



Relationship between freight accessibility and logistics employment in US counties



Frank P. van den Heuvel^{a,*}, Liliana Rivera^b, Karel H. van Donselaar^a, Ad de Jong^a, Yossi Sheffi^b, Peter W. de Langen^a, Jan C. Fransoo^a

^aSchool of Industrial Engineering, Eindhoven University of Technology, The Netherlands

^bCenter for Transportation and Logistics, Massachusetts Institute of Technology, United States

ARTICLE INFO

Article history:

Received 7 January 2013

Received in revised form 21 October 2013

Accepted 4 November 2013

Keywords:

Accessibility

Freight transport

Logistics employment

ABSTRACT

This paper analyzes the relationship between freight accessibility and logistics employment in the US. It develops an accessibility measure relevant for logistics companies based on a gravity model. This allows for an analysis of the accessibility of US counties focusing on four different modes of transportation: road, rail, air, and maritime. Using a Partial Least Squares model, these four different freight accessibility measures are combined into two constructs, continental and intercontinental freight accessibility, and related to logistics employment. Results show that highly accessible counties attract more logistics employment than other counties. The analyses show that it is very important to control for the effect of the county population on both freight accessibility and logistics employment. While county population explains the most variation in the logistics employment per county, there is a significant relationship between freight accessibility and logistics employment, when controlling for this effect.

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1. Introduction

One of the key factors to a region's economic performance is a reliable and efficient transportation infrastructure. "A well-developed transportation system provides adequate access to the region, which in turn is a necessary condition for the efficient operation of the manufacturing, retail, labor, and housing markets" (Ozbay et al., 2006, p. 3). The accessibility of a location is, naturally, an important factor for the location decision of logistics companies (such as third party logistics service providers, warehouses, motor carriers, and the logistics/distribution operations of retailers, distributors and manufacturers). Better accessibility results in lower transportation costs and a shorter time to the market (Limão and Venables, 2001), which have a direct impact on the cost and service level that logistics operations enjoy. Therefore, logistics employment is expected to be concentrated in areas that are highly accessible. Hence, it is not surprising that improvements to the road network significantly affect the location of agglomerations of logistics firms (Taniguchi et al., 1999), that logistics clusters in the US are primarily developed close to major airports and seaports and in central areas such as Chicago, Kansas City and Dallas (Rivera and Sheffi, 2012), or that logistics establishments in the Netherlands relocate relatively often in areas with intermodal terminals (Van den Heuvel et al., 2013). In this paper, we analyze whether there is a general relation between freight accessibility and logistics employment. This topic may be especially relevant given Hesse's (2008) argument that logistics investments may accelerate economic development of areas. This argument is also advanced by Sheffi (2012),

* Corresponding author. Address: School of Industrial Engineering, Eindhoven University of Technology, P.O. Box 513, 5600 MB Eindhoven, The Netherlands. Tel.: +31 40 247 38 41.

E-mail addresses: FPvandenHeuvel@gmail.com (F.P. van den Heuvel), MLRivera@mit.edu (L. Rivera), K.H.v.Donselaar@tue.nl (K.H. van Donselaar), A.d.Jong@tue.nl (A. de Jong), Sheffi@mit.edu (Y. Sheffi), P.W.d.Langens@tue.nl (P.W. de Langen), J.C.Fransoo@tue.nl (J.C. Fransoo).

who demonstrates that logistics clusters attract manufacturing sub-clusters. Several studies have found that accessibility is an important factor for urbanization (population and employment growth, see e.g. [Jiwattanakulpaisarn et al., 2010](#); [Song et al., 2012](#)). However, the relationship between freight accessibility and logistics employment has hardly been studied. Such an analysis requires a measure of freight accessibility. Although freight accessibility is important for location decisions of companies ([Porter and Rivkin, 2012](#)), limited efforts have been put in developing freight accessibility measures.¹ This paper addresses these gaps; we develop a freight accessibility index and analyze the relationship between freight accessibility and logistics employment.

The remainder of this paper is structured as follows. Section 2 presents an overview of the relevant literature on the relationship between accessibility and employment, while Section 3 reviews the academic literature on accessibility measures. Section 4 presents an accessibility measure especially developed for freight transport. Using data at the county level in the US, Section 5 presents the analysis into the relation between freight accessibility and logistics employment per county, based on a Partial Least Squares model. Finally, Section 6 concludes the paper and discusses options for further research.

2. Relationship between accessibility and employment

The relationship between transport infrastructure investments (not specifically accessibility) and spatial development has been widely studied (e.g., [Rietveld, 1994](#); [Berechman, 1994](#); [Berechmen et al., 2006](#); [Ribeiro et al., 2010](#)). These studies show that transport infrastructure investments can both have positive (increased population or gross product) and negative economic impacts (degradation of the region, because firms and residents can move away from the region more easily). Transport infrastructure investments positively influence an area's economic growth if three conditions are met: it increases accessibility *within* a region, transport is a relevant input for the processes of the firms in the area, and the infrastructure does not generate significant negative environmental externalities ([Berechman, 1994](#)).

Scholars have also analyzed the relationship between accessibility and growth of jobs and population. [Weisbrod et al. \(1993\)](#) found that the impact of airport-induced job growth on land use in the vicinity of airports is substantial. Areas within four miles of airports added jobs two to five times faster than the overall suburban ring in which the airport is located. Most of the employment was concentrated around the airport or along a major access corridor within fifteen minutes of the airport. In addition, [Allen et al. \(1993\)](#) look at the effect of accessibility on different types of areas. He concludes that accessibility has a significant effect on employment growth rates in central business districts and areas outside the central city; no significant effect was found in the rest of the central city areas. [Thompson and Taniguchi \(2001\)](#) conclude that the construction of transportation infrastructure (increasing accessibility) leads to employment growth and lower consumer prices of commodities at the city level. The effects at the state level are addressed by [Jiwattanakulpaisarn et al. \(2010\)](#), who conclude that increased accessibility is a determinant of state employment growth in the service sector. Next to employment, the effect of accessibility on labor supply has also been analyzed thoroughly (see e.g. [Hansen, 1959](#); [Banister and Berechman, 2000](#); [Berechman and Paaswell, 2001](#); [Ozbay et al., 2006](#); [Du and Mulley, 2007](#)). A common approach is to assume that individuals allocate their total daily hours between work and non-work activities. Hence, reduced travel time will result in more time available for both work and leisure time activities. Given assumptions on work/leisure time substitution as well as on the income effect from reduced travel times and costs, improved accessibility has a positive effect on the amount of labor that individuals are willing to supply ([Ozbay et al., 2006](#)).

Regarding population, [Chi \(2010\)](#) shows a positive effect of highway expansion on population change in rural and suburban areas on the lowest geographical scale in the US, the minor-civil division level. In urban areas, there is no effect. In addition, [Chi \(2012\)](#) shows that airport accessibility and highway improvement promote population growth in rural areas. In suburban areas, airport accessibility promotes population growth, while highway accessibility facilitates migration of population out of the area. In urban areas, highways and airports have no significant effect on population growth. [Chi \(2010, 2012\)](#) explains these outcomes by the fact that infrastructure does not create a comparative advantage when none exists; it just facilitates flows of people (and freight) from one location to the other. Furthermore [Chi \(2010, 2012\)](#) argues that in urban areas, infrastructure development reaches maturity, meaning that extra investments do not result in growth or development of the area.

Finally, the importance of road transport infrastructure in the location decision of firms has been studied. This importance varies with various firm characteristics. [Leitham et al. \(2000\)](#) show that for newly built industrial premises in the UK, firms from within the UK indicate a higher importance of road links than firms from outside the UK. Similarly, for location decisions made by foreign logistics firms in China, road transport infrastructure is more important for the location decision for headquarters than for logistics establishments. Furthermore, new firms were more attracted by road transport infrastructure than mature firms ([Hong, 2007](#)).

None of the aforementioned works specifically analyze the relationship between freight accessibility and logistics employment. In the logistics industry accessibility is an important location factor because better accessibility translates to lower transportation costs and shorter time to markets ([Limão and Venables, 2001](#)). Hence, areas with better accessibility

¹ This lack of research is in contrast with passenger accessibility. This may be explained by the fact that passenger cars account for 89.8% of the vehicle-miles on US roads, while trucks only account for 9.1% of the vehicle-miles traveled. The rest are buses and motorcycles that represent 1.1% ([US Department of Transportation, 2011b](#)).

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