



# Towards incorporating location choice into integrated land use and transport planning and policy: A multi-scale analysis of residential and job location choice behaviour



Ransford A. Acheampong

Department of Geography, Trinity College Dublin, The University of Dublin, Museum Building, Dublin 2, Ireland

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## ABSTRACT

Residential and job location decisions have lasting impacts on the emergent structure of cities, which in turn, determines travel patterns, energy use and travel-related greenhouse gas emissions. The ability to understand and predict these choice processes are therefore crucial to long-term sustainable urban land use and transport strategies. Understanding housing-job location choice processes requires unpacking the interplay among heterogeneous attributes of decision-makers on the one hand, and various location-defining attributes observable at multiple spatial scales on the other hand. Also, to better understand the interdependence between these location choice sets, empirical examination of how the home and work locations respond to each other over time is necessary. This study responds to these empirical imperatives by exploring residential-job location choice behaviour of households and individuals in a metropolitan context in Ghana, West Africa. The study utilizes data from a cross-sectional survey of 665 households and their 1158 individual workers in the Kumasi metropolis, Ghana's second largest metropolis. Results show variations in preferences among households and individuals for macro-scale location-defining factors as well as discrete spatial choice alternatives specified as urban-zones, dwelling types and tenancy arrangements. Retrospective analysis of the residential-job choice interdependence shows that in most cases, residential location decisions are taken first, implying a sequential choice process where job location decisions are subsequently anchored on the initial home locations. Besides the in-depth empirical contributions, the paper outlines how the findings could ultimately inform the development of planning support systems to integrate location choice into sustainable urban development and transport management policies.

## 1. Introduction

In the last seven decades, cities in the Global South have experienced high levels of urbanization. On the African continent, for example, while only 14% of the population lived in cities in the 1950s, this had increased to 40% by 2015, and by the first half of the 21st century, it is estimated that about 55% of the continent's population will be living in cities (United Nations, 2014). The increasing urban population impact the physical size and structure of cities through the development of land for various uses including housing, employment and infrastructure (Angel et al., 2012; Pacione, 2001).

The emergent structure of cities, observed as the distribution of various land use activities and the functional relationships among them is influenced by the interplay of several process which occur over different time horizons. Prominent among the processes underlying the observed structure of cities globally are the location decisions of actors

in the urban property and employment markets (Wegener and Fürst, 2004; Waddell, 2011). For example, as urban population increases, the housing needs of the population are met either through individual households acquiring land and building houses on incremental basis through the self-build model, which is common in most cities in the Global South (see e.g. Ferguson and Smets, 2010; Acheampong, 2016; Amoako and Boamah, 2017) and/or through organized private property development industry. Indeed, in most cities in developing countries, rapid peri-urbanization, which is characterized by unconsolidated lateral expansion of larger cities engulfing smaller towns and villages in hitherto largely agricultural lands (see e.g. Doan and Oduro, 2012; Webster, 2002; Simon et al., 2004) have resulted mainly from the demand for cheap land at these peripheral locations for housing development. Consequently, globally, residential development is one of the main driver of land use change, and accounts for the largest share of all land uses in urban area (see e.g. Liu and Robinson, 2016; Cobbinah and

E-mail address: [Acheampr@tcd.ie](mailto:Acheampr@tcd.ie).

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Amoako, 2012; Angel et al., 2012).

Moreover, at the household level, individual workers make job location decisions, which are shaped by the pre-determined distribution of employment centres resulting from the location choices of firms and businesses. In the context of most developing countries in the Global South, including Ghana, the majority of small-scale businesses and individual workers operate in the informal economy, which has traditionally been perceived as an unregulated, non-formal sector of the market economy that produces goods and services for sale and for other forms of remuneration (Hart, 1973; Becker, 2004). Within the informal economy, there are the sedentary workers who operate in designated commercial areas such as markets and/or choose the home and locations within the immediate vicinity of the operate their businesses. Itinerant workers such as hawkers other hand, are more mobile and opportunistic in their daily employment location choices and thus, tend to operate along congested road corridors and in major commercial/industrial hubs where slow moving traffic and/or large population concentrations provide ready market for their goods.

Understanding urban location decisions is therefore crucial for two main reasons. Firstly, households and individuals' location choice behaviour with respect to where to live and work have profound impact on the physical size of cities and the spatial configuration of land use activities within them, and in turn, provide the structural conditions that affect travel behaviours, energy consumption and travel-induced impacts on society and the environment (Wegener and Fürst, 2004; Naess, 2013; Pagliara et al., 2010). Secondly, understanding housing-job location behavior at the individual level as well as the outcomes of these choices are fundamental to urban land use and travel demand management in cities (Batty, 2013; Habib and Kockelman, 2008; Pinjari et al., 2011). Indeed, observing and replicating the nature of residential and job location choice behavior have preoccupied researchers in the inter-disciplinary field of land use and transport interaction (LUTI) modelling: the field concerned with the development of state-of-the-art dynamic simulation models as decision-support systems for integrated land use development and travel demand management policies (see e.g. Acheampong and Silva, 2015; Batty, 2013; Yang et al., 2013).

Traditionally, studies of urban location choice have presented aggregate spatial zones, such as Traffic Analysis Zones (TAZs), Census Tracts and City-districts as discrete choice alternatives (see e.g. Pinjari et al., 2011; de Palma et al., 2007; Bhat and Guo, 2007). However, the observed distributions of home and employment locations are the outcome of the interplay of location-defining attributes at multiple spatial-scales and socio-demographic attributes of households and individuals who have heterogeneous preferences (Yang et al., 2013; Pagliara et al., 2010; Van Ommeren et al., 2000). This implies that empirical research must go beyond aggregate zonal representations in observing the determinants of the home-work location combinations of households and individuals.

Moreover, for analytical purposes, the interdependence between the residential and job location choice sets has been modelled in some cases assuming a conditional choice process in which the place of residence is assumed to come first followed by the place of work or vice versa (Waddell et al., 2007; Waddell, 1997) or the conjoint assumption in which choice for both the place of residence and work-place are assumed to occur at the same time (Boschmann, 2011; Yang et al., 2013; Inoa et al., 2015). The validity of any of these assumptions how depends on the urban context being examined.

Also, even within a given urban context, different households and individuals may implement different combinations of the above assumptions in their location decisions. Thus, empirically examining the interdependence between these two long-term choice sets is critical for a better understanding and representation of the choice process within any given urban context. This is of particular importance given that much of the evidence about location choice behavior have accumulated from empirical works conducted largely in cities in the Global North. In the context of developing countries, especially in Africa, there is a

paucity of empirical work, albeit location choice and the resultant conversion of land into housing and employment activities, fundamentally underpin the rapid expansion of cities in these countries (Angel et al., 2012; Acheampong et al., 2017).

In view of the foregoing, the objective of this paper is to examine empirically, the residential location preferences of households, the job location choice of individuals within the households and the interdependence between the two choice sets. The evidence presented in this paper is based on a cross-sectional survey which examines retrospectively, the residential and job location choices of households and individuals in the Kumasi Metropolis, the second largest urban agglomeration in Ghana, West Africa. The main contribution of the paper is that it contributes to our understanding of the influence of location-defining factors at different spatial scales on the home-work location choice of heterogeneous households and individuals, as well as the sequence of the choice process within the context of a rapidly urbanizing African metropolis. In doing so, it provides in-depth empirical foundations for integrating these long-term choices into urban land use development and transport management strategies.

## 2. Understanding housing-job location choice behaviour and choice interdependence

The residential and job location decisions of individuals and households directly impact urban spatial structure and define the activity-travel environment within which spatial interaction occur daily (Yang and Ferreira, 2008; Pinjari et al., 2011). The ability to model residential and job location decisions therefore has a great potential for improving long-range land use and travel demand forecasting in cities (Habib et al., 2011).

Previous studies, conducted mainly in the context of cities in developed countries have established that residential location choice is influenced by several factors, comprising location-defining attributes at the city and neighbourhood scales as well as dwelling-defining attributes at the micro-scale. Specifically, factors such as noise levels, municipal taxes, house prices and rent levels determine location choice (Hunt, 2010; Pagliara et al., 2010). In addition, available mobility options, including proximity to public transit lines (Boschmann, 2011), the density of development and access to high-quality schools (Pagliara et al., 2010) influence the home location choices of households. Other determinants of residential location choice are the degree of commercial or mixed land-uses in an area, income and neighbourhood composition (Pinjari et al., 2011), extended family ties (Acheampong, 2016), social networks (Tilahun and Levinson, 2011), and the composition and evolution of household structure over time (Habib et al., 2011; Lee and Waddell, 2010).

Moreover, the job locations of individuals within the household are also influenced by the interaction between personal characteristics such as levels of educational attainment and skills match between job seekers and available jobs (Glaeser and Resseger, 2010). Also, wider circumstances of the job seeker's household including, family size, number of working members and number of children do influence work locations (Habib et al., 2011; Pagliara et al., 2010). For example, couples with children may not find the need to choose the closet employment locations because of their preference for suburban locations that meet the housing and environmental amenity needs of families (Kim et al., 2005). The literature further shows that urban structural factors such as the spatial distribution of employment zones relative to other activity locations in the urban area and the prospect of high and competitive wages do influence individuals employment location decisions (Kim et al., 2005; Glaeser and Resseger, 2010). Indeed, the location of employment centres relative to land uses such as the place of home, determines not only physical accessibility to jobs but also work-related travel costs. Consequently, low-wage workers who have a pressing need for affordable transportation services tend to choose employment locations to which public transit services are well linked (Legrain et al.,

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