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Do all transport modes impact on industrial employment? Empirical evidence from the Spanish regions

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ABSTRACT

This paper examines the direct, indirect and total impacts of all transport modes on industrial employment in Spain from 1995 to 2008. Through spatial econometric methods, this study finds that only ports are able to generate positive total effects, and that the increase in industrial employment that a region obtains from having more kilometers of motorways results in less industrial employment in other nearby regions. In contrast, airports and railways do not have a relevant impact on industrial employment. Overall, the level of employment in a country's manufacturing activities is related with those transport infrastructures that improve its international connectivity.

1. Introduction

Transport infrastructure is crucial for the economic development of regions, since better infrastructure implies a greater outlay of public capital and, hence, the higher productivity of private factors, fewer transport costs for firms and greater accessibility to territories. However, as suggested by Redding and Turner (2014), the analysis of the economic impact of transport infrastructure on regions requires that the effects related to growth be distinguished from those related to the reorganization of economic activity, population or employment.

Numerous empirical studies have examined the impact of infrastructure on economic growth, most of them using production functions (Aschauer, 1989; Munnell, 1990; García-Milà and McGuire, 1992; Holtz-Eakin, 1994) or cost functions[1] (Nadiri and Mamuneas, 1994; Morrison and Schwartz, 1996) to analyze the impact of public capital on countries or regions.

While a vast literature has been built up on the link between public capital and output (and, to a lesser extent, costs), few studies examine the impact of different modes of transport infrastructure on employment, using country or regional level data and those studies that do this analysis generally focus on just one specific mode. In fact, most of these studies have analyzed the effect of highways on employment with mixed results (Clark and Murphy, 1996; Duranton and Turner, 2012; Jiwattanakulpaisarn et al., 2009, 2010), some have focused on seaport infrastructure and obtain evidence of positive effects for European and Italian regions (Bottasso et al., 2013; Ferrari et al., 2010, respectively), and another group of studies has reported positive effects of airport infrastructure (Albalate and Fageda, 2016; Brueckner, 2003; Blonigen and Cristea, 2015; Percoco, 2010).

This paper examines the determinants of industrial employment in Spanish regions using annual data for the period that goes from 1995 to 2008. Controlling for various regional attributes, it examines the direct, indirect and total impacts of various modes of transportation, including roads, railways, ports and airports. This study focuses specific attention on identifying whether the different transport modes have an effect in terms of the growth of industrial employment or in terms of its reorganization within regions.

The methodology employed is based on the use of spatial econometric techniques. Specifically, this study considers a spatial Durbin model (SDM), which measures the spatial interaction of the dependent and explanatory variables (LeSage and Pace, 2009) so that it can examine the direct effects on the areas in which the infrastructure is located and the spillover effects on neighboring regions. To this point, the impact on employment of a better endowment of transport infrastructure in one region on its neighbors is not, a priori, clear. Indeed, improved infrastructure may give rise to a competition effect associated with the agglomeration of activities in the region with better infrastructure and a complementary effect associated with improved

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[1] Melo et al. (2013) provide a meta-analysis of the impact of transport infrastructure on economic activity.

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access to other regions or international markets.

This research focuses on the industrial sector given its relevance for regional economies.[2] Cohen and Morrison Paul (2004) argue that the focus on a particular sector offers more plausible and more interpretable results than a macroeconomic approach, while Holtz-Eakin and Lovely (1996) show that manufacturing activity benefits more than other productive sectors from improved transport infrastructure.

The industrial sector is clearly very important for regional economies, given that a high proportion of exports and R & D expenditure are associated with manufacturing activities. Note also that industrial establishments can occupy a variety of locations, while service industries tend to be located in the central business districts of major urban areas. In this regard, rather than addressing transport infrastructure that only improves intra-urban mobility, this study focuses on infrastructures that influence intra- and inter-regional mobility.

We find that the aggregate effect of transportation on industrial employment is only positive and statistically significant in the case of ports. Regions with more kilometers of roads are able to attract more industrial employment but this is at the expense of nearby regions. In contrast, regions that benefit from having a large port, along with the regions located nearest to these port regions, obtain more employment in manufacturing activities without harming the other regions. Finally, we do not find any significant impact for airports and railways.

This research contributes to evaluate how transport infrastructure influences industrial activity. Thus, policy makers can analyze and understand the relevance of their investment decisions of different transport modes and the effect on industrial activity.

The rest of the paper is organized as follows: Section 2 describes the data; Section 3 justifies the explanatory variables selected and explains the econometric techniques used; Section 4 presents the main findings. The last section discusses policy implications.

2. Data

This section describes the data and variables used to estimate the determinants of industrial employment across the Spanish regions by building a balanced panel dataset for the period that goes from 1995 to 2008. While homogeneous data of industrial employment for more recent periods are not available, the analysis for this period has the advantage that is not conditioned by the severe worldwide economic crisis from 2008 onwards.

This analysis considers the 47 Spanish provinces that correspond to the NUTS-3 level in the European territorial unit classification[3]; however, it excludes the Island regions (Balearic and Canary) and the two territories located in the North of Africa (Ceuta and Melilla) as it is unable to assess the indirect impact of surface transportation in these regions.

The employment data are based on the sector classification provided by Spain's National Institute of Statistics, which disaggregates employment statistics as follows: 1) Agriculture, livestock and fisheries; 2) Energy; 3) Industry; 4) Construction; 5) Market services; and 6) Non-market services. In this regard, this analysis is focuses on the industry sector.

While the literature generally considers the impact of the value of the public capital stock (related to transport infrastructure) on the monetary gross domestic product, this paper focuses on the relationship between industrial employment and physical indicators of transport infrastructure. Specifically, this analysis uses the number of kilometers of highways and railways, and port and airport traffic measured in tones and in kilograms of goods, respectively.

Investment in transport infrastructure has two effects (Vickerman, 1987): in the short run, the investment itself reactivates the construction sector while, in the long run, the investment has an external effect on the region's production costs by reducing accessibility costs. Here, the use of physical indicators, as opposed to monetary indicators, should help isolate this long-run effect. Indeed, the use of physical measures should capture the services provided by the infrastructure more appropriately, while the stock of capital is essentially an indicator of construction costs.

However, the use of physical measures also has limitations as we are assuming that each kilometer has the same effect on industrial employment. Ideally, the best variable to measure the improvements in transport connections would be an accessibility variable. Unfortunately, it is not possible to collect data for a measure of improvements in accessibility for the considered period (1995–2008).

All variables used in this analysis are in log-linearized form in order to estimate the output elasticity of these variables. Table 1 reports the variables used in the empirical analysis, the sources of information drawn upon and their descriptive statistics. Note that the dependent variable is total employment in the industrial sector, while the explanatory variables include physical indicators of transport infrastructure, density of population and levels of education. As additional explanatory variables, this model also includes the spatial lag of the dependent variable and spatial lags of the rest of the explanatory variables (for more details on the econometric approach, see the next section).

Note here that our data have three important limitations that must be taken into account in the interpretation of results of the empirical analysis. First, the data for the motorway and railway endowment variables are only available at the NUTS-2 level (in Spain, that of the Autonomous Communities). Data for monetary values of transport infrastructures (investments, capital stock) are available at the NUTS-3 level. However, we consider more appropriate the use of physical indicators as our dependent variable is employment of the industrial sector. In any case, we have run regressions with the monetary indicators at the NUTS-3 level and the performance of the model is worse than with the regressions reported in the text.

Regarding the measures of infrastructure stocks, there is a mismatch across the variables as some of them indicate usage equilibrium (as in the case of ports and airports, where the relevance of infrastructure is measured with traffic) and some others indicate public capital provision (as in the case of roads and railways, as they are measured in kilometers). Unfortunately, we have not able to collect better data. Data about traffic of roads and railways is not available for Spanish regions, while it has been not been possible to get comparable physical indicators of ports and airports.

Furthermore, we only have available aggregated data at the regional level so that some important complementarities between different transport modes (for example, an airport or a port is more competitive if it is surrounded by a denser network of roads and/or railways) cannot be identified.

While these data limitations may impose some bias in the estimation, we do not expect that they distort the sign and statistical significance of the main variables considered in the empirical analysis. However, they may have an effect on the magnitude of the coefficients.

Finally, this section gives a brief descriptive analysis of the regional distribution of the dependent variable and transport variables in Spain. An examination of the geographical distribution of employment in the manufacturing sector reveals a marked difference between coastal areas and the interior.

[2] Other studies that examine the role of transportation or public capital on the industrial sector include Hulten and Schwab (1991), Cohen and Morrison Paul (2003, 2004), Morrison and Schwartz (1996) and Moreno and López-Bazo (2007).

[3] Eurostat's NUTS classification (Nomenclature of Territorial Units for Statistics) is the European Commission's hierarchical statistics system for referencing the economic territory of the EU. A NUTS-2 area should have a population between 800,000 and 3,000,000 inhabitants, while that of a NUTS-3 area should range between 150,000 and 800,000 inhabitants. In practice, the statistical territorial units are defined in terms of the existing administrative units in the Member States and do not necessarily fulfill these population limits. In Spain, NUTS 2 are the *Comunidades Autónomas* (autonomous communities, or first-level political and administrative divisions) and NUTS 3 are the provinces.