(4)	(5)
VARIABLES	Employment growth	Employment growth	Employment growth	Employment growth	Employment growth
Population density	-0.0377	0.0385	0.0388	0.0278	0.0331
	(0.0369)	(0.0428)	(0.0429)	(0.0548)	(0.0553)
Specialisation		-0.348***	-0.342***	-0.342***	-0.330***
		(0.0489)	(0.0493)	(0.0497)	(0.0514)
Diversity		-0.00811	-0.0129	-0.0157	-0.0214
		(0.0740)	(0.0743)	(0.0755)	(0.0757)
Competition		-0.253***	-0.256***	-0.255***	-0.268***
		(0.0450)	(0.0454)	(0.0459)	(0.0479)
Average Firm Size		-0.296***	-0.309***	-0.311***	-0.311***
		(0.0706)	(0.0715)	(0.0723)	(0.0725)
Proportion of skilled prodn. workers in ind-dist			0.0415	0.0340	0.0256
			(0.155)	(0.158)	(0.160)
Proportion rural				-0.0397	-0.0510

				(0.241)	(0.242)
Distance to Accra (IHS trans.)				-0.0187	-0.0178
				(0.0469)	(0.0471)
Distance to Kumasi (IHS trans.)				0.00273	0.00112
				(0.0436)	(0.0437)
log (imports, USD)					0.0234
					(0.0451)
log (exports, USD)					0.00678
					(0.0300)
Constant	0.211	-1.165***	-1.207***	-1.047	-1.646*
	(0.186)	(0.345)	(0.353)	(0.671)	(0.923)
Observations	709	708	707	707	707
R-squared	0.001	0.289	0.290	0.291	0.292
Standard errors in parentheses					
*** p<0.01, ** p<0.05, * p<0.1					

Table 7: IV regressions using lagged population values

	(1)	(2)	(3)	(4)	(5)	(6)
		Second stage		Second stage		Second stage
VARIABLES	Employment growth	Population density (log)	Employment growth	Population density (log)	Employment growth	Population density (log)
Population density (log)	-0.0505		-0.0161		-0.00648	
	(0.0391)		(0.0463)		(0.0463)	
Specialisation			-0.374***	-0.167***	-0.363***	-0.171***
			(0.0495)	(0.0161)	(0.0498)	(0.0161)
Diversity			0.0292	0.140***	0.0330	0.137***
			(0.0748)	(0.0249)	(0.0747)	(0.0248)

Competition			-0.227***	0.174***	-0.236***	0.181***
			(0.0457)	(0.0146)	(0.0462)	(0.0147)
Average Firm Size			-0.257***	0.283***	-0.307***	0.286***
			(0.0715)	(0.0229)	(0.0744)	(0.0237)
Proportion of skilled prodn. workers in ind-dist					-0.102	-0.139**
					(0.187)	(0.0641)
1970 Population density (log)		0.903***		0.789***		0.791***
		(0.0121)		(0.0126)		(0.0125)
Constant	0.273	1.377***	-0.760**	2.639***	-0.826**	2.704***
	(0.196)	(0.0497)	(0.369)	(0.0894)	(0.378)	(0.0925)
Observations	709	709	708	708	706	706
R-squared	0.001		0.287		0.293	
Standard errors in parentheses						
*** p<0.01, ** p<0.05, * p<0.1						

Table 8: IV regressions continued.

	(7)	Second stage	(9)	Second stage
VARIABLES	Employment growth	Population density (log)	Employment growth	Population density (log)
Population density (log)	-0.0477		-0.0457	
	(0.0613)		(0.0617)	
Specialisation	-0.360***	-0.141***	-0.352***	-0.151***
	(0.0500)	(0.0152)	(0.0518)	(0.0156)
Diversity	0.0193	0.0829***	0.0147	0.0858***
	(0.0752)	(0.0235)	(0.0755)	(0.0235)
Competition	-0.238***	0.149***	-0.248***	0.156***
	(0.0465)	(0.0140)	(0.0484)	(0.0145)
Average Firm Size	-0.314***	0.238***	-0.314***	0.233***
	(0.0750)	(0.0226)	(0.0751)	(0.0226)
Proportion of skilled prodn. workers in ind-dist	-0.105	-0.0927	-0.118	-0.103*

	(0.189)	(0.0600)	(0.191)	(0.0606)
Proportion rural	-0.139	-0.455***	-0.149	-0.447***
	(0.241)	(0.0751)	(0.241)	(0.0750)
Distance to Accra (IHS trans.)	-0.0570	-0.0972***	-0.0574	-0.0983***
	(0.0483)	(0.0143)	(0.0484)	(0.0143)
Distance to Kumasi (IHS trans.)	-0.0192	-0.0952***	-0.0213	-0.0943***
	(0.0441)	(0.0133)	(0.0441)	(0.0133)
log (imports, USD)			0.0285	0.00307
			(0.0445)	(0.0141)
log (exports, USD)			-0.00300	-0.0187**
			(0.0297)	(0.00936)
1970 Population density (log)		0.717***		0.713***
		(0.0139)		(0.0139)
Constant	-0.168	4.035***	-0.657	4.332***
	(0.733)	(0.165)	(0.971)	(0.251)
Observations	706	706	706	706
R-squared	0.292		0.293	
Standard errors in parentheses				
*** p<0.01, ** p<0.05, * p<0.1				