

Who shops at informal firms?

Keywords: Developing cities, informality, firms, mobility, urban economics

Extended Abstract

In recent years increasing availability of mobile phone based data has opened up new frontiers in economic data science and urban studies. In particular, the daily travel patterns of urban dwellers have been well characterised, and detailed studies into segregation and the impacts of income inequality and race on mobility have been conducted. More recently, there has been an emerging focus on so-called ‘experienced segregation’ [1], whereby a large number of studies have combined point of interest data (e.g., banks and hospitals from Google Places or restaurants from Yelp) with high resolution GPS mobile phone data in order to explore patterns of ‘co-presence’ of distinct socio-economic and racial groups in particular types of places [2]. What has been less explored, or almost entirely neglected due a lack of data until now, is the intersection of urban mobility and access to the informal economy. A lot is at stake: the informal sector comprises up to 90% of economic activity in middle and low income countries, but much of its functioning is still considered a black box due to data scarcity. Here, we build on new work that deploys novel techniques to detect the location of informal commerce from street imagery [3] in order to investigate the mobility behaviour of customers to informal retail establishments.

Classical retail location theory suggests that businesses should competitively cluster in order to maximize their catchment sizes, leading to the development of retail clusters. In Christaller’s well-known Central Place Theory, firms are thought to divide customers into equal size catchments. The size of these catchments vary with product demand. More demand means a smaller catchment is needed - for instance, in a typical American city, a restaurant’s catchment population is 1/14 that of a furniture store. Furthermore, many business amenities tend to cluster complementarily to take advantage of customer spillovers.

In terms of informal firms, there is evidence that lower income groups tend to make more purchases at informal firms and that rising incomes lead to a lower propensity to consume informal sector goods [4]. Formal and informal firms are thought to compete when of a similar size and characteristics [5], sharing an overlapping customer base [4] for both complementary and substitute goods [6]. One might expect that the catchment area of an informal firm is limited compared to a formal firm, in line with previous work that suggests that more productive firms have larger catchment areas [7] and the fact that lower income groups tend to travel less distance in many (not all) contexts [8] - but this is mere conjecture.

To the authors’ knowledge, no previous studies have directly investigated the customer catchment area of informal firms. How far do customers travel to access informal vs formal firms? Are informal firms mainly accessed near to home, or also as part of work commutes? Do different socio-economic groups visit and mix in informal firms? Additionally, there is limited research regarding the nature of informal firms’ clustering behaviour - are competitive/complementary clustering tendencies similar for informal firms as for formal firms? Do informal firms inhabit distinct spaces or do they coexist alongside formal firms?

We focus on cities in Colombia, a middle income, fast growing economy with very high rates of informality, including up to 90% of the workforce outside the formal sector in some cities. Answering these questions requires a two prong approach. First, we must detect informal commercial firms which are almost entirely absent from official data. To do this we build on an approach developed by Straulino et al (2021) [3] in which the authors trained a machine vision algorithm to identify commercial firms ('visible establishments') in Google Street View imagery. These include all establishments with a visible facade, including both formal and informal firms. When (spatially) overlapped with data on the location of formal firms, we can infer the location and density of informal commercial firms, as shown in the figure for Medellín, Colombia. Here we extend this approach and, instead of using firms extracted from street imagery, we use amenities and businesses recorded in Google Places to build a base dataset to be overlapped with a formal firm registry. While fewer informal firms will be detected using this method, we will know the type of shop or amenity (see [9]).

The second strand of work (ongoing) focuses on capturing visits of customers to informal firms using high-resolution mobility data derived from GPS mobile phone data. In particular, our data contains location time-stamps of when customers open particular apps (aggregated by a private company), which enables us to robustly identify home and work locations, as well as visits to locations such as shops. From here, deploying a wide array of appropriate methods [10], we can straightforwardly begin to investigate the clustering and catchment area of firms, and the socio-economic status and mixing of informal firm customers.

References

1. Moro, Esteban, et al. "Mobility patterns are associated with experienced income segregation in large US cities." *Nature Communications* 12.1 (2021): 4633.
2. Davis, Donald R., et al. "How segregated is urban consumption?." *Journal of Political Economy* 127.4 (2019): 1684-1738.
3. Straulino, Daniel, et al. "Uncovering commercial activity in informal cities." *Royal Society Open Science* 9.11 (2022): 211841.
4. Böhme, Marcus, and Rainer Thiele. "Is the informal sector constrained from the demand side?" *World Development* 40.7 (2012): 1369-1381.
5. González, Alvaro, and Francesca Lamanna. Who fears competition from informal firms? Evidence from Latin America. Vol. 4316. *World Bank Publications*, 2007.
6. Grimm, Michael, and Isabel Günther. "Growth and poverty in Burkina Faso: A reassessment of the paradox." *Journal of African Economies* 16.1 (2007): 70-101.
7. Chong, Shi Kai, et al. "Economic outcomes predicted by diversity in cities." *EPJ Data Science* 9.1 (2020): 17.
8. Suárez, Manuel, Masanori Murata, and Javier Delgado Campos. "Why do the poor travel less? Urban structure, commuting and economic informality in Mexico City." *Urban Studies* 53.12 (2016): 2548-2566.
9. Heroy, Samuel, et al. "Are neighbourhood amenities associated with more walking and less driving? Yes, but predominantly for the wealthy." *Environment and Planning B: Urban Analytics and City Science* (2022): 23998083221141439.
10. Kung, Kevin S., et al. "Exploring universal patterns in human home-work commuting from mobile phone data." *PloS One* 9.6 (2014): e96180.

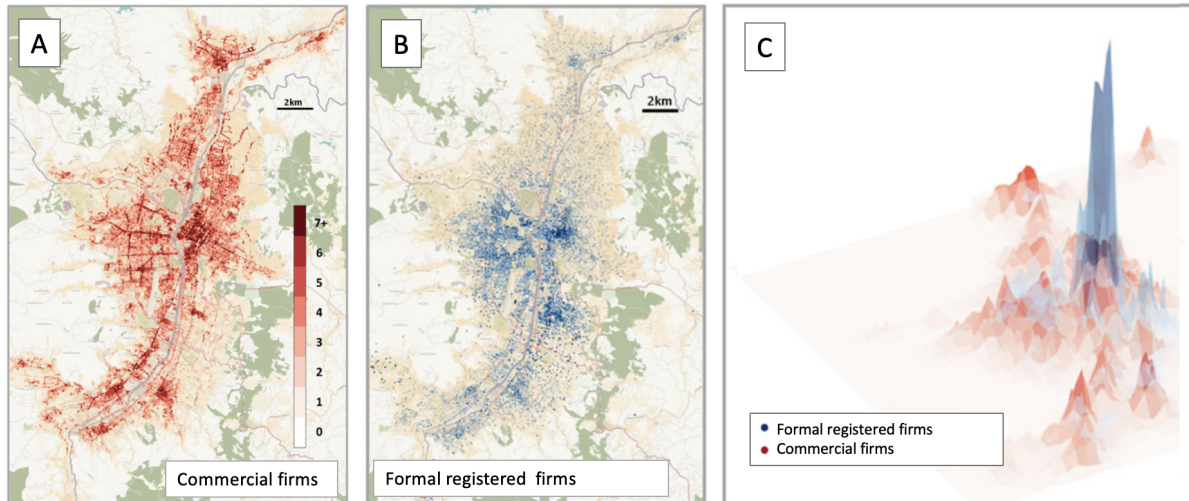


Figure: (A) The spatial distribution of all ‘visible’ commercial formal firms in Medellin, Colombia derived from Google Street Imagery. (B) The distribution of formal registered firms. (C) A 3D density plot highlights the concentration of formal firms in single central location, while commercial (informal) firms are widely distributed across the metropolitan area.