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Job Accessibility & Employment in Accra [1]

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Abstract: This paper measures job accessibility within Accra and assesses its relationship with labour outcomes. We provide consistent estimates of each neighbourhood's accessibility to employment opportunities using innovative datasets. We concentrate on the three main commuting modes (private cars, walking, and informal shared mini-buses) and identify sharp disparities with respect to job accessibility by commuting mode. While most jobs can be reached by car within 60 minutes from any neighbourhood, only between 20 to 30% of formal jobs on average are accessible in the same timeframe by the more popular minibus. We complement these findings by looking at how accessibility is related to individual labour outcomes. Our findings suggest that a better access to employment opportunities is correlated with a higher likelihood of employment and a lower probability of engaging in the informal sector. Women tend to be the most affected. Supporting these findings, we also see firms located in neighbourhoods with a greater labour pool reach being less likely to report unfilled vacancies. On the whole, while descriptive, the analysis strongly suggests that Accra's lack of efficient connectivity harms labour and firm economic outcomes.

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1. Introduction

Rapid population growth and rural-urban migration has fuelled rapid and unprecedentedly fast-paced urbanization in sub-Saharan Africa (SSA) over the last three decades. As a result, cities have often expanded horizontally in an uncoordinated fashion, with large shares of urban dwellers facing inadequate access to public services and infrastructure. A recent report by the World Bank (2017) characterizes African cities as costly, disconnected and crowded. Accra is no exception to this trend. Being one of the fastest growing cities in SSA, its population more than doubled in less than two decades. The city's resulting physical expansion is linked to long and costly commuting journeys, making connectivity a key issue to address. This is the objective of this paper: to provide a diagnostic of employment accessibility across Accra and its proximity, and understand its relationship with individual labour market outcomes and firm's hiring capacities.

Well-functioning cities reduce distance between people and economic opportunities (Avner & Lall 2016). Agglomeration economies and urban productivity growth surge as a result. Poor connectivity is thus an obstacle for growth. On the demand side, it limits the effective size of the labour market preventing successful matching between workers and firms, and leading to a misallocation of productive resources and economic inefficiencies. Further, disconnected and costly cities deter entrepreneurs from investing in manufacturing and the production of tradable goods and services (Venables 2017), hampering potential agglomeration economies (Duranton & Puga 2004). From the labour supply side, poor employment accessibility can be a deterrent from labour market participation and formal employment as it can increase reservation wages and information frictions (Gobillon & Selod 2014). Households may compromise their living conditions to be close to economic opportunities (Galiani et al. 2016). Understanding the patterns of employment accessibility in developing countries cities is key to deliver on the liveable and productive cities agendas.

This paper puts the emphasis on Accra and achieves two main objectives. First, it provides consistent and precise measures of each neighbourhood's accessibility to employment opportunities. Using innovative datasets, we concentrate on the three main commuting modes of Accra's residents, i.e., private cars, walking, and informal shared mini-buses (tro-tro). Our analysis reveals sharp disparities with respect to job accessibility. We mostly focus on formal jobs, but incorporate a larger definition that encompasses all job-related urban amenities. We believe these two definitions offer a good measure of the spatial distribution of jobs within Accra. As expected, residents of the city-proper have the highest capacity to access jobs, irrespective of the modes of commute. However, there are significant inequalities in terms of accessibility by commuting mode. While most jobs can be reached by car within 60 minutes from any neighbourhood, access to jobs by the more popular tro-tro or walking is highly unequal across Accra's neighbourhoods. Together these two modes account for more than 80% of Accra's residents commuting modes. Yet, on average a working age individual can only reach between 20 to 32% of all formal job opportunities by tro-tro within 60 minutes. Workers commuting by foot cannot access more than 5 to 7% of formal jobs within the same time.

Second, we investigate the extent to which labour and firms' outcomes are associated with employment accessibility. Relying on micro census data (2010), we relate one's performance on the labour market to their job accessibility. We also examine the influence of the effective accessible labour force on formal firms' capacity to recruit suitable workers using micro enterprise data. Our econometric findings point towards a positive relationship between job accessibility and satisfactory labour outcomes. Better

connected individuals appear more likely to be employed and work in the formal sector. Conversely, individuals facing obstacles to reach job opportunities are more likely to be sole self-employed and work in the informal sector. This is consistent with self-employment and the informal sector being a constrained occupational choice for individuals lacking viable alternatives. The predominance of employment in the low-wage non-tradeable informal services sector may rather reflect the barriers to urban agglomeration economies (Avner & Lall 2016). Interestingly, we find women to be more sensitive to accessibility. This supports evidence found in other developing countries that women tend to be less mobile (Baker et al. 2015). They also tend to have less bargaining power in their household residential location decisions. This gender heterogeneity matters for policy implications. Supporting these findings, we also see that firms located in neighbourhoods with a higher labour pool reach are less likely to report unfilled vacancies. On the whole, the analysis we conduct, while descriptive, strongly suggests that Accra's lack of efficient connectivity harms labour and firm economic outcomes.

Our study is linked to a larger body of research in urban planning and economics concerned with the distance between jobs and households within urban areas. The Spatial Mismatch Hypothesis (SMH), first postulated by Kain (1968), held that the suburbanisation of jobs and the concentration of low-income households in central areas were partly responsible for the unemployment of black minorities in metropolitan areas in the U.S. The SMH has regained relevance in the context of large spatial inequalities in overcrowded and sprawling urban areas in developing countries, where central areas concentrate economic opportunities and high-income households, while the vast peripheral low-income areas offer only limited formal job opportunities (Cervero 2013; Duranton & Guerra 2016; Moreno-Monroy 2016). We follow recent work by Peralta Quirós & Mehndiratta (2014) and Avner & Lall (2016) measuring accessibility and employment in large developing countries' cities. In these cities, accessibility constraints related to long distances to job centres and poor transport infrastructure provision translate into disproportionally large commuting costs for poor households. Recent studies have found that commutes for low-income workers are not only less frequent but also shorter (Motte et al. 2016; Suárez et al. 2016). These results suggest that workers facing poor accessibility are locked in low quality informal occupations because these are the only opportunities available within their constrained commute radius.

Our work is also related to a nascent empirical literature in development and urban economics estimating the effect of accessibility on labour market outcomes in developing countries (Franklin 2016; Abebe et al. 2017, Picarelli 2017). These studies test the hypothesis that increased search costs for job seekers resulting from poor job accessibility are partly responsible for worse labour market outcomes. Picarelli (2017) finds that households relocating to peripheral low-cost housing projects in South African urban areas have worse labour market outcomes, partly as a result of increased distance. Franklin (2016) and Abebe et al. (2017), use experimental settings in Addis Ababa and find that easing search frictions through transport subsidies results in improved labour market outcomes for job seekers residing far away from jobs. In particular, Franklin (2016) finds that a transport subsidy increases job search intensity and the likelihood of finding a good job. Abebe et al. (2017) find that a transport subsidy lowers the gap between self-employment rates among workers living far away from the city centre and those living close by. These results are in line with those of Phillips (2014) using a similar strategy in the context of a developed a country. He finds that a transport subsidy leads to increased job search intensity among low-wage workers in Washington, D.C. Other channels through which poor accessibility may result in worse labour market outcomes, such as employer discrimination (Gobillon et al. 2007), have not been yet tested empirically. There is also no available experimental evidence for developing countries on the effect of job accessibility on firms' outcomes.

This paper contributes to this body of research by providing a diagnostic of employment accessibility by the various modes of transportation across Accra's neighbourhoods. By looking at accessibility by private car, informal minibus and walking, we are able to gauge the commuting costs of the vast majority of the population in a fast-growing African city. We further relate accessibility to the labour outcomes of working age residents and to formal firms' hiring capacities. These complementary sides provide a consistent picture. Although our analysis is largely descriptive, important implications for public policy can be drawn. The lack of connectivity we document is found to affect both workers and firms. Poor employment matching can be harmful for the economic development of Accra as labour and capital productive resources are not allocated to their most efficient use. At a more aggregated level, agglomeration economies, manufacturing employment growth, and urban productivity are hampered by the lack of accessibility and the city-wide disconnect between workers and formal firms. It is thus important to understand how city authorities can increase accessibility and enable labour market pooling to reap the benefits of agglomeration economies.

The remainder of the paper proceeds as follows. Section 2 provides some background information on Accra's context. In the third section, we detail the methodology we use to measure accessibility and discuss job accessibility across Accra by the different commuting modes. The fourth section discusses the econometric analysis. Section 6 discusses policy implications, while the last section concludes by summarising our main findings and drawing recommendations for public policy.

2. Accra's Context

Accra is Ghana's capital and its largest city. It also one of the fastest growing cities in sub-Saharan Africa (SSA) with an estimated annual growth rate of 2.2%. The city was founded by the Ga people of Ghana in the late 1600s. It replaced Cape Coast as the capital of the British Gold Coast colony in 1877 and became the economic centre of the country soon after. The city of Accra (Accra Metropolitan Area – AMA) is part of the Greater Accra region (Greater Accra Metropolitan Area or GAMA), which is one of the ten administrative regions of the country. It is the smallest of the ten regions, occupying an area of 3,245 square kilometres or 1.4 percent of the total land area of Ghana (Government of Ghana 2017). The region is further divided into ten municipal districts (Figure 1).

According to the 2010 census, 62% of Accra's population is under the age of 30. The female population constitutes 52% of the city total population, implying that for every 100 males there are 108 females. Close to half of the city inhabitants are migrants (born elsewhere in the country or outside Ghana) with more than 95% being Ghanaian nationals. Migrants disproportionally come from neighbouring regions such as the Central, Eastern or Volta regions. The illiteracy rate is relatively low, with only 13% of individuals aged 15 and older not knowing how to read and write.

The Accra Metropolitan Area is the economic hub of the Greater Accra Region and the rest of the country. It hosts a number of manufacturing industries, oil companies, financial institutions, telecommunication, education, and health providers. Together with Kumasi, Accra represented close to 20% of the country's GDP in 2008, with the Greater Accra Region accounting for close to 51% of manufacturing activity in Ghana. Still, the manufacturing sector is small in Ghana, even compared to other SSA countries, accounting only for 5.8% of total GDP and close to 11% of total employment. Most urban jobs are concentrated in low value-added informal services (World Bank 2015). Figures 2 and 3 (discussed in detail later) show the spatial distribution of formal establishments (2006) and amenities

(2015) in Accra and its periphery[2]. The city exhibits quite a marked monocentric city pattern. A dense cluster of firms can be seen in the south and centre of Accra. Most of the industries in which these establishments engage are financial services, government and public administration, retail trade, accommodation and food services, and light manufacturing. In 2009, UN-Habitat estimated that 65% of vehicular movements was towards to the Central Business District (CBD). A small cluster of firms can also be noticed in Tema (to the East). This municipality hosts a heavy industrial base and one of Ghana's two deep seaports.

According to the Census 2010, about 70% of the population aged 15 years and older is economically active. The unemployment rate is quite low at an estimated 7%. Informality is predominant with private informal jobs accounting for 74% of all jobs. More than a third of the employed population works in the wholesale and retail trade industry. Manufacturing represents 14% of total employment, while accommodation and food services stand at 10%. The self-employed without any employee represent 48% of the employed population. Employees on the other hand account for 35% of the employed.

Ghana has been urbanizing rapidly since the mid-1980s. As the country's total population doubled between 1990 and 2014, the urban population more than tripled rising from close to 5 million to nearly 15 million people. At the end of the last decade the urban population became larger than the rural population for the first time in the country's history (Figure 4). By 2030, 65% of Ghana's population will be located in urban areas (World Bank 2008). All regions of the country have experienced steady urbanization, with smaller cities witnessing faster population growth. With a population of 2.1 million people (2010 National Population Census), Accra is today one of the most populated and fastest growing Metropolis in Africa. Its urban primacy has however diminished over the last 20 years.

The rapid urbanization of the country, pushed by a period of sustained growth in the past decade (close to 7% annual GDP growth), has brought about significant challenges for city authorities in terms of infrastructure and service provision, environmental costs and socioeconomic inequalities. About 90% of housing in urban Ghana is built without local authority control (UN-Habitat 2012). Much suburban development has occurred unplanned, without adequate services and infrastructure, which has increased transportation costs and commuting times. As a consequence of this urbanization and spatial expansion, long daily and regular commuting between residential areas, the CBD, or industrial areas has become a characteristic of Accra inhabitants' life. High-capacity mass transport is non-existent in Accra[3] where less than 0.3% uses public buses (World Bank 2015). As a result, urban residents have to either rely on private cars, often unaffordable, or resort to informal solutions, which are subject to severe cost and safety concerns and contribute to road congestion. According to the National Household Transport Survey (2012), walking remains the main mode of commuting across urban areas (50%), followed by tro-tro (shared mini buses - 20%), and shared taxis (12%). The picture is different in Accra, where more than 75% of city dwellers use tro-tro for commuting and only 13% chooses to walk; the rest using private vehicles (World Bank 2017). Half of commuting workers in the Greater Accra region cite bad roads as the main limitation to access the workplace, and a quarter cites heavy congestion as main barrier (Table 1). Among those actively looking for jobs, more than 50% report inaccessibility to the workplace as their main challenge (Table 2). Tackling connectivity challenges remains key for fostering agglomeration economies and promoting inclusive growth.

[2] See section 3.14 for details.
[3] A Bus Rapid Transit (BRT) system was launched in Accra in November 2016 (Government of Ghana 2017).

3. Measuring Accessibility

We draw information from several datasets. This section describes the different sources, the methodology employed to measure accessibility, as well as other key variables' definitions. It also provides descriptive statistics about accessibility and employment in Accra.

3.1 Data Sources and Main Definitions

This analysis mostly focuses on accessibility to formal jobs and its effect on individuals. We complement it by also looking at the firms' side. To address this question, we need three main types of information regarding mobility and location patterns within Accra. The first one concerns information on transportation networks and the different modes of commuting available to Accra's residents to compute transportation costs; the second are residential locations and employment outcomes of city dwellers; and the last concerns data on the distribution and location of economic opportunities or jobs within the city. We detail these next.

3.1.1 Accra Spatial Units

Our area of analysis is the Accra Metropolitan Area (AMA) and close external suburbs (Figure 7)[4]. This choice is constrained by data availability. We refrain from using the full GAMA because of the lack of data on transport networks beyond AMA's periphery. Further, the fringe of the GAMA region is not part of Accra's urban labour market. This issue also guides the final extent of the external suburbs we work with.

First, within AMA we use smaller spatial units that represent functional neighbourhoods (green area in Figure 7). The boundaries of these 'vernacular neighbourhoods' represent broadly recognized and agreed borders by residents. We obtained these spatial references from Weeks et al. (2010)[5]. They have been defined to be directly linked to the Census EAs. There are in total 132 vernacular neighbourhoods in our final area of analysis. The interest in using this spatial definition is the fact that they represent organic neighbourhoods, which includes shared identities, social networks, and common socioeconomic characteristics. By not limiting our analysis to administrative units we are capturing the extent of local communities and neighbourhood-level residential sorting.

The optimal spatial area of analysis here would be the extent of the local labour market. Restricting the area to AMA fails to account for this fully. To increase precision, we include AMA's immediate external suburbs. We include all EAs whose centroids fall within a buffer of 5km from the periphery of AMA (orange shaded area in Figure 7). We also incorporate most of Tema. Most of the added EAs are urban areas (95.26%). While EAs are purely administrative boundaries, areas at the periphery of AMA are relatively large and they have been defined to reflect population densities (Ghana Statistical Service, GSS). Overall, the final spatial extent of our area of analysis is 20 km from North to South (highest extent) and 56 km from West to East. The total area is 642km^2. There are 161 neighbourhoods overall (including suburban EAs).

[4] We exclude one EA (empty area between green and orange shaded polygons) because it is a natural reserve and including it would introduce error in our dataset.

[5] The development of Accra neighbourhood boundaries was funded by grant number R01 HD054906 from the U.S. Eunice Kennedy Shriver National Institute of Child Health and Human Development ("Health, Poverty and Place in Accra, Ghana," John R. Weeks, Project Director/Principal Investigator).

3.1.2 Transport Costs

According to the International Association of Public Transport (IATP 2010), Accra residents use three main modes for daily commutes: walking (ca.13%), private cars (ca.12%) and the informal minibus networks called tro-tro[6] (ca.75%). Compared to other major African cities, walking holds a relatively low share among commuting modes. The usage of informal minibus networks is one of the largest of the region, but it remains relatively close to other West-African cities such as Dakar and Abidjan (World Bank 2017). The predominance of tro-tro usage in Accra may be explained by the fact that it is a relatively regulated system as tro-tros are licensed by the Ministry of Transport. However, routes and fares are determined through their own unions, and while formal routes and stops exist, they can be boarded and disembarked anywhere along the route. The small share of private vehicles as a chosen mode for commuting is uniform across SSA. These average patterns hide significant disparities in terms of income, as low and middle-income households disproportionately choose walking and tro-tro (World Bank 2015). Reflecting the widespread use of these modes, according to the National Transport Survey 2012 the average commuting time in the Greater Accra Metropolitan Area (GAMA) was 110 minutes for an average distance of 3.28km.

We define transport costs as the time-cost of commuting. Using time-cost is standard in the literature as the measure better reflects the opportunity cost of time. The standard mono-centric model in urban economics posits that people's residential location decisions within cities are a function of their trade-off between the opportunity cost of time and their housing consumption. Thinking of commuting time as the real cost of commuting is thus more relevant (Duranton & Guerra 2016). Further, travel times also vary significantly by mode, and households at various income-levels are penalized differently for the same distance travelled. We focus on Accra's three main modes of commute here and obtain our data as follows.

Private Vehicle. We access the Google Drive Matrix API using the R package stplanr (Lovelace and Ellison, 2017) to obtain the average time travelled on an average trip by car from each neighbourhoods' geographic centroid to all other neighbourhoods' geographic centroids in our area of analysis (see 3.1.1), to create an Origin-Destination (OD) matrix. The interest of this measure is that Google provides real daily averages according to compiled information from travellers' flows. The main caveat however is that the data compiled for Accra does not specifically measures peak vs. off-peak hours. They are free flow estimates. As most commutes to work take place in peak hours, they do not take congestion into account and are thus lower-bound estimates. Still, they provide useful information to draw comparisons with other modes of commutes.

Pedestrians. In a similar fashion, we calculate a pedestrian OD matrix for our area of analysis, i.e. the time-distance of accessing all other neighbourhood's centroids from a given centroid by foot. For this, we use a network analysis using the layers of roads provided by OpenStreetMaps (OSM) (Figure 5), and approximate pedestrians' walking times at 4km per hour.

Tro-tros. Routes, directions, and time travelled in GTFS (General Transit Fee Specification) format have been collected for a majority of tro-tro routes in AMA and Tema. These were collected by the French Development Agency (AFD) between May and June 2015, with the objective of developing an online app

[6] Tro-tros are privately owned informal minibuses that can seat on average between 8-25 persons.

of tro-tro routes in Accra[7] . The data contains information on 640 routes, including ca. 2400 stops in each direction (going from and towards CBD) (Figure 6). We use this dataset in two ways. First, from the GTFS we estimate the average travel time of tro-tros for each different route and obtain the average time per km for all routes (25km/hr). We then use this estimate (i.e. we assume travel time of tro-tros to be 0.42 km per minutes along any route) to compute the OD matrix using network analysis for all the neighbourhoods in our area of analysis. To the estimated time we add 30 minutes to account for travel time to a stop and waiting times. The added time is conservative to avoid introducing substantial measurement error.

Following these methods, we obtain OD matrices for the time-cost of commuting using the 3 main commuting modes in Accra. The average travel time to access all of Accra's neighbourhoods using private cars (from a given neighbourhood) is 36 minutes, while average pedestrian and tro-tro travelling times are 228 and 60 minutes, respectively.

3.1.3 Residential Locations & Employment Outcomes

We obtain data on the distribution of residents across Accra from the 10% sample of the Census 2010. We restrict our sample to working age individuals, that is, individuals between 16 and 65 years old. Figure 8 shows the spatial distribution of the working age population. The interest of using the census here is that it is representative at a small spatial level. We use Enumeration Areas (EAs) that we assign to our vernacular neighbourhood definitions. Further, the census contains detailed information on a person's socio-economic characteristics. We use individual observations in our final analysis for a total 198,201 individuals across Accra.

The summary statistics of main outcomes variables are shown in Table 3. The main outcome variables are the economic activity status of individuals, which in the census were recorded according to the status of the person in the 7 days preceding census night. A person was considered as economically active if they were employed, or unemployed and actively looking for a job. Employed is defined as working for pay or profit or family gain at least 1 hour per week. It thus includes formal and informal work. Unemployed is defined as those not performing any remunerated work but being actively looking for a job; while self-employed is defined as those not working for an employer, with or without employees (GSS 2012). We focus on informal and sole self-employed in our analysis. There is no official definition of what constitutes working on the informal sector in the census, and we assume the definition to be self-identified informal workers. Finally, we also use a measure of education level in our analysis of firms. The level of education in the census was defined as the highest level of formal school that a person ever attended or was attending when interviewed.

On average 68% are employed in the final dataset, and less than 6% declare being unemployed. More than one quarter is inactive, suggesting that those that do not work prefer to opt out of the active labour market. 47% are sole self-employed, and the majority declares working in the informal sector (72%). The largest sector of activity is the services and sales workers (near 40% percent). Only 25% of the working age adults in the sample (above 20 years old), have completed secondary education or more. The adults in the sample are predominantly urban (99%) as can be expected given the spatial area studied. Access to electricity is widespread (91%) and most residents have lived in their area for more than 5 years (74%).

[7] We obtained the dataset from the AFD.

Table 4 displays the same summary statistics by sex. There are fewer females employed than males (4 percentage point difference) but both display similar levels of unemployment. The most noticeable differences concern the sector of employment, with females disproportionately reported as sole self-employed (59% vs. 34% for males) and as working in the informal sector (81% vs. 63% for males). They are also predominantly employed in the services and sales sector (53% vs. 21% for males). These descriptive statistics suggest females may be more affected by accessibility, as they seem to be over-represented in the non-tradable informal services sector.

3.1.4 Firms locations & information

We obtain information on economic opportunities in Accra using two datasets.

The first one is the Job Survey 2006 conducted by GSS. The dataset contains information for all formal firms in Accra in that year, their number of employees, vacancies, and sector of operation (i.e. agriculture, manufacturing or services), as well as their address (Table 5). We manually geo-located each business using the addresses given in the dataset using Google Maps and obtained the precise coordinates for most of the sample (93% of the sample). The final geo-located sample includes 501 firms employing 40,089 individuals. 64% of these firms are in the service sector, while 35% are in the manufacturing sector. On average firms in the dataset employ 80 employees. Close to 30% of the firms report having unfilled vacancies, for an average of 3.2 vacancies. These firms are relatively old with an average age of 15 years. While relatively outdated, the interest of this dataset is to obtain intensive margins (number of employees) and vacancies[8]. Further, it is unlikely that the overall spatial patterns have changed significantly in the past 10 years (as confirmed below). The dataset only covers formal firms, and focusing on formal firms is sensible. The informal sector in Accra is largely concentrated in the non-tradable services sector. It can thus be considered more of a response to the lack of accessibility with a relatively widespread distribution in Accra.

Still, we use a second dataset to complement the analysis, and incorporate to some extent, informal jobs' locations. For this we use 2015 OSM data on the location of amenities across GAMA. We exclude all amenities that are not job-related (i.e. monuments, religious buildings, parks). The final sample includes 1,340 establishments among which are schools and universities, banks, restaurants, bars and shops. While we do not have intensive margins here, the establishments' distribution should better reflect the current spatial distribution of jobs within the metropolitan area. It also accounts for both formal and informal job locations. Figures 2 and 3 map kernel densities of the number of establishments across Accra using both datasets. Their distribution is fairly similar despite the time lapse, with the main difference being the larger concentration in the Tema municipality using the OSM amenities data, and a more visible shift towards the Eastern side of the city. Our empirical findings are essentially consistent using the different datasets.

3.2 Measuring Accessibility

3.2.1 Methodology

Accessibility can be broadly understood as "the potential of opportunities for interaction", with its key elements including the spatial distribution of opportunities, the mobility provided by the transportation system, the temporal constraints of individuals and activities, and the individual characteristics of people

[8] Unfortunately, we did not have access to the 2015 IBES dataset with the most recent census of firms in Accra.

(Peralta Quiros & Mehndiratta 2014). Defining and measuring accessibility has empirical and conceptual challenges. In theory, it requires knowing about households' travel decisions, the choices of destinations, the prices of travel and housing, and preferences, size, income and composition of the household in question (Duranton & Guerra 2016). Here, we follow standard practice in the literature. We define accessibility as the share of opportunities that can be accessed in Accra in a given time-frame using various transport modes, under typical travel conditions (Avner & Lall 2016). As specified above our unit of analysis are functional neighbourhoods within AMA and surrounding EAs. The accessibility index is defined as follows:

$$A_i = \sum_{j=1}^{n} O_j \, f(C_{ij}) \quad (1)$$

$$with \, f(C_{ij}) = 1 \, if \, C_{i,j} \leq t; \;\; f(C_{ij}) = 0 \, if \, C_{i,j} > t$$

where i indexes for origin, and j indexes for destination. O are all the opportunities accessible in destination j. These are defined as a function $f(C_{ij})$ of the travel time (or cost) C from i to j; and equal to one below or at a threshold of time t, and zero otherwise. The use of a binary threshold considers any opportunity within that threshold equally accessible.

We estimate equation (1) for every origin and destination pair in Accra using OD matrices of time-costs of the three main modes of commute (i.e., private vehicle, walking and tro-tro). Further, we do the analysis both from the individual/worker and the firm sides. For the first, we define opportunities both as the number of formal jobs accessible (using 2006 Jobs Survey, definition 1), and as the number of establishments accessible (using the OSM amenities dataset, definition 2). For the second, we use measures of the accessible effective labour market pool defined as the number of working age individuals, the number of working age individuals with completed secondary education or more, and the number of working age individuals with tertiary education. The worker side is defined from the workers' neighbourhood of residence, while the firm side is defined from the firms' location. The analysis of firms is only carried out using firms in the 2006 Jobs Survey, since it is the only dataset that contains information on vacancies (i.e., positions firms cannot fill). We mostly focus the analysis on opportunities that can be reached within 45 and 60 minutes.

3.2.2 Accessibility in Accra

This section discusses accessibility to jobs in Accra using the different modes of commute. It looks at firms' 'accessibility' in a second stage. Table 6 contains accessibility indices for working age adults using the different modes of travel. To be more informative, these descriptive values are population-weighted.

On average, car users within Accra (AMA and extended suburbs) can access respectively 69% and 94% of total formal job opportunities within a 45 and 60 minutes timeframe (definition 1). The shares are similar when measuring opportunities by the number of accessible amenities (Table 7). Accessibility for car users is very large. However, these results do not take into account congestion and should be nuanced. During peak hours, accessibility is likely to be smaller. Using tro-tro, workers can access on average 4%, 32% and 62%, of total formal job opportunities in Accra, within 45, 60 and 90 minutes respectively. By comparison in Nairobi, users of the equivalent 'matatu' can only access 10% and 20%, for the first two thresholds (Avner & Lall 2016). While the spatial extents of the cities are similar, both close to 700km², Nairobi is larger than Accra in population terms with the metro area populated by more than 6 million people. Higher densities may explain the differences. Still, accessibility by tro-tro, the main mode of

commute, remains quite limited with only a third of formal jobs accessible in a 120 minutes two-way commute.

Pedestrian figures are even lower, as can be expected. Only 4%, 7% and 19% of jobs are accessible within 45, 60 and 90 minutes on average for workers commuting by foot, respectively. These figures suggest individuals using tro-tro and walking to work are penalized the most in terms of accessibility to formal jobs in Accra. Travelers using these modes are likely to be poor and middle-income households. Less than 15% of commuters in the city use cars for their daily travel. These inequalities are mirrored in the spatial patterns (Figures 9 to 20). Figures 21 to 23 captures how equally distributed job opportunities are in Accra through Lorenz Curves and their attached Gini coefficients, following the methodology of Avner & Lall (2016). Depending on the transport mode used, it can be seen that within 60 minutes, accessibility to opportunities are unequally distributed to various extents throughout the urban area of Accra, with tro-tro and walking users having the most unequal access. Gini coefficients are respectively, 0.49 and 0.73. These are extremely high. Although they are slightly lower for accessibility to amenities (0.46 and 0.60, respectively), they remain disproportionately large with respect to car users.

The picture is similar for firms. Table 8 contains the firms' labour pool access indices using the different modes of travel. On average, if all workers commuted by car firms would have access to 65% and 91% of the effective labour pool within a 45 and 60 minutes, respectively. The large numbers mirror the high accessibility to jobs for commuters using cars. Again, congestion is however not included in the time estimates here. If all working age adults used tro-tro to commute (as most do) firms would have on average, an effective labour pool force of 3%, 21% and 57% within 45, 60 and 90 minutes respectively. These numbers are small. Most adults commute with tro-tro in Accra, which means firms have access to half of the labour force pool if commuters are willing to travel more than two and a half hours daily two-ways; and to less than one fourth of the available labour force pool if commuters are willing to take two hours trips every day. As before, numbers are even smaller for pedestrian commuters. If all workers walked to work, firms would only be able to access an average of 3%, 6% and 14% of the effective labour force pool within 45, 60 and 90 minutes, respectively. The numbers are quite similar when restraining the working age pool to those with completed secondary education or more (Table 9). They are even smaller only when restricting the sample to those with tertiary education, which suggests residential sorting for highly educated workers farther from jobs (Table 10). This population group is however more likely to commute by car. The firm side approach we take here matters for firms' productivity. The size of the accessible labour pool reflects metropolitan-wide agglomeration economies. Higher firm density requires accessibility for and to workers. The low levels of the effective available labour pool may thus be partly responsible for the large share of the non-tradable informal service sector in the economy.

This section has highlighted the inequalities of access in Accra by the different modes of transport. These inequalities are likely to penalize poor households the most. Poor households are more likely to walk, and to a lesser extent use tro-tro for commuting to work. The data is not available for Accra, but research suggests that the cost of collective motorized urban transportation (such as tro-tros) is a high relative to household budgets in SSA's major cities. This renders it unaffordable on a daily basis, especially for the poorest (World Bank 2017). The poor are also more likely to live at the periphery of the city where formal employment opportunities are farther to reach. Even for middle-class households commuting by tro-tro, accessibility is low. This analysis does not consider the evolution of residential growth patterns. However, it is worth noting that the spatial layout of Accra, which is growing horizontally and is characterized by low-density sprawl, makes the issue of accessibility even more relevant. The World Bank (2015) estimated

that the highest population growth rates occurred in neighbouring districts about 10 km away from the city proper, and declined outside of that radius. The population of GAMA increased by 50% in 15 years (1985-2000) while the urban extent of the city increased by 160%.

4. Regression Analysis

This section aims at measuring the relationship between connectivity and economic outcomes using individual and firm level data. We first present the empirical strategy we adopt for both types of economic agents and then discuss our results.

4.1 Empirical Strategy & Limitations

We begin by focusing on labour outcomes. Using housing and population census data, we relate one's performance on the labour market to the accessibility measure of their neighbourhood of residence. Doing so brings up important issues for identification.

First, we cannot exclude measurement error from the fact that accessibility is assumed to be homogeneous by mode of transport within spatial units. Relatedly, we do not observe the preferred mode of transport for each individual or household, and our results are conditional on all workers choosing the same mode each time. A more important issue concerns residential sorting. A large literature in urban economics has shown that residential choices within cities are the result of a complex trade-off between access to amenities (Brueckner et al. 1999), distance to jobs (Zenou 2009), housing quality and housing supply (Rosenthal 2014). Higher income households may choose to locate in neighbourhoods with better infrastructure and thus better access to formal jobs. Without properly dealing with sorting across spatial units, we cannot fully disentangle the reverse causation due to a person's residential choice being related to its labour outcomes, further linked to its overall accessibility to jobs. While we are very well aware of this limitation, both the nature of our research question and available dataset restrict our capacity to address the issue properly. In our econometric analysis while we try our best to account for individual and neighbourhood characteristics, there could still be unobserved factors inducing bias. Similar endogeneity concerns apply when looking at the firms' side. The distribution of firms across space is far from random (see for instance Head & Mayer 2004). Despite our efforts to control for important observable firm characteristics that are likely to be correlated with both location and performance, we cannot rule out the possibility of *unobservables* contaminating our econometric estimates. We therefore interpret our results with great caution and describe our findings as associations. We also caution against interpreting the small size of the coefficients strictly. In spite of these limitations, the following empirical analysis is still highly instructive.

4.1.1 Labour outcomes

To measure the effect of job accessibility on labour market outcomes, we estimate the following equation:

$$L_{i,n.m} = \beta_0 + \beta_1 . A_n + X_i . \beta_2 + W_n . \beta_3 + \mu_m + \varepsilon_{i,n,m} \qquad (2)$$

where *i* denotes individual, *n* neighbourhood, and *m* municipality. The dependent variable $L_{i,n,m}$ is a binary indicator of individual *i*'s labour outcomes. The four outcomes we focus on are: being employed, economically inactive, self-employed without any employee, and working in the informal sector. A_n is the main variable of interest and is a job accessibility index defined at the neighbourhood level and expressed

in logs. In the vector X_i we parsimoniously control for age and its square, and marital status. We also control for educational highest achievement by including dummy variables for primary and tertiary education completion. $\varepsilon_{i,n,m}$ is the error term. We further introduce two neighbourhood level covariates in the W_n vector to capture neighbourhoods' socio-economic status. These are the percentage of individuals with access to electricity and the share of adults having completed no more than primary education. We also include municipality fixed effects μ_m (Accra Metropolitan Area, Tema, and outer neighbourhoods) to moderate sorting related issues. We restrict our analysis to individuals aged 16 to 65 years old and cluster standard errors at the neighbourhood levels. The main coefficient of interest is β_1 and measures the percentage point variation in the probability of being employed, inactive, informal or self-employed associated with a one hundred percent increase in job accessibility (or a doubling of job accessibility). We also run separate regressions by gender, and specific for the working-age with less than secondary education. We estimate both linear probability and logistic regression models to account for the dichotomous nature of the dependent variables. Results are unchanged.

4.1.2 Firm vacancies

We now turn to the effect of accessibility on firm vacancies. Using firm answers from the 2006 job survey, we estimate equation 3:

$$V_{j,s,n.m} = \gamma_0 + \gamma_1 . E_n + C_j . \gamma_2 + \sigma_k + \omega_s + \mu_m + \eta_{j,n,m} \quad (3)$$

where we regress the outcome of firm j in sector s and neighbourhood n on the labour force accessibility index E_n. We only consider a dummy variable indicating at least one vacancy as left-hand side variable. We control for the number of years the firm has been operating and its square, and the size of its workforce in C_j. We add ownership type fixed effects σ_k, industry sector fixed effects ω_s, and municipality fixed effects μ_m. $\eta_{j,n,m}$ is the error term. Equation 3 is estimated using least squares and logistic regressions. The main coefficient we are in interested in here is γ_1. It measures the percentage point variation in the probability of having unfilled vacancies associated with a one hundred percent increase in job accessibility. We cluster our standard errors at the neighbourhood level.

4.2 Results

Tables 11 and 12 display the results based on equation (2) using accessibility indices defined by the three main modes of commutes within 45 and 60 minutes, respectively. The main outcomes here are different variables of labour market participation as explained above. Columns 1-4 display the results using OLS, while columns 5-8 are Logit estimates (marginal effects conditional on covariates held at their means). Each cell represents an independent regression, printing the point estimate of the accessibility measure on a labour market outcome. All regressions control for individual characteristics and neighbourhood characteristics, as well as municipality fixed-effects, as specified above. The top panel of the table groups results using accessibility measures to formal jobs (2006) and the bottom one accessibilities to amenities (2015). These first two tables look at the effect for all working-age individuals in our sample. We focus on the OLS results for simplicity but coefficients are stable and very close in size irrespective of the estimator.

Both increased accessibility within 45 and 60 minutes display similar patterns with respect to their relationship to labour outcomes. A 100% increase in pedestrian accessibility to formal jobs (Panel A), is associated with on average, a 0.4 percentage point (pp) higher likelihood of being employed, and a similar

negative probability of being inactive. This result is significant at 5% level for the 45-minutes measure and at 10% levels for the 60-minutes measure. While point estimates are also positive with other modes, being able to walk to work seem to matter the most with respect to formal jobs. This might be related to the larger spatial concentration of formal jobs near the CBD in our sample. Looking at amenities (Panel B) suggests increased pedestrian accessibility also matters for shorter commutes, but other modes are also important. Doubling car accessibility within 45 minutes is positively associated with the probability of being employed (1.8 pp increase). Tro-tro accessibility seems to matter the most for longer commutes (60 minutes accessibility). Point estimates are the largest with a 100% increase in tro-tro accessibility within 60 minutes associated with 0.55 pp higher probability of being employed on average. This is significant at 5% level. The increases in employment are mirrored in a reduction in the probability of working in the informal sector. For the 45-minute commute, tro-tro and walking seem to be the most related with a lower likelihood of informal sector employment; while increased car accessibility has the largest effect on the longer commute. These results are sensible in that accessibility by all modes seems to matter for the probability of being employed, with pedestrian and car accessibility being the most important in 45-minutes travel times, while tro-tro dominates in the 60-minute frame.

The relationship between job accessibilities and labour market outcomes shows more distinct patterns when we allow for heterogeneity across gender. In Tables 13 to 16, we show heterogeneous effects for females and males side by side, with OLS estimates in the first two, and Logit in the second two tables. As with previous results we focus on OLS.

Again, the relationship of accessibility to formal jobs (2006) and labour market outcomes is relatively low. Only pedestrian accessibilities in shorter and longer commutes are associated with a higher likelihood of being employed (and active for females), for both males and females alike. The sizes are close to our pooled results. When looking at amenities (Panel B) the picture is more nuanced. Across the board, the female workforce benefits significantly more from greater accessibilities to amenities (2015) than their male counterpart. Almost all measures of accessibility are linked to better job prospects for female workers. For shorter commutes (Table 13), again both car and pedestrian accessibility are negatively related to the probability of being inactive for female, while only car accessibility is positively associated with the likelihood of employment for male. Accessibility by tro-tro and walking both are negatively related to the probability of working in the informal sector here, suggesting informality might be a choice related to the lack of access.

For longer commutes (Table 14), both tro-tro and walking seem to matter for the likelihood of employment and activity for female workers. Higher accessibility by foot, tro-tro, and car also greatly decrease their likelihood to seek sole self-employment. These results are interesting in that they suggest different modal choices for commuting to jobs between females and males, with the former likely to rely less on cars. A small literature has looked at this question in developing countries, and finds that women do indeed predominantly choose to walk which limits the size of their effective labour market (Baker et al. 2015). Further, the difference suggests there is a gender-segmentation of the labour markets, with a predominance of informality for females, as discussed in the previous section (Table 15). In our sample, 80% of females work in the informal sector, compared to only 62% of males. The choice of working in the informal non-tradable service sector is often viewed as a response to the lack of accessibility in large cities of developing countries (Avner & Lall 2016). Finally, given that our power to disentangle residential sorting here is limited, this heterogeneous patterns can potentially also be explained by the different degrees of sorting power within households. If households sort based on where the male household

heads work, we can expect to find a stronger relationship between accessibility and females' labour outcomes.

Tables 17 to 20, display the effects of accessibility on labour outcomes for working-age individuals with less than secondary education. This sector of the workforce is more likely to work in the informal sector and exploring how accessibility matters specifically provides interesting intuitions. OLS estimates are presented in the first two tables, with Logit in the second two. As with previous results we focus on OLS. Firstly, higher accessibility to formal jobs (Panel A) has a limited effect on the labour outcomes of this group. No coefficient is significant in the 60-minutes frame, with only a small association captured with an increase in 45-minutes pedestrian accessibility. Similar patterns emerge with respect to accessibility to amenities. Here, the probability of employment depends little on higher accessibility. The only discernible pattern concerns how irrespective of the mode of transport, accessibilities are linked to a lower probability of working in the informal sector. These patterns are interesting in that they suggest accessibility matters less for the less educated in terms of overall employment, with a partial effect on the probability of working in the formal sector. Understanding better how human capital levels and accessibility are related in cities of developing countries is important. As mentioned earlier, poorer households are likely to be more penalized with expensive and long commutes. These are also likely to be less educated and rely mostly in the informal sector.

The results in this section are limited in that we cannot rule out that they are driven by residential sorting. In the case that poor or rich households are unevenly distributed across space in Accra, our findings may reflect these mechanical relationships. For instance, accessibility by car or tro-tro may be picking up the effect of living a neighbourhood with higher-quality of infrastructure (i.e., roads). As discussed, our municipality fixed-effects should marginally reduce this bias but cannot take care of the endogeneity issue completely. The patterns we find here are still telling: accessibility to amenities and formal jobs does seem to have a positive correlation with labour outcomes. This relationship is larger for female members that are plausibly less mobile, have a higher propensity to work in informal non-tradable sectors and have less bargaining power within households. Results concerning the effect on those with less than secondary education are difficult to interpret.

Finally, we look at the other side of the question: are firms affected by accessibility? Is the likelihood of unfilled-positions related to a firms' limited access to the effective labour pool in Accra? Table 21 looks at this question, displaying results from equation (3) both using OLS and Logit estimators. This table is organized as before, each cell represents the estimated coefficient between the firms' accessible labour force pool and its probability of having vacancies. We distinguish between accessibility to the overall working-age pool, those with secondary education or more, and workers with tertiary education only.

Overall, we find that an increase in the accessible labour force within 60 minutes by foot reduces firms' vacancies. This is only true for the higher-qualified labour force (with completed secondary education or more, and tertiary education), with no effect being picked up for the overall labour force. These results are consistent with our demand-side patterns, in that we only picked up a positive association of pedestrian and labour outcomes when using the firms' 2006 sample. The small sample size and large set of fixed effects limit the power of our estimates. To some extent, results here can be considered a robustness test. The fact that most coefficients are not significant but consistently negative supports our overall findings regarding the negative effect the lack of accessibility has on overall firm's productivity and employment outcomes of the labour force.

5. Policy Discussion: Increasing Accra's Accessibility

The main contribution of this paper has been to quantify accessibility disparities across Accra, highlighting not only gender disparities but also spatial inequalities. This section goes further in discussing policy options.

Policies that impact the transport structure of a city are very complex. They not only include infrastructure investments, but also urban planning and land use policies, systemic reforms, information campaigns and even group-specific targeted strategies, among many others. The need for comprehensive and multi-nodal strategies, encompassing both supply and demand-side measures further add to these difficulties. Further, public transport policies go beyond infrastructure investments. They need to understand their linkages to land use, human behaviour, the environment, and affordability. Optimal transport systems also require a good understanding of existing networks to achieve integrated grids where transfer requirements and route duplications are minimized (Fang et al. 2015). Finally, elements of financial sustainability and institutional arrangements are also central (World Bank 2014).

Because of these complexities, the impact of a single transport-related policy is very hard to quantify without considering general equilibrium effects, particularly in medium to long-term perspectives. A recent literature in urban and transport economics (see e.g., Tang 2016, Heilmann 2017) has shown that policies such as BRTs or congestion charges have not only an effect on traffic but also on the re-allocation of economic activities and residential patterns, and as such on housing prices, informality, and pollution, for instance.

The results of this paper emphasize the need to incorporate affordability and gender-dimensions into public transport reforms in Accra. Because of the set up and data limitations we cannot model changes in accessibility differently by income-groups or gender in this paper. Further, we cannot really estimate general equilibrium changes from specific transport-related policies. Still, we find interesting to carry the following exercises.

We consider two city-wide reductions in tro-tro travel times of 10 and 20 minutes (Table A1). For instance, under the 10 minutes simulation residents can access in 45 minutes the jobs they had access to within a 55-minute one-way commute. We focus on this smallest reduction as it is a target city authorities can realistically achieve in the short to medium term. Table A1 and A2 in Appendix I show that under this scenario, residents have a greater average access to employment opportunities. For instance, formal job accessibility within 60 minutes increases by 10 pp on average. Overall this connectivity improvement is accompanied by a reduction in spatial inequality of access (for trotro users). We display the Lorenz curve inward shifts resulting from our simulation in Figures A1-3. The dashed-line displays current estimates while the solid line incorporates the 10 minutes city-wide reduction. This 10-minute reduction across all of Accra's neighbourhoods translates in heterogeneous accessibility gains, however. In Figures A4 and A5, we map changes in accessibility by neighbourhood. We find that for relatively short commutes of 45 minutes, the accessibility of central city residents increases the most. For longer 60-minute journeys, the accessibility of Northern suburbs residents improves the most. Tema residents experience relatively small accessibility gains in each case. While limited, these results pinpoint on the importance of targeting transit policies and integrating networks for areas that are now less accessible.

6. Conclusions

This paper measures accessibility to employment and its relationship with resident's labour outcomes and firms' employment capacities in Accra, Ghana's capital and its largest city. One of its main contributions is to provide consistent estimates of accessibility to jobs using the three main modes of commute (i.e., cars, walking and tro-tro) across the city's neighbourhoods.

Our findings suggest highly unequal spatial patterns of accessibility to jobs, further affected by the mode of transport chosen. Car users (less than 15% of city residents) are the best suited to access jobs in the city. Close to 75% of adults use tro-tro for their daily commutes in Accra, however. We find that on average, only 32% of formal jobs and 20% of job-related amenities are accessible within a 60 minutes one-way commute by trotro for Accra and its periphery. We complement these findings by looking at how accessibility relates to individual labour outcomes. Our results overall indicate that a better access to employment opportunities is correlated with a higher likelihood of employment and a lower probability of engaging in the informal sector. We also find that the worse the access to opportunities the more likely a person is to be sole self-employed. This is consistent with self-employment being a constrained occupational choice for individuals lacking viable alternatives. Our findings are generally stronger for women. In other words, women tend to be the most affected by their access to transportation, supporting evidence found in other developing countries that women tend to be less mobile (Baker et al. 2015). They also tend to have less bargaining power in their household residential location decisions. These results are supported by our findings when looking at how formal firms' capacity to fill vacancies is affected by their access to the local labour force. We find evidence of a negative relationship between having unfilled vacancies and greater access to the higher educated labour force pool.

While our findings cannot be interpreted as causal relationships, they are quite informative for policy makers and city planners. The results of this paper emphasize the need to incorporate affordability and gender-dimensions into public transport reforms in Accra. We find evidence of important spatial disparities in terms of access to employment opportunities across the various neighbourhoods of Accra, as well as heterogeneous gender effects of connectivity on labour outcomes. Further, both individual labour outcomes and firm performance seem affected by how efficient one's access to transportation is. With the high rates of urbanisation in SSA expected to continue in the next few decades, policy makers must plan the necessary investments to make cities both productive and liveable. Accessibility to employment opportunities is among one of these many challenges. Poorer households and rural migrants located in peripheral and difficult-to-access areas usually find it hard to secure and engage in meaningful economic activities. At the more aggregated level of the city, poor connectivity prevents the growth of clusters and urban productivity. As discussed, there are many ways to influence accessibility within cities including but not limited, to investments in public transit, reforming land-use regulations and the careful design of low-income housing policies. Increasing accessibility is not only important for city dwellers, it is also essential to stimulate agglomeration economies and economic growth in the longer run.

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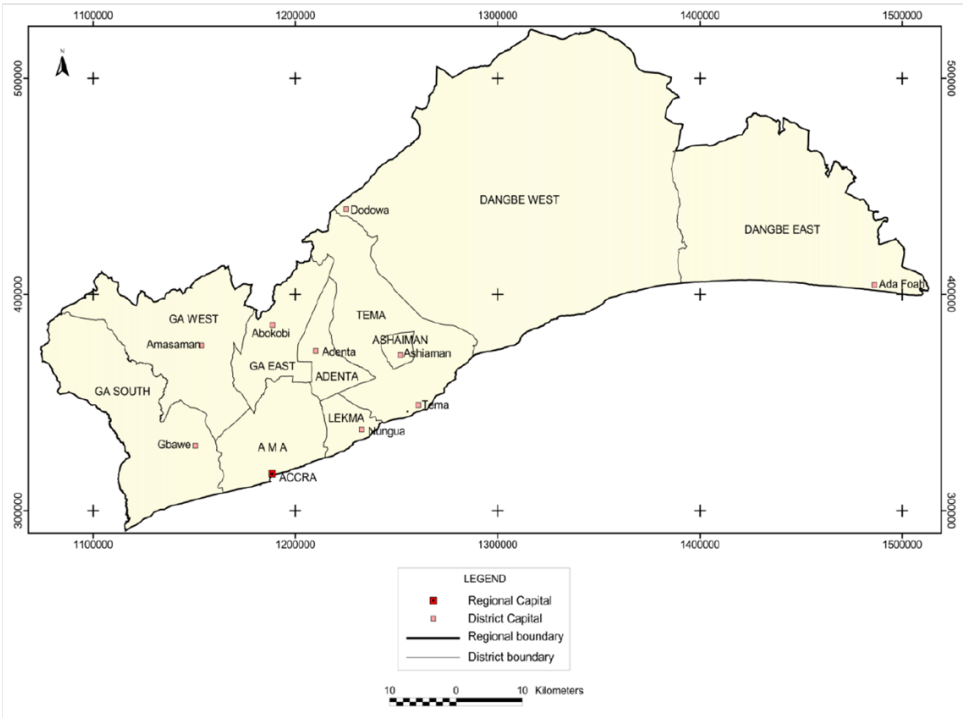
Main Tables & Figures

Accessibility & Labour Outcomes in Accra

July 28th, 2017

1. Figures

Figure 1. Greater Accra Region, Main Districts



Notes: There are 10 Districts in the GAMA. Obtained from Ghana Statistical Office, Census 2010 Report.

Figure 2. Kernel Densities - Formal Jobs (2006)

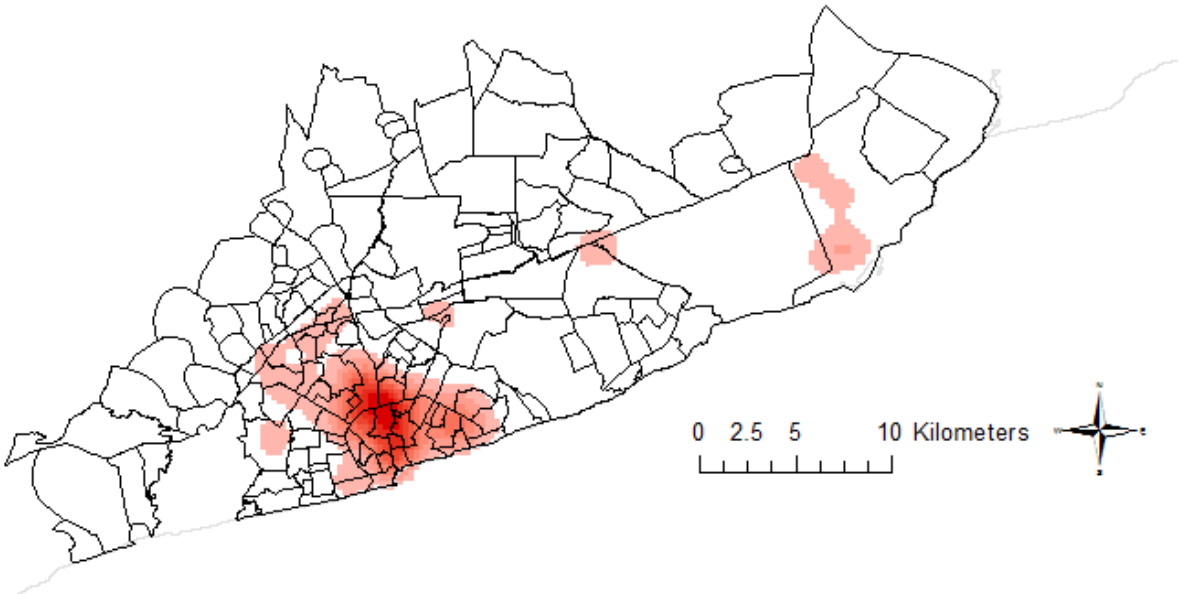


Figure 3. Kernel Densities - OSM Establishments (2015)

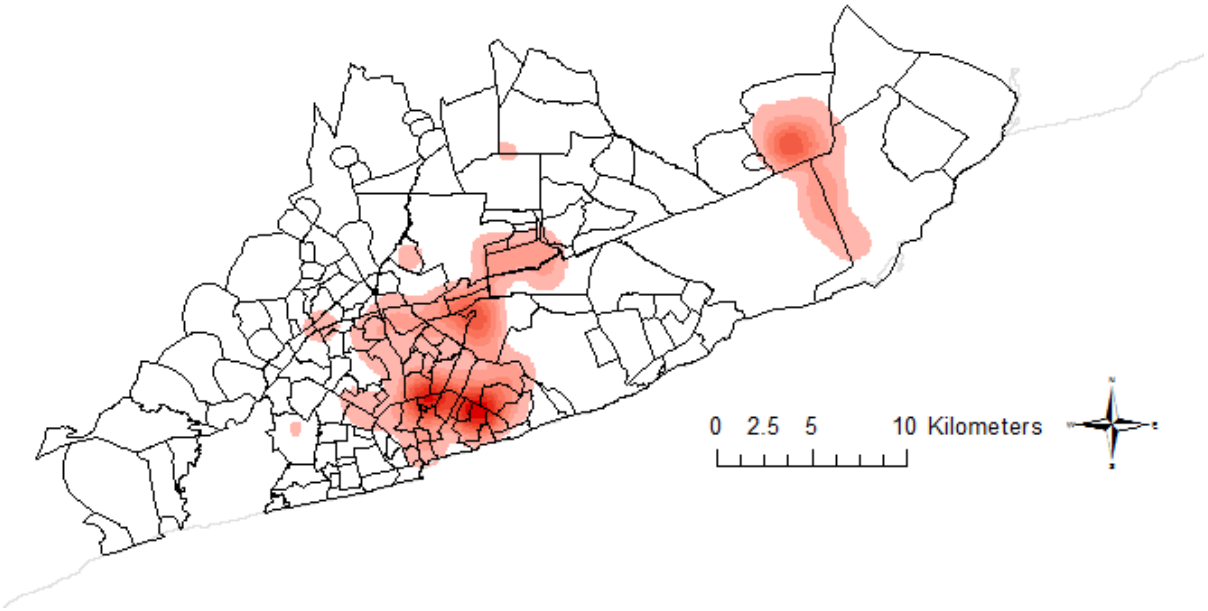
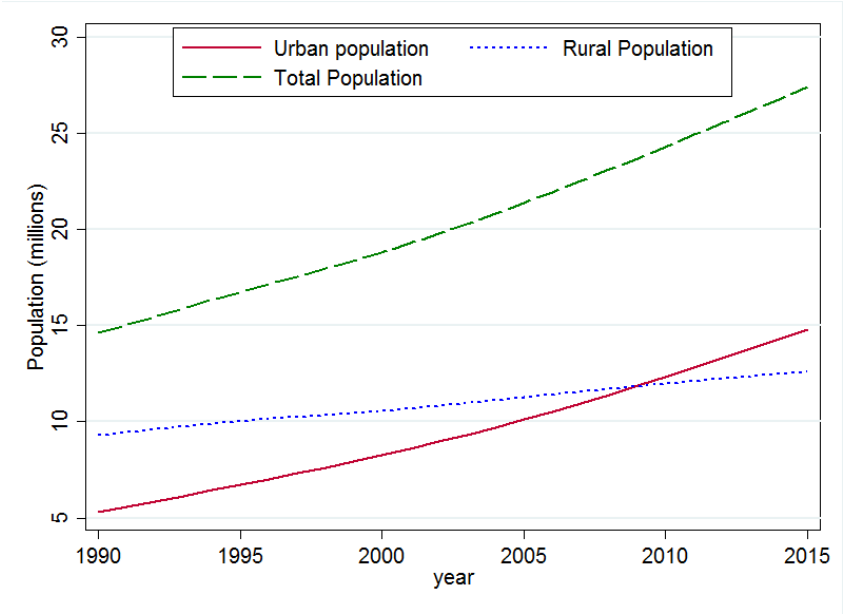


Figure 4. Accra Population (Urban, Rural, Total) 1990-2015.



Notes: Data from Census 2010.

Figure 5. Distribution of Roads (OSM) in Accra study area

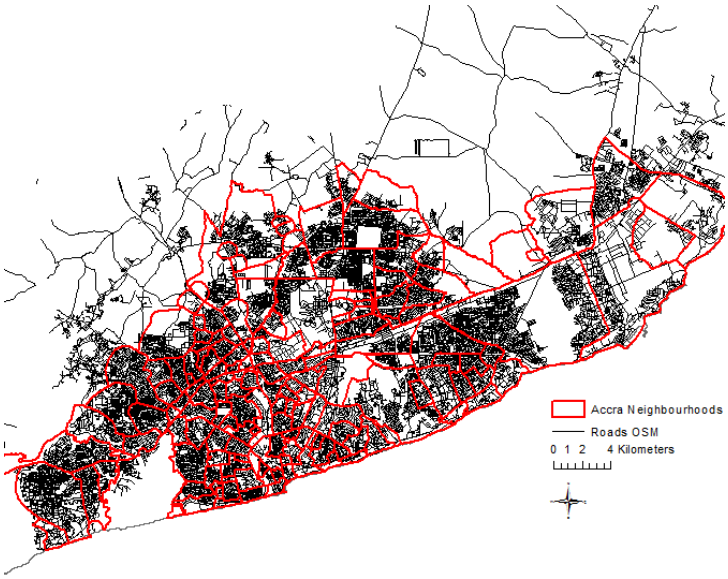
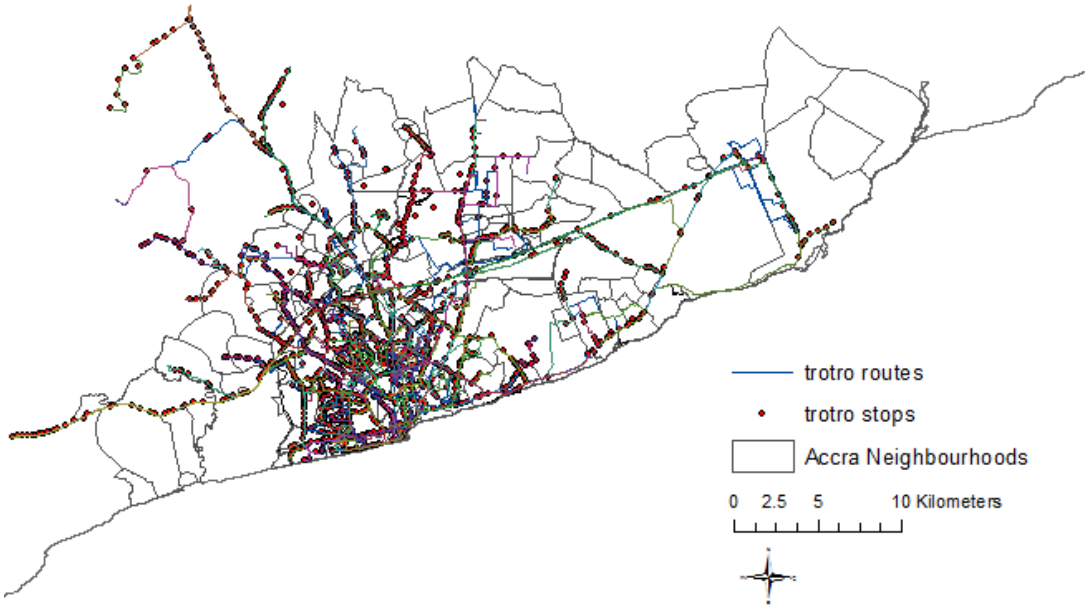
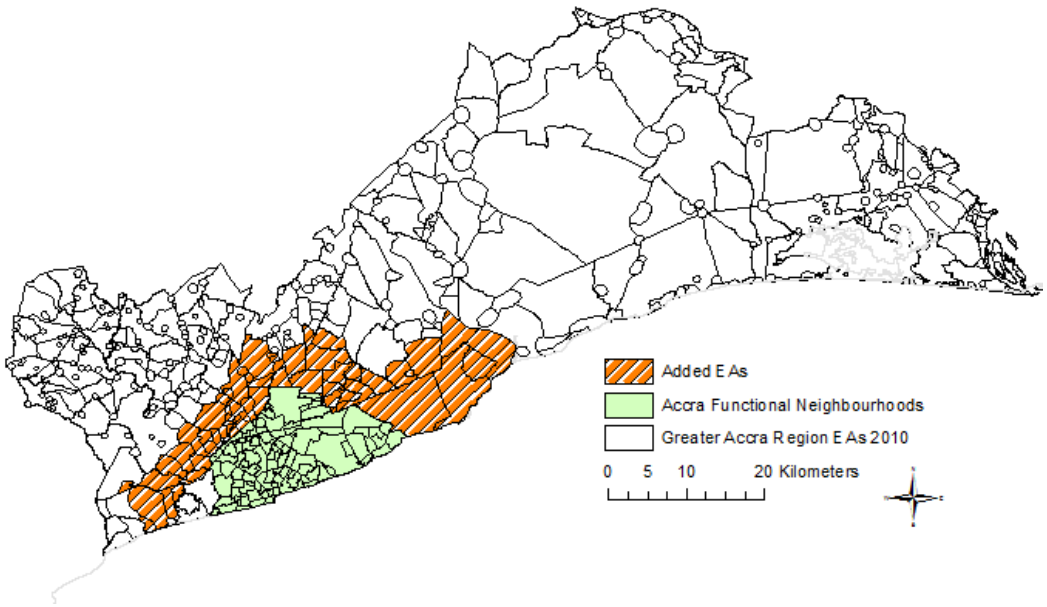


Figure 6. Trotro Routes in Accra (Mapped 2015)



Notes: Data from AFD (2016)

Figure 7. Spatial Area of Analysis (N=161)



Notes: data from OSM and Weeks et al. (2010)

Figure 8. Working Age Population (Census 2010)

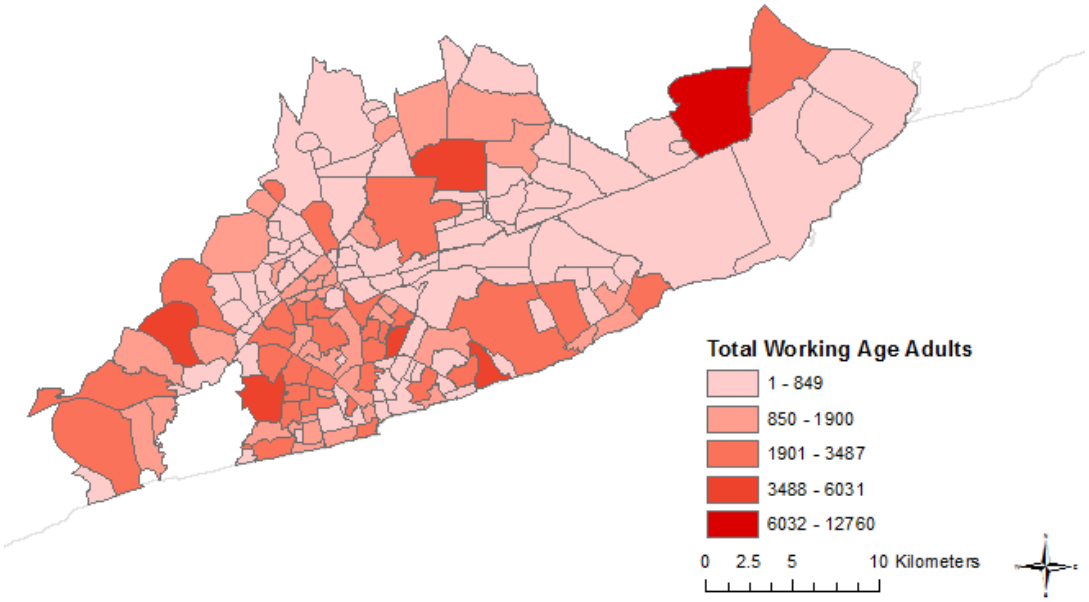


Figure 9. Accessibility to Formal Jobs Walking, 45 min

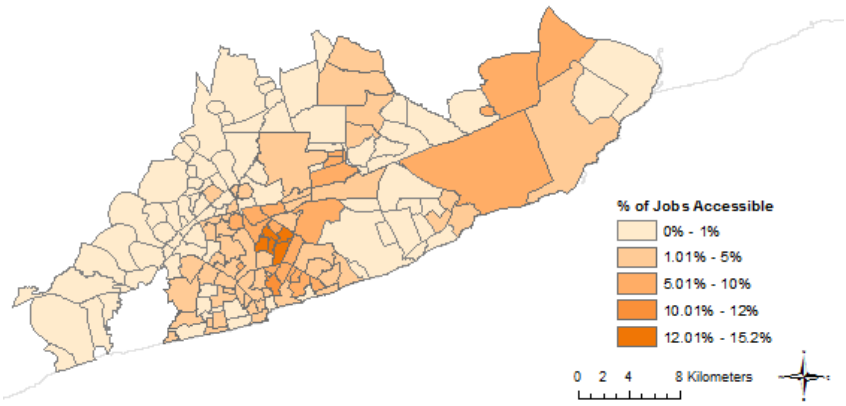


Figure 10. Accessibility to Formal Jobs by Trotro, 45 min

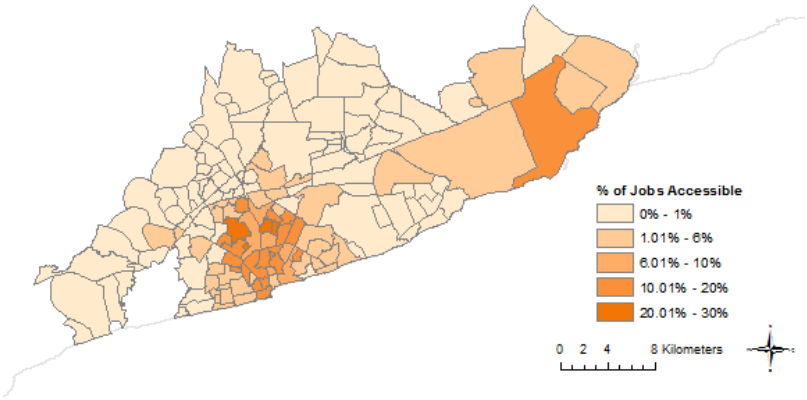


Figure 11. Accessibility to Formal Jobs by Car, 45 min

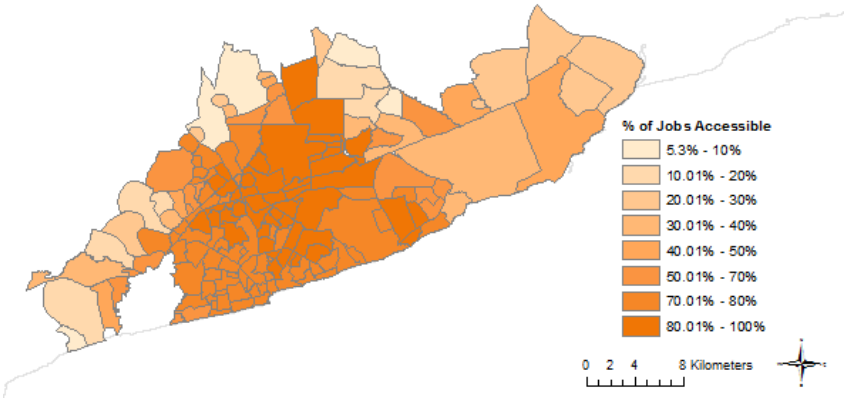


Figure 12. Accessibility to Formal Jobs Walking, 60 min

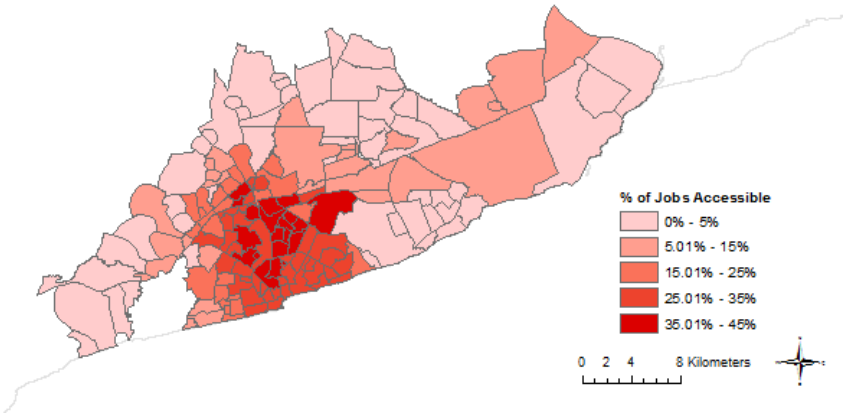


Figure 13. Accessibility to Formal Jobs by Trotro, 60 min

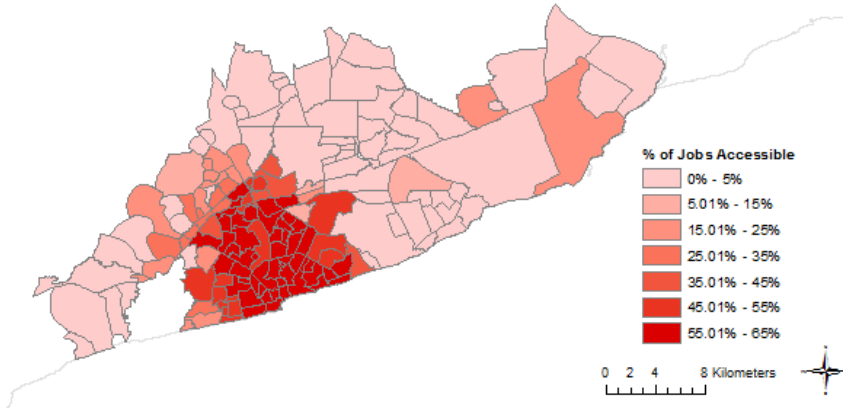


Figure 14. Accessibility to Formal Jobs by Car, 60 min

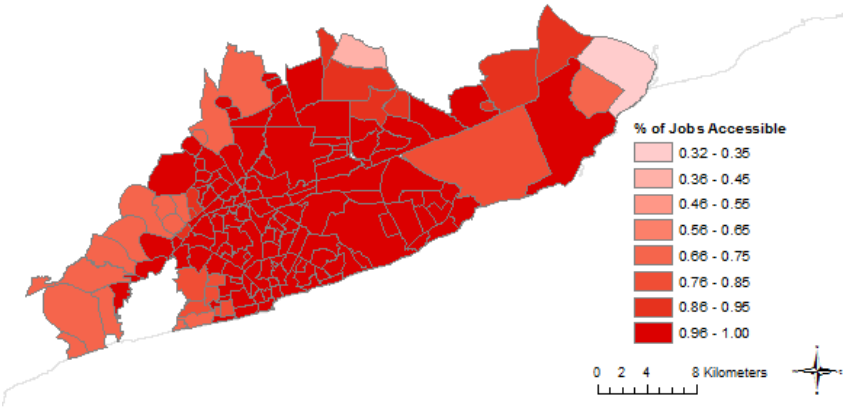


Figure 15. Accessibility to Amenities Walking, 60 min

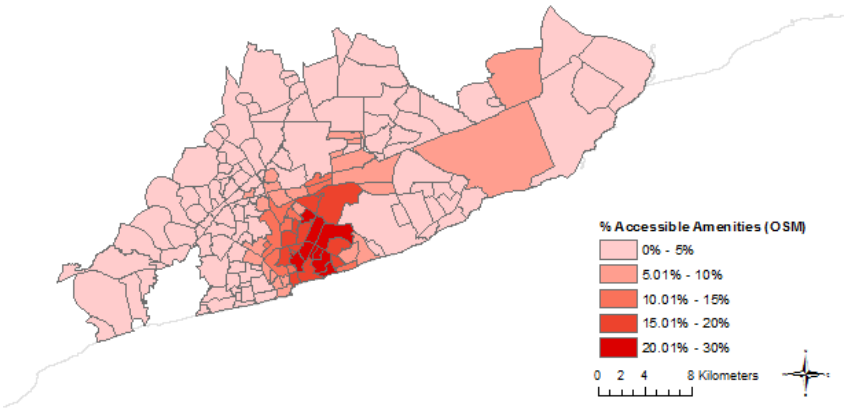


Figure 16. Accessibility to Amenities by Trotro, 60 min

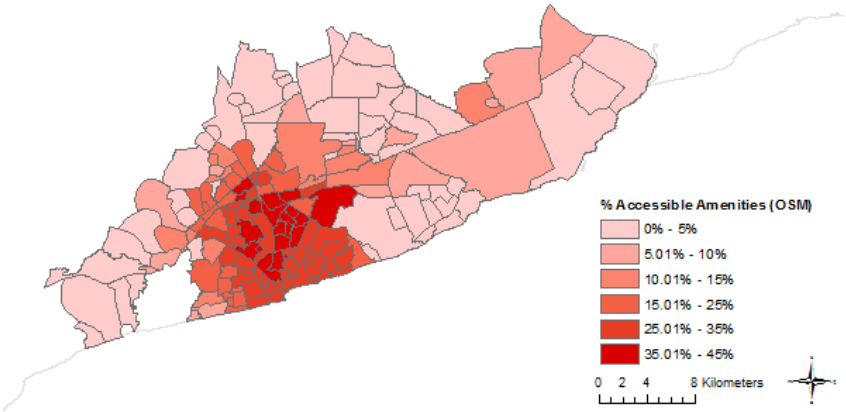


Figure 17. Accessibility to Amenities by Car, 60 min

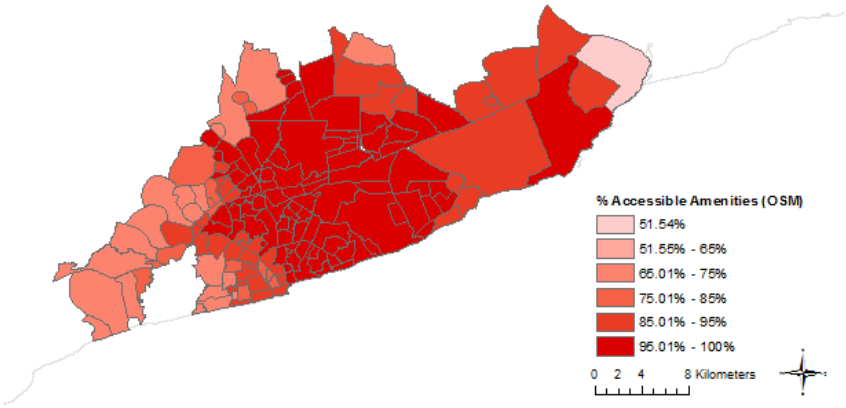


Figure 18. Accessible Labour Force Pool Walking, 60 min

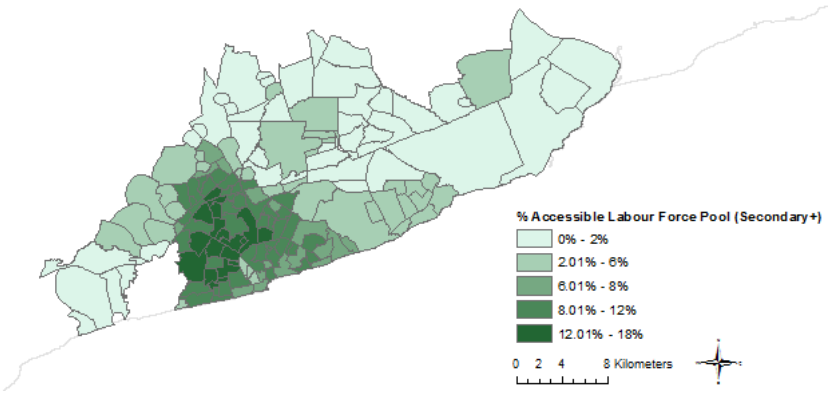


Figure 19. Accessible Labour Force Pool TroTro, 60 min

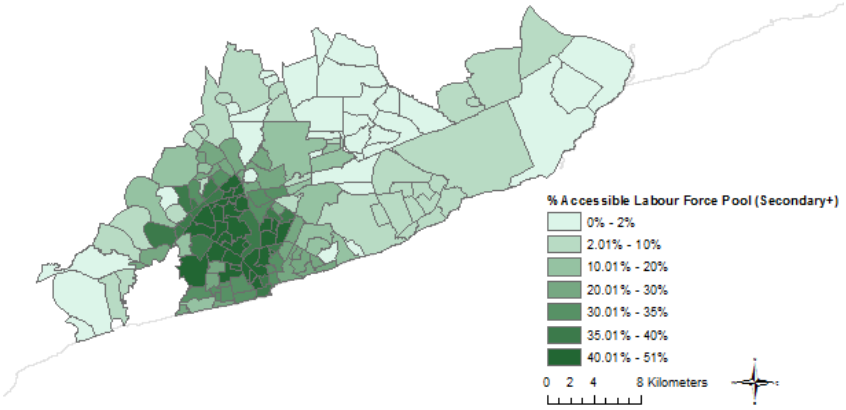


Figure 20. Accessible Labour Force Pool Car, 60 min

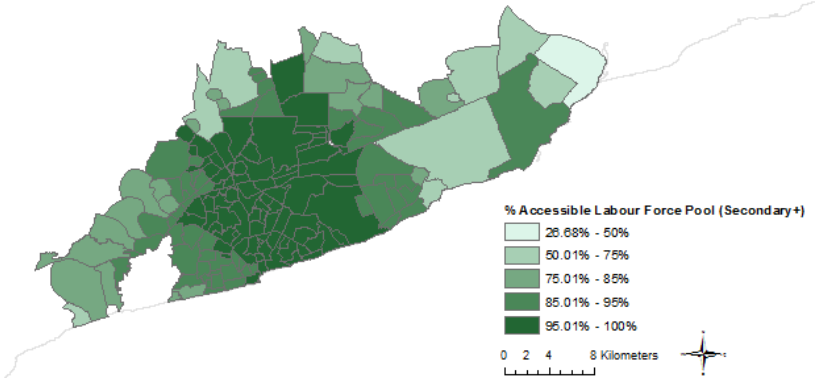


Figure 21. Lorenz Curve of Accessibility - Amenities (60 min)

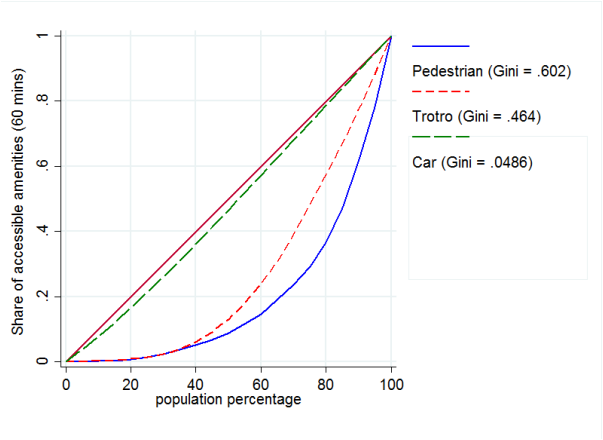


Figure 22. Lorenz Curve of Accessibility - Formal Jobs (60 min)

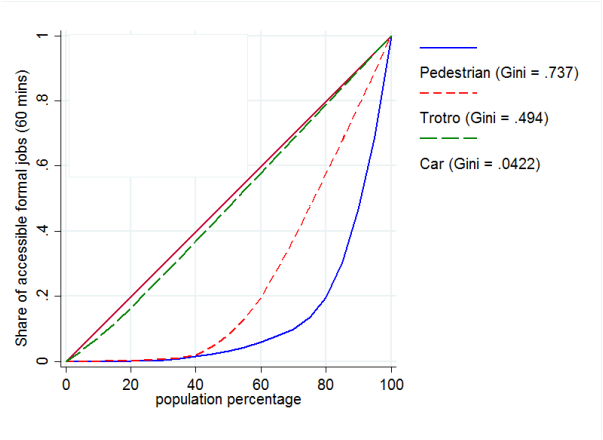
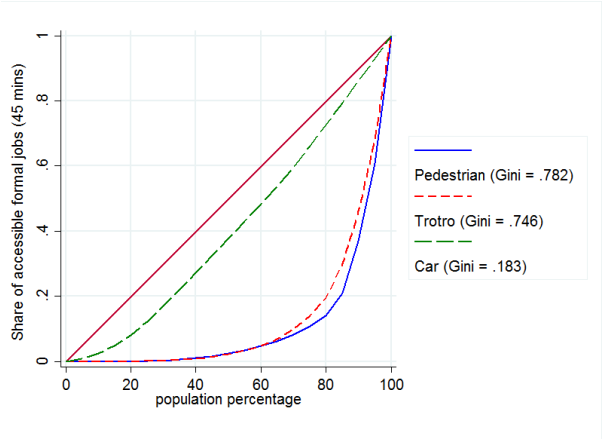


Figure 23. Lorenz Curve of Accessibility - Formal Jobs (45 min)



2. Tables

Table 1. Accessibility to Work in Greater Accra (Employed)

Facing difficulty accessing workplace:		
	N	%
Yes	498	51.29
No	473	48.71
Main difficulty:		
Bad roads	249	51.23
No access road	126	25.93
Distance too long	72	14.81
Difficulty getting vehicle	22	4.74
No money for transport	4	0.82
Unreliable transportation to workplace:		
Not reliable	422	45.18
Reliable	301	32.23
Reliable sometimes	211	22.59

Notes:Data from TID 2012, sample of Employed in GAMA.

Table 2. Accessibility to Work in Greater Accra (Unemployed), %

Currently unemployed and searching for job:	
No	87.46
Yes	10.63
Main difficulty (for yes):	
Distance too far	14.89
Workplace inaccessible	26.24
Out of season	26.24
Retrenchment	7.09
Other	25.5

Notes:Data from TID 2012, sample of unemployed and actively looking for a job in GAMA. N=156 (of 1127 unemployed).

Table 3. Census Data 2010 (10 % sample), 16-65 yrs old:

	Mean	**Std. Dev.**	**N**
Employed	0.681	0.466	198201
Unemployed	0.058	0.234	198201
Inactive	0.261	0.439	198201
Self-employed (alone)	0.471	0.499	139855
Self-employed (employees)	0.074	0.262	139855
Employee	0.364	0.481	139855
Private informal	0.721	0.449	139855
Private formal	0.181	0.385	139855
Services & sales workers	0.37	0.483	139855
Individual characteristics:			
Females	0.518	0.5	198201
Age	32.726	12.103	198201
Primary only	0.077	0.267	198201
Secondary incomplete	0.430	0.495	198201
Secondary complete or more	0.250	0.433	198201
Urban	0.989	0.103	198201
Electricity	0.919	0.273	190192
Resident less than 5 years	0.261	0.439	198201
# Children	1.521	1.869	102592

Notes: Census 2010, Individual level census data, restricted to Accra + surroundings. Variable definitions and spatial area definition in section 3.

Table 4. Census Data 2010 (10 % sample), 16-65 yrs old by Sex :

	Mean	**Std. Dev.**	**N**
Females:			
Employed	0.662	0.473	102592
Unemployed	0.06	0.238	102592
Inactive	0.278	0.448	102592
Self-employed (alone)	0.594	0.491	70765
Self-employed (employees)	0.066	0.248	70765
Employee	0.245	0.43	70765
Private informal	0.814	0.389	70765
Services & sales workers	0.525	0.499	70765
Males:			
Employed	0.701	0.458	95609
Unemployed	0.056	0.23	95609
Inactive	0.243	0.429	95609
Self-employed (alone)	0.344	0.475	69090
Self-employed (employees)	0.082	0.275	69090
Employee	0.486	0.5	69090
Private informal	0.625	0.484	69090
Services & sales workers	0.211	0.408	69090

Notes: Census 2010, Individual level census data, restricted to Accra + surroundings. Variable definitions and spatial area definition in section 3.

Table 5. Geo-located firms (Jobs Survey 2006)

	Mean	Std.Dev	Min	Max	Obs
Sector: Agriculture	0.012	0.109	0	1	501
Sector: Industry	0.353	0.478	0	1	501
Sector: Services	0.635	0.482	0	1	501
# employees (2006)	80.339	221.732	0	3760	499
Age	15.186	13.313	0	78	435
Firms with vacancies	0.289	0.454	0	1	501
# of vacancies	3.253	14.5	0	225	501

Notes: Jobs Survey 2006, GSS.

Table 6. Summary: Accessibility to formal jobs, by mode of commute in Accra

	Obs	Mean	Std.Dev	Min	Max
By Car					
45 min	161	0.694	0.240	0.053	0.998
60 min	161	0.938	0.102	0.317	0.998
90 min	161	0.998	0.00	0.998	0.998
Walking					
45 min	161	0.037	0.070	0.00	0.364
60 min	161	0.072	0.109	0.00	0.467
90 min	161	0.188	0.209	0.00	0.605
By Trotro					
45 min	161	0.041	0.062	0.00	0.285
60 min	161	0.323	0.256	0.00	0.631
90 min	161	0.621	0.191	0.00	0.889

Notes: Accessibility Index to Formal Jobs (Jobs Survey 2006), population weighted (Census 2010, 10% sample)

Table 7. Summary: Accessibility to amenities, by mode of commute in Accra

	Obs	Mean	Std.Dev	Min	Max
By Car					
45 min	161	0.651	0.199	0.062	0.968
60 min	161	0.899	0.095	0.515	0.974
90 min	161	0.974	0.00	0.973	0.974
Walking					
45 min	161	0.030	0.034	0.00	0.182
60 min	161	0.056	0.061	0.00	0.285
90 min	161	0.134	0.131	0.001	0.499
By Trotro					
45 min	161	0.030	0.039	0.00	0.151
60 min	161	0.192	0.143	0.00	0.433
90 min	161	0.496	0.139	0.00	0.741

Notes: Accessibility Index to Amenities (OSM 2015), population weighted (Census 2010, 10% sample)

Table 8. Summary: Available labour force pool (all working age), by mode of commute in Accra

	Obs	Mean	Std.Dev	Min	Max
By Car					
45 min	161	0.650	0.229	0.076	0.969
60 min	161	0.911	0.108	0.278	1.00
90 min	161	1.00	0.001	0.990	1.00
Walking					
45 min	161	0.032	0.028	0.00	0.110
60 min	161	0.062	0.047	0.00	0.174
90 min	161	0.141	0.099	0.00	0.384
By Trotro					
45 min	161	0.028	0.027	0.00	0.119
60 min	161	0.207	0.169	0.00	0.523
90 min	161	0.569	0.218	0.00	0.754

Notes: Accessible Labour Force Pool, working age (16-65 years old) (Census 2010, 10% sample)

Table 9. Summary: Available labour force pool (secondary or more), by mode of commute in Accra

	Obs	Mean	Std.Dev	Min	Max
By Car					
45 min	161	0.669	0.233	0.053	0.979
60 min	161	0.922	0.105	0.267	1.00
90 min	161	1.00	0.00	0.995	1.00
Walking					
45 min	161	0.032	0.026	0.00	0.104
60 min	161	0.061	0.045	0.00	0.169
90 min	161	0.141	0.095	0.00	0.364
By Trotro					
45 min	161	0.027	0.024	0.00	0.101
60 min	161	0.204	0.164	0.00	0.509
90 min	161	0.578	0.225	0.00	0.773

Notes: Accessible Labour Force Pool, Complete secondary or more (16-65 years old) (Census 2010, 10% sample)

Table 10. Summary: Available labour force pool (Tertiary education), by mode of commute in Accra

	Obs	Mean	Std.Dev	Min	Max
By Car					
45 min	161	0.528	0.183	0.042	0.774
60 min	161	0.729	0.082	0.218	0.790
90 min	161	0.790	0.00	0.786	0.790
Walking					
45 min	161	0.025	0.020	0.00	0.080
60 min	161	0.048	0.035	0.00	0.130
90 min	161	0.110	0.073	0.00	0.278
By Trotro					
45 min	161	0.021	0.018	0.00	0.075
60 min	161	0.158	0.126	0.00	0.392
90 min	161	0.455	0.178	0.00	0.61

Notes: Accessible Labour Force Pool, Tertiary education (16-65 years old) (Census 2010, 10% sample)

Table 11: Accessibility to Jobs & Labour market outcomes: 45 mins

	OLS				Logit			
	employment	inactive	self-emp alone	informal	employment	inactive	self-emp alone	informal
Panel A: Accessibility to jobs								
within 45 min by foot	0.0041**	-0.0041**	0.0011	0.0030	0.0048**	-0.0039**	0.0012	0.0037
	(0.0018)	(0.0019)	(0.0028)	(0.0035)	(0.0021)	(0.0019)	(0.0031)	(0.0041)
within 45 min by trotro	0.0012	-0.0004	-0.0009	-0.0004	0.0012	0.0001	-0.0012	-0.0005
	(0.0013)	(0.0014)	(0.0027)	(0.0042)	(0.0016)	(0.0015)	(0.0031)	(0.0051)
within 45 mins by car	0.0064	-0.0061	0.0015	0.0063	0.0070	-0.0049	0.0019	0.0071
	(0.0086)	(0.0089)	(0.0059)	(0.0092)	(0.0103)	(0.0094)	(0.0068)	(0.0116)
Panel B: Accessibility to amenities								
within 45 min by foot	0.0040*	-0.0049**	-0.0064**	-0.0130***	0.0044	-0.0046*	-0.0074**	-0.0159***
	(0.0023)	(0.0025)	(0.0026)	(0.0038)	(0.0028)	(0.0026)	(0.0029)	(0.0046)
within 45 min by trotro	-0.0013	0.0004	-0.0067**	-0.0119***	-0.0022	0.0013	-0.0079***	-0.0143***
	(0.0023)	(0.0023)	(0.0026)	(0.0040)	(0.0029)	(0.0026)	(0.0029)	(0.0050)
within 45 mins by car	0.0182**	-0.0199**	-0.0059	-0.0091	0.0213**	-0.0200**	-0.0061	-0.0121
	(0.0078)	(0.0082)	(0.0060)	(0.0067)	(0.0095)	(0.0088)	(0.0069)	(0.0085)
N	180035	180035	125453	125453	180035	180035	125453	125453
Ind. & nbhd controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipality fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Marginal effects are reported for logit. Robust standard errors in parenthesis clustered at the neighbourhood level. The accessibility measures are in logs. Individual controls include dummy variables for the level of education (secondary excluded) and for marital status, as well as age, age squared, and sex. Neighbourhood controls include the share of neighbourhood residents with less than primary education and with access to electricity. *p $\leq$ 0.10 ** p$\leq$0.05 *** p$\leq$0.01

Table 12: Accessibility to Jobs & Labour market outcomes: 60 mins.

	OLS				Logit			
	employment	inactive	self-emp alone	informal	employment	inactive	self-emp alone	informal
Panel A: Accessibility to jobs								
within 60 min by foot	0.0047*	-0.0043	-0.0001	0.0014	0.0052*	-0.0036	-0.0001	0.0016
	(0.0026)	(0.0032)	(0.0022)	(0.0022)	(0.0030)	(0.0029)	(0.0025)	(0.0027)
within 60 min by trotro	0.0032	-0.0023	0.0005	0.0042	0.0035	-0.0017	0.0005	0.0048
	(0.0021)	(0.0025)	(0.0026)	(0.0031)	(0.0023)	(0.0023)	(0.0030)	(0.0036)
within 60 mins by car	0.0159	-0.0299	-0.0212	-0.0471	0.0178	-0.0299	-0.0234	-0.0574
	(0.0216)	(0.0227)	(0.0308)	(0.0370)	(0.0269)	(0.0255)	(0.0352)	(0.0485)
Panel B: Accessibility to amenities								
within 60 min by foot	0.0048*	-0.0059**	-0.0068**	-0.0133***	0.0051	-0.0053*	-0.0079**	-0.0163***
	(0.0027)	(0.0030)	(0.0027)	(0.0042)	(0.0032)	(0.0030)	(0.0031)	(0.0052)
within 60 min by trotro	0.0055**	-0.0043	0.0002	0.0017	0.0063**	-0.0037	0.0001	0.0020
	(0.0027)	(0.0028)	(0.0038)	(0.0053)	(0.0031)	(0.0027)	(0.0044)	(0.0064)
within 60 mins by car	0.0142	-0.0382	-0.0776***	-0.1177***	0.0140	-0.0372	-0.0875**	-0.1462***
	(0.0256)	(0.0267)	(0.0297)	(0.0391)	(0.0320)	(0.0298)	(0.0340)	(0.0503)
N	180035	180035	125453	125453	180035	180035	125453	125453
Ind. & nbhd controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipality fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Marginal effects are reported for logit. Robust standard errors in parenthesis clustered at the neighbourhood level. The accessibility measures are in logs. Individual controls include dummy variables for the level of education (secondary excluded) and for marital status, as well as age, age squared, and sex. Neighbourhood controls include the share of neighbourhood residents with less than primary education and with access to electricity. *p $\leq$ 0.10 ** p$\leq$0.05 *** p$\leq$0.01

Table 13: Accessibility & labour market outcomes by gender: 45 mins (OLS)

	Female				Male			
	employment	inactive	self-emp alone	informal	employment	inactive	self-emp alone	informal
Panel A: Accessibility to jobs								
within 45 min by foot	0.0038*	-0.0046**	0.0024	0.0031	0.0043**	-0.0034*	-0.0007	0.0026
	(0.0020)	(0.0022)	(0.0036)	(0.0052)	(0.0018)	(0.0018)	(0.0021)	(0.0017)
within 45 min by trotro	0.0011	-0.0007	-0.0013	-0.0017	0.0011	-0.0000	-0.0007	0.0009
	(0.0015)	(0.0016)	(0.0039)	(0.0066)	(0.0014)	(0.0015)	(0.0023)	(0.0017)
within 45 mins by car	0.0014	-0.0044	0.0106	0.0106	0.0118	-0.0078	-0.0083	0.0023
	(0.0091)	(0.0097)	(0.0098)	(0.0151)	(0.0099)	(0.0096)	(0.0084)	(0.0051)
Panel B: Accessibility to amenities								
within 45 min by foot	0.0040	-0.0061**	-0.0103***	-0.0219***	0.0038	-0.0034	-0.0021	-0.0032*
	(0.0025)	(0.0027)	(0.0035)	(0.0062)	(0.0026)	(0.0025)	(0.0049)	(0.0019)
within 45 min by trotro	-0.0008	-0.0009	-0.0094**	-0.0194***	-0.0020	0.0020	-0.0038	-0.0037**
	(0.0025)	(0.0024)	(0.0038)	(0.0069)	(0.0026)	(0.0025)	(0.0046)	(0.0018)
within 45 mins by car	0.0128	-0.0182*	-0.0026	-0.0159	0.0235***	-0.0214**	-0.0089	-0.0008
	(0.0087)	(0.0096)	(0.0089)	(0.0102)	(0.0086)	(0.0083)	(0.0073)	(0.0056)
N	90417	90417	64714	64714	89618	89618	60739	60739
Ind. & nbhd controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipality fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Robust standard errors in parenthesis clustered at the neighbourhood level. The accessibility measures are in logs. Regressions are run separately for male and females. Individual controls include dummy variables for the level of education (secondary excluded) and for marital status, as well as age and age squared. Neighbourhood controls include the share of neighbourhood residents with less than primary education and with access to electricity. *p $\leq$ 0.10 ** p$\leq$0.05 *** p$\leq$0.01

Table 14: Accessibility & labour market outcomes by gender: 60 mins (OLS)

	Female				Male			
	employment	inactive	self-emp alone	informal	employment	inactive	self-emp alone	informal
Panel A: Accessibility to jobs								
within 60 min by foot	0.0052*	-0.0054	0.0014	0.0009	0.0041*	-0.0032	-0.0018	0.0018
	(0.0031)	(0.0036)	(0.0029)	(0.0032)	(0.0024)	(0.0028)	(0.0021)	(0.0015)
within 60 min by trotro	0.0040	-0.0036	0.0033	0.0060	0.0023	-0.0009	-0.0027	0.0021
	(0.0025)	(0.0030)	(0.0031)	(0.0044)	(0.0019)	(0.0022)	(0.0024)	(0.0019)
within 60 mins by car	0.0063	-0.0311	-0.0356	-0.0802	0.0254	-0.0278	-0.0049	-0.0106
	(0.0197)	(0.0220)	(0.0525)	(0.0591)	(0.0265)	(0.0253)	(0.0255)	(0.0189)
Panel B: Accessibility to amenities								
within 60 min by foot	0.0062**	-0.0083**	-0.0105***	-0.0227***	0.0030	-0.0030	-0.0029	-0.0031
	(0.0031)	(0.0034)	(0.0038)	(0.0068)	(0.0029)	(0.0029)	(0.0049)	(0.0021)
within 60 min by trotro	0.0061**	-0.0057*	0.0034	0.0005	0.0048*	-0.0027	-0.0034	0.0029
	(0.0031)	(0.0032)	(0.0052)	(0.0083)	(0.0028)	(0.0028)	(0.0038)	(0.0028)
within 60 mins by car	0.0087	-0.0428	-0.1148**	-0.1873***	0.0194	-0.0324	-0.0377	-0.0420*
	(0.0246)	(0.0266)	(0.0472)	(0.0622)	(0.0309)	(0.0297)	(0.0318)	(0.0227)
N	90417	90417	64714	64714	89618	89618	60739	60739
Ind. & nbhd controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipality fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes:Robust standard errors in parenthesis clustered at the neighbourhood level. The accessibility measures are in logs. Regressions are run separately for male and females. Individual controls include dummy variables for the level of education (secondary excluded) and for marital status, as well as age and age squared. Neighbourhood controls include the share of neighbourhood residents with less than primary education and with access to electricity. *p $\leq$ 0.10 ** p$\leq$0.05 *** p$\leq$0.01

Table 15: Accessibility & labour market outcomes by gender: 45 mins (Logit)

	Female				Male			
	employment	inactive	self-emp alone	informal	employment	inactive	self-emp alone	informal
Panel A: Accessibility to jobs								
within 45 min by foot	0.0042*	-0.0040**	0.0024	0.0037	0.0052**	-0.0035*	-0.0008	0.0032
	(0.0023)	(0.0019)	(0.0036)	(0.0060)	(0.0021)	(0.0019)	(0.0026)	(0.0020)
within 45 min by trotro	0.0010	-0.0002	-0.0014	-0.0021	0.0012	0.0004	-0.0009	0.0010
	(0.0018)	(0.0015)	(0.0039)	(0.0078)	(0.0018)	(0.0017)	(0.0027)	(0.0021)
within 45 mins by car	0.0001	-0.0023	0.0112	0.0122	0.0140	-0.0075	-0.0103	0.0022
	(0.0104)	(0.0093)	(0.0099)	(0.0184)	(0.0121)	(0.0109)	(0.0101)	(0.0060)
Panel B: Accessibility to amenities								
within 45 min by foot	0.0038	-0.0049*	-0.0104***	-0.0259***	0.0044	-0.0032	-0.0025	-0.0038*
	(0.0029)	(0.0025)	(0.0035)	(0.0072)	(0.0031)	(0.0028)	(0.0056)	(0.0023)
within 45 min by trotro	-0.0019	0.0002	-0.0097***	-0.0228***	-0.0029	0.0030	-0.0046	-0.0042**
	(0.0030)	(0.0026)	(0.0037)	(0.0081)	(0.0032)	(0.0029)	(0.0053)	(0.0021)
within 45 mins by car	0.0130	-0.0156*	-0.0022	-0.0198	0.0283***	-0.0230**	-0.0107	-0.0017
	(0.0103)	(0.0094)	(0.0090)	(0.0125)	(0.0105)	(0.0095)	(0.0088)	(0.0070)
N	90417	90417	64714	64714	89618	89618	60739	60739
Ind. & nbhd controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipality fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Marginal effects are reported for logit. Robust standard errors in parenthesis clustered at the neighbourhood level. The accessibility measures are in logs. Regressions are run separately for male and females. Individual controls include dummy variables for the level of education (secondary excluded) and for marital status, as well as age and age squared. Neighbourhood controls include the share of neighbourhood residents with less than primary education and with access to electricity. *p $\leq$ 0.10 ** p$\leq$0.05 *** p$\leq$0.01

Table 16: Accessibility & labour market outcomes by gender: 60 mins (Logit)

	Female				Male			
	employment	inactive	self-emp alone	informal	employment	inactive	self-emp alone	informal
Panel A: Accessibility to jobs								
within 60 min by foot	0.0055	-0.0042	0.0015	0.0010	0.0047*	-0.0026	-0.0022	0.0020
	(0.0034)	(0.0029)	(0.0029)	(0.0038)	(0.0028)	(0.0028)	(0.0025)	(0.0018)
within 60 min by trotro	0.0045*	-0.0029	0.0036	0.0069	0.0025	-0.0003	-0.0034	0.0023
	(0.0027)	(0.0024)	(0.0032)	(0.0051)	(0.0022)	(0.0022)	(0.0029)	(0.0021)
within 60 mins by car	0.0046	-0.0300	-0.0368	-0.0946	0.0299	-0.0278	-0.0045	-0.0128
	(0.0238)	(0.0222)	(0.0512)	(0.0741)	(0.0330)	(0.0299)	(0.0304)	(0.0236)
Panel B: Accessibility to amenities								
within 60 min by foot	0.0063*	-0.0068**	-0.0106***	-0.0269***	0.0032	-0.0025	-0.0034	-0.0037
	(0.0034)	(0.0030)	(0.0038)	(0.0080)	(0.0035)	(0.0032)	(0.0057)	(0.0025)
within 60 min by trotro	0.0069**	-0.0047*	0.0035	0.0006	0.0055	-0.0021	-0.0042	0.0033
	(0.0035)	(0.0028)	(0.0053)	(0.0097)	(0.0034)	(0.0030)	(0.0045)	(0.0033)
within 60 mins by car	0.0039	-0.0372	-0.1155**	-0.2243***	0.0225	-0.0334	-0.0431	-0.0521*
	(0.0301)	(0.0272)	(0.0462)	(0.0761)	(0.0385)	(0.0346)	(0.0378)	(0.0280)
N	90417	90417	64714	64714	89618	89618	60739	60739
Ind. & nbhd controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipality fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Marginal effects are reported for logit. Robust standard errors in parenthesis clustered at the neighbourhood level. The accessibility measures are in logs. Regressions are run separately for male and females. Individual controls include dummy variables for the level of education (secondary excluded) and for marital status, as well as age and age squared. Neighbourhood controls include the share of neighbourhood residents with less than primary education and with access to electricity. *p $\leq$ 0.10 ** p$\leq$0.05 *** p$\leq$0.01

Table 17: Accessibility & labour market outcomes for less than secondary education: 45 mins (OLS)

	Less than secondary educ.			
	employment	inactive	self-emp alone	informal
Panel A: Accessibility to jobs				
within 45 min by foot	0.0030*	-0.0029**	0.0004	0.0021
	(0.0017)	(0.0014)	(0.0026)	(0.0031)
within 45 min by trotro	0.0003	0.0001	-0.0023	-0.0016
	(0.0013)	(0.0013)	(0.0025)	(0.0039)
within 45 mins by car	0.0078	-0.0067	0.0071	0.0092
	(0.0093)	(0.0084)	(0.0071)	(0.0100)
Panel B: Accessibility to amenities				
within 45 min by foot	0.0026	-0.0035	-0.0068***	-0.0132***
	(0.0023)	(0.0021)	(0.0025)	(0.0040)
within 45 min by trotro	-0.0029	0.0012	-0.0081***	-0.0129***
	(0.0028)	(0.0025)	(0.0026)	(0.0041)
within 45 mins by car	0.0180**	-0.0195**	-0.0005	-0.0058
	(0.0087)	(0.0077)	(0.0070)	(0.0069)
N	127453	127453	89043	89043
Ind. & nbhd controls	Yes	Yes	Yes	Yes
Municipality fixed effects	Yes	Yes	Yes	Yes

Notes: Robust standard errors in parenthesis clustered at the neighbourhood level. The accessibility measures are in logs. Regressions are run for working age individuals with less than secondary education. Individual controls include dummy variables for the level of education (secondary excluded) and for marital status, as well as age and age squared. Neighbourhood controls include the share of neighbourhood residents with less than primary education and with access to electricity. *p $\leq$ 0.10 ** p$\leq$0.05 *** p$\leq$0.01

Table 18: Accessibility & labour market outcomes for less than secondary education: 60 mins (OLS)

	Less than secondary educ.			
	employment	inactive	self-emp alone	informal
Panel A: Accessibility to jobs				
within 60 min by foot	0.0021	-0.0015	-0.0005	0.0011
	(0.0020)	(0.0017)	(0.0023)	(0.0021)
within 60 min by trotro	0.0006	0.0003	-0.0003	0.0039
	(0.0014)	(0.0012)	(0.0025)	(0.0028)
within 60 mins by car	0.0252	-0.0424	-0.0140	-0.0436
	(0.0265)	(0.0263)	(0.0338)	(0.0385)
Panel B: Accessibility to amenities				
within 60 min by foot	0.0022	-0.0031	-0.0075***	-0.0136***
	(0.0026)	(0.0024)	(0.0027)	(0.0044)
within 60 min by trotro	0.0036	-0.0026	-0.0006	0.0015
	(0.0026)	(0.0021)	(0.0039)	(0.0050)
within 60 mins by car	0.0189	-0.0502*	-0.0783**	-0.1173***
	(0.0297)	(0.0266)	(0.0327)	(0.0417)
N	127453	127453	89043	89043
Ind. & nbhd controls	Yes	Yes	Yes	Yes
Municipality fixed effects	Yes	Yes	Yes	Yes

Notes: Robust standard errors in parenthesis clustered at the neighbourhood level. The accessibility measures are in logs. Regressions are run for working age individuals with less than secondary education. Individual controls include dummy variables for the level of education (secondary excluded) and for marital status, as well as age and age squared. Neighbourhood controls include the share of neighbourhood residents with less than primary education and with access to electricity. *p $\leq$ 0.10 ** p$\leq$0.05 *** p$\leq$0.01

Table 19: Accessibility & labour market outcomes for less than secondary education: 45 mins (Logit)

	Less than secondary educ.			
	employment	inactive	self-emp alone	informal
Panel A: Accessibility to jobs				
within 45 min by foot	0.0048**	-0.0029*	-0.0024	0.0019
	(0.0023)	(0.0018)	(0.0021)	(0.0012)
within 45 min by trotro	0.0007	0.0007	-0.0022	0.0003
	(0.0019)	(0.0017)	(0.0022)	(0.0015)
within 45 mins by car	0.0177	-0.0112	-0.0063	0.0035
	(0.0138)	(0.0115)	(0.0093)	(0.0044)
Panel B: Accessibility to amenities				
within 45 min by foot	0.0039	-0.0020	-0.0035	-0.0035**
	(0.0033)	(0.0028)	(0.0047)	(0.0016)
within 45 min by trotro	-0.0035	0.0037	-0.0052	-0.0039***
	(0.0036)	(0.0031)	(0.0044)	(0.0015)
within 45 mins by car	0.0287**	-0.0225**	-0.0066	0.0008
	(0.0123)	(0.0104)	(0.0067)	(0.0035)
N	127453	127453	89043	89043
Ind. & nbhd controls	Yes	Yes	Yes	Yes
Municipality fixed effects	Yes	Yes	Yes	Yes

Notes: Marginal effects are reported for logit. Robust standard errors in parenthesis clustered at the neighbourhood level. The accessibility measures are in logs. Regressions are run for working age individuals with less than secondary education. Individual controls include dummy variables for the level of education (secondary excluded) and for marital status, as well as age and age squared. Neighbourhood controls include the share of neighbourhood residents with less than primary education and with access to electricity. *p $\leq$ 0.10 ** p$\leq$0.05 *** p$\leq$0.01

Table 20: Accessibility & labour market outcomes for less than secondary education: 60 mins (Logit)

	Less than secondary educ.			
	employment	inactive	self-emp alone	informal
Panel A: Accessibility to jobs				
within 60 min by foot	0.0030	-0.0007	-0.0035	0.0012
	(0.0026)	(0.0021)	(0.0023)	(0.0012)
within 60 min by trotro	0.0002	0.0016	-0.0044*	0.0019
	(0.0021)	(0.0016)	(0.0027)	(0.0014)
within 60 mins by car	0.0426	-0.0374	0.0004	-0.0091
	(0.0369)	(0.0332)	(0.0270)	(0.0198)
Panel B: Accessibility to amenities				
within 60 min by foot	0.0022	-0.0009	-0.0055	-0.0039**
	(0.0036)	(0.0031)	(0.0050)	(0.0018)
within 60 min by trotro	0.0040	-0.0008	-0.0060	0.0025
	(0.0036)	(0.0028)	(0.0041)	(0.0022)
within 60 mins by car	0.0362	-0.0463	-0.0408	-0.0445**
	(0.0422)	(0.0350)	(0.0297)	(0.0224)
N	66993	66993	45774	45774
Ind. & nbhd controls	Yes	Yes	Yes	Yes
Municipality fixed effects	Yes	Yes	Yes	Yes

Notes: Marginal effects are reported for logit. Robust standard errors in parenthesis clustered at the neighbourhood level. The accessibility measures are in logs. Regressions are run for working age individuals with less than secondary education. Individual controls include dummy variables for the level of education (secondary excluded) and for marital status, as well as age and age squared. Neighbourhood controls include the share of neighbourhood residents with less than primary education and with access to electricity. *p $\leq$ 0.10 ** p$\leq$0.05 *** p$\leq$0.01

Table 21: Firm accessibility to labour force by education level

Access to labour force of:	Working-age:		Secondary educ.:		Tertiary educ.:	
Specification:	OLS	Logit	OLS	Logit	OLS	Logit
within 45 mins:						
by foot	-0.0131	-0.0129	-0.0290	-0.0279	-0.0322	-0.0309
	(0.0277)	(0.0268)	(0.0264)	(0.0255)	(0.0262)	(0.0254)
by trotro	-0.0088	-0.0094	-0.0155	-0.0163	-0.0161	-0.0170
	(0.0120)	(0.0125)	(0.0141)	(0.0147)	(0.0145)	(0.0150)
by car	-0.0975	-0.0875	-0.1079	-0.0970*	-0.1105	-0.0995*
	(0.0689)	(0.0595)	(0.0676)	(0.0581)	(0.0676)	(0.0581)
within 60 mins:						
by foot	-0.0349	-0.0351	-0.0599*	-0.0597*	-0.0655**	-0.0653**
	(0.0376)	(0.0400)	(0.0324)	(0.0325)	(0.0312)	(0.0309)
by trotro	-0.0067	-0.0073	-0.0110	-0.0119	-0.0115	-0.0125
	(0.0091)	(0.0097)	(0.0105)	(0.0112)	(0.0107)	(0.0115)
by car	-0.2827	-0.2604	-0.2987	-0.2740	-0.3094	-0.2840
	(0.2726)	(0.2490)	(0.2804)	(0.2535)	(0.2851)	(0.2577)
N	432	432	432	432	432	432

Notes: Marginal effects are reported for logit. Robust standard errors in parenthesis clustered at the neighbourhood level. Regressions are run separately for differente definitions of effective labour force pool. These are all working-age, working-age with secondary education or more, and working-age with tertiary education. All regressions include controls for firms' age (and age squared), sector of operation, size and ownership type. *p $\leq$ 0.10 ** p$\leq$0.05 *** p$\leq$0.01

Appendix I

Accessibility & Labour Outcomes in Accra

July 28th, 2017

I. Appendix Figures

Figure A1. Lorenz Curve of Accessibility Alternative Trotro times-Amenities (60 min)

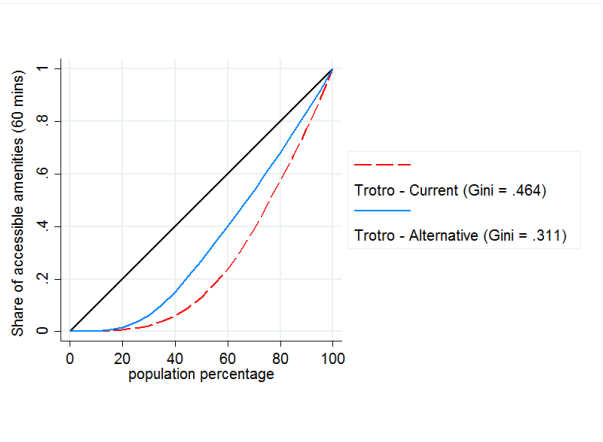


Figure A2. Lorenz Curve of Accessibility Alternative Trotro times-Formal Jobs (60 min)

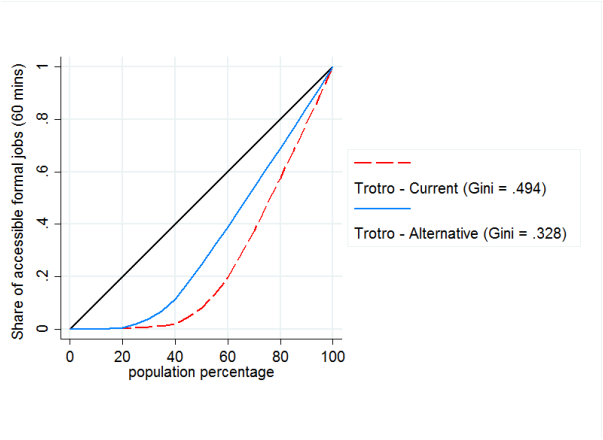


Figure A3. Lorenz Curve of Accessibility Alternative Trotro times-Formal Jobs (45 min)

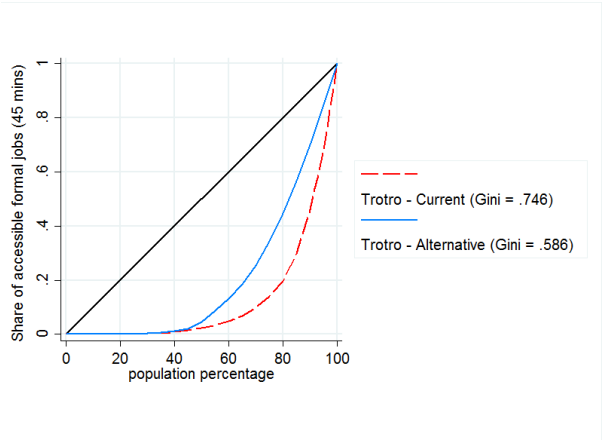
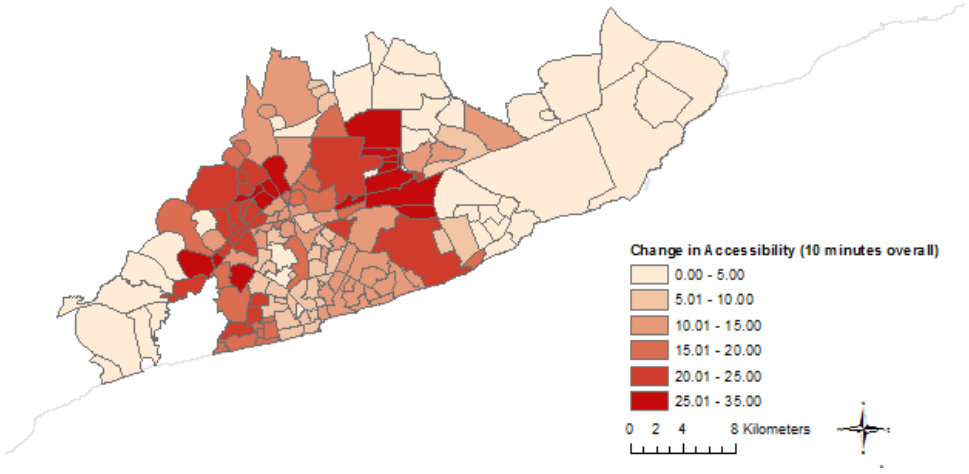
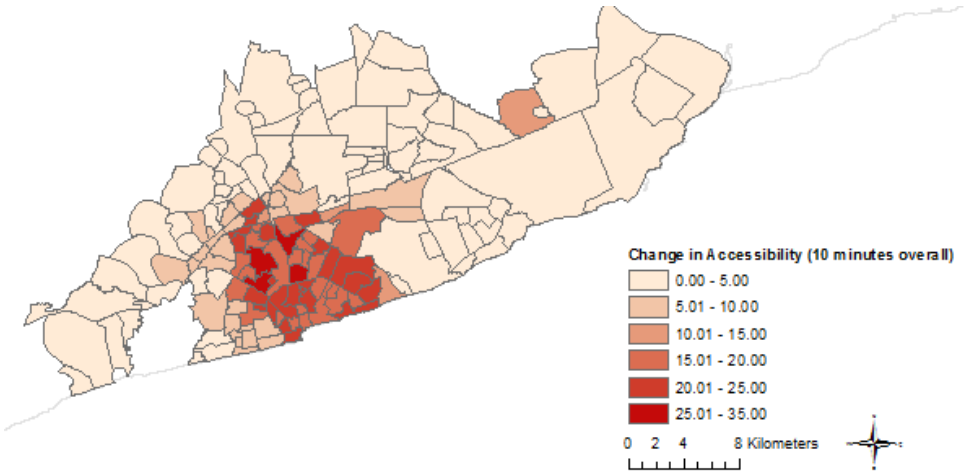


Figure A4. Spatial Distribution of Change In Accessibility 60min (10min reduction)



Notes: Distance to amenities.

Figure A5. Spatial Distribution of Change In Accessibility 45min (10min reduction)



Notes: Distance to amenities.

II. Appendix Tables

Table A1. Summary: Accessibility to formal jobs - Alternative Scenarios

	Obs	Mean	Std.Dev	Min	Max
By Trotro					
45 min	161	0.041	0.062	0.00	0.285
60 min	161	0.323	0.256	0.00	0.631
90 min	161	0.621	0.191	0.00	0.889
By Trotro - 10 minute overall					
45 min	161	0.184	0.200	0.00	0.579
60 min	161	0.422	0.267	0.00	0.685
90 min	161	0.676	0.183	0.00	0.945
By Trotro - 20 minute overall					
45 min	161	0.387	0.268	0.00	0.656
60 min	161	0.553	0.229	0.00	0.722
90 min	161	0.734	0.145	0.00	0.946

Notes: Accessibility Index to Formal Jobs (Jobs Survey 2006), population weighted (Census 2010, 10% sample)

Table A2. Summary: Accessibility to Amenities - Alternative Scenarios

	Obs	Mean	Std.Dev	Min	Max
By Trotro					
45 min	161	0.030	0.039	0.00	0.151
60 min	161	0.192	0.143	0.00	0.433
90 min	161	0.496	0.139	0.00	0.741
By Trotro - 10 minute overall					
45 min	161	0.109	0.108	0.00	0.360
60 min	161	0.297	0.172	0.00	0.576
90 min	161	0.573	0.168	0.00	0.838
By Trotro - 20 minute overall					
45 min	161	0.250	0.158	0.00	0.477
60 min	161	0.401	0.167	0.00	0.626
90 min	161	0.644	0.133	0.00	0.847

Notes: Accessibility Index to Formal Jobs (Jobs Survey 2006), population weighted (Census 2010, 10% sample)

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