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Firm heterogeneity and the accessibility of manufacturing firms to labour markets

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ABSTRACT

In this paper, we propose a measure of geographic accessibility of firms to labour markets. This measure is computed from the microeconomic perspective, avoiding *ex ante* imposition of administrative boundaries and including the individual characteristics of firms and workers along with the geographical environment and the urban structure of territories through the estimation of particular impedance functions. Computation is done using microdata on more than 60,000 Spanish manufacturing firms and over a million workers' commutes across the full road transport infrastructure network (urban and intercity). We estimate impedance functions that incorporate the specific characteristics of firms and workers. Results show notable accessibility differences across firms due not just to their geographic location but also to their intrinsic industry characteristics and the strategies that they follow.

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1. Introduction

The analysis of the decision processes underlying the location of firms confirms the importance of the proximity to labour markets which have adequate and required specialisation endowments (Midelfart-Knarvik et al., 2001; Audretsch et al., 2012; Arauzo-Carod, 2013). Firms often necessitate workers with specific qualifications that are not necessarily available across all possible locations. There is empirical evidence that better matching between workers' abilities and qualifications and firms' requirements is attained throughout most agglomerated cities, contributing to improvements in the productivity of firms (Andersson et al., 2007; Martín-Barroso et al., 2015). Further, proximity between firms and workers reduces commuting costs and thus reservation wages, affecting firms' profitability (So et al., 2001). Thus, these related factors —the availability of human capital and associated commuting costs— should be jointly included in firms' measures for accessibility to labour markets.

The concept of accessibility first arises in the context of measuring and evaluating the connection of firms with main transport infrastructures (Lutter et al., 1992; Holl, 2007). Successive accessibility measures evolve towards more complex formulations that incorporate interconnection between firms and final markets, i.e., market potential measures (Graham, 2007; Holl, 2012; Le Néchet et al., 2012). The analysis of accessibility to labour markets, in particular, has always attempted to incorporate the interrelations between firms and workers, mainly focusing on the labour supply side (i.e., the accessibility of workers to jobs), considering just small administrative or geographical units — municipalities, functional areas, industrial districts, local labour markets, etc. (Gibbons et al., 2010; Melo et al., 2013; Bania et al., 2008; Wang, 2003). Bunel and Tovar (2014) argue that although many commutes are in fact short, imposing restrictive geographical boundaries from mere administrative areas may lead to omitting an important amount of commutes and thus obtain inaccurate measures of accessibility.

Thus, a crucial aspect for calculating accessibility indicators is the identification of the area from which firms' workers come or how distance, time, or other transport costs influence the probability of hiring job candidates. The intensity of transport costs and its relationship with the time or distance of observed commutes depend on both the characteristics of the job and the worker and the geographical

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environment or urban structure (i.e. the size of cities, the spatial distribution of cities, and the structure of transport networks between and inside the cities) where they are located (Manaugh et al., 2010).The commuting literature confirms that skilled, male and younger workers and those commuting in large urban areas usually show longer commutes (Matas et al., 2010; Wang, 2003). Nevertheless, only a few of the available measures of accessibility indicators take these aspects (i.e., sex, skill, etc.) into account, or introduce them separately one at a time. Furthermore, homogenous impedance functions are often assumed for all individuals and geographical contexts (refer to Bania et al., 2008 for a literature review).

There is also an evident trade-off between the size of considered study areas and the number of elements or agents for which labour accessibility indicators are calculated. Thus, papers that analyse the accessibility of a certain group of individuals usually focus on a very precise region (e.g., Cheng and Bertolini, 2013). If the analysis is carried out for large areas (e.g., different countries), accessibility is not computed for individuals, but administrative units such as regions, provinces or municipalities (Reggiani et al., 2011).

This paper contributes to the literature on firms' accessibility to labour markets from a methodological as well as an empirical perspective. From the methodological point of view, we provide an indicator that improves existing measures of accessibility by defining a labour accessibility indicator from the microeconomic perspective of demand (i.e., firms), eliminating the administrative boundaries nested in countries, and introducing both the individual characteristics of the economic agents involved and the geographical environment and urban structure of territories through the estimation of specific impedance functions.

From the empirical perspective side, our methodological proposal is applied using Spanish microdata. The accessibility indicators are computed for a sample of more than 60,000 manufacturing Spanish firms in 2011, considering the complete road network (urban and intercity). In order to precisely measure accessibility, we have gathered information from a wide range of databases, microeconomic for firms and workers, geographical to identify the location and duration of commutes, and aggregate datasets to determine active population and the spatial distribution of jobs. The computation of an accessibility indicator for each firm has been carried out according to the following procedure. In the first place, we estimated a generic impedance function that incorporates the individual characteristics of workers, firms, and territories. Secondly, we calculated the specific impedance functions at each concrete firm-district pair (district of worker's residence[4]). Lastly, the firm-specific accessibility indicator is calculated by combining the realisations of the impedance function with the demand and supply of labour observed within the area where the firm may hire its workers.

Results show that the accessibility of firms to workers is higher in large agglomerated urban areas. The notorious attraction of workers to large cities generates a decrease in labour opportunities and accessibility across firms located in the neighbourhood of large urban agglomerations. Furthermore, we confirm that higher value-added firms from most innovative sectors of economic activity have better accessibility scores, showing evidence in favour of the bid-rent theory.

The next section presents the indicator used to accurately measure the accessibility of firms to labour markets and explains how impedance functions are obtained. Section 3 describes the sources of the information used and how the different databases have been combined in order to construct the variables required for computing the accessibility indicators. Results for the accessibility measures are presented and discussed in Section 4. Final conclusions appear in Section 5.

[4] Municipal districts are geographical units smaller than municipalities; there are 10,517 municipal districts in Spain, whose average area is 50 km^2 (equivalent to a circle with an approximate radius of 4 km). The smallest district has an area of 0.02 km^2, whilst the largest one has 1668.20 km^2.

2. The indicator of the accessibility of firms to labour markets

The different concepts of accessibility, as well as the difficulties associated with its measurement, for instance, due to demanding information requirements, have generated diverse methodologies for the computation of specific indicators. The accessibility of firms to labour markets can be defined as the ability that firms have to hire appropriate workers (i.e., holding the required specific qualification) who reside in a sufficiently close area of influence. In this regard, selected measures should include those aspects identified by the specialised literature as relevant and capable enough to guarantee a proper indicator for accessibility.

According to Geurs and van Eck (2001), and adapting the idea to the case of the accessibility of firms to labour markets, these measures should include the following components:

(i) Transport infrastructure availability, which refers to the configuration and quality of the transport infrastructure network. It also takes into account the loss of utility derived from the length of commutes.
(ii) The land use component, which describes the distribution of workers across the geographically relevant market (i.e., area of influence).
(iii) The individual component, which basically refers to the characteristics of firms and workers that enhance/hinder matching in the labour market.
(iv) The temporal component, which, although relevant, is often ignored, as the availability of workers and transport means and congestion levels vary in time, or instead is taken into account by the inclusion of the average levels of corresponding variables.

Additionally, Bunel and Tovar (2014) identify five methodological aspects to be taken into account when measuring these types of indicators:

(i) Job reachability. It is related to the effect of distance on the probability of hiring (job proximity) and frontier effects.
(ii) Mobility. It refers to access to transport, the level of congestion, and the organisation of the different modes of transport.
(iii) Job availability. It analyses the availability of employment and the degree of qualitative match, especially in terms of skills.
(iv) Local job competition amongst both workers and firms.
(v) The possibilities of commuting between workers' residences and different jobs.

Accessibility indicators are usually classified according to these components and aspects, the procedures followed for calculations, or the data used. Although different classifications of accessibility indicators exists, all of them could be grouped within four main categories, (i) those based on infrastructures, (ii) the ones based on the activity (also known as location-based measures), (iii) those based on utility, and (iv) mixed measures, essentially Person-based measures (Geurs and van Wee, 2004).

Amongst all available possibilities, the most appropriate measure of the accessibility of firms to labour markets is the one proposed by Shen (1998, 2001), which is grounded on the competition for opportunities idea contemplated in those measures based on the activity. Its appropriateness relies on the possibility to include the different accessibility components[5] previously pointed out. It is important to note that the indicator that we propose implies that each firm geographically defines its

[5] The indicator may also include the temporal component, either calculating it by time intervals or by considering a weighted average of these time intervals. The database used for calculations incorporates travel times under standard conditions of commuting at working hours; thus, the temporal component is considered via the weighted average option. The possibility of commuting between workers' residences and different jobs is not taken into account.

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