



Regional logistics hubs, freight activity and industrial space demand: Econometric analysis



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ABSTRACT

There has been a continuing interest among transportation researchers and the logistics industry in the relationship between the consumption of industrial space and freight transportation activity. With the growing importance of logistics and supply chain economics to global industries, firms organizing their industrial activities and locating their warehousing and operational centers must increasingly consider the availability, quality and cost of a range of transportation services. Accordingly, the development of logistics facilities in conjunction with regional freight transportation hubs has become an important element of the overall industrial economy, predicated on the notion that robust freight activity is a good indicator of the consumption of industrial space. In this study, we conduct an econometric analysis of a longitudinal data set consisting of twenty metropolitan markets observed annually from 1997 to 2007. From those results, we develop a methodology to score and rank metropolitan markets according to their potential for industrial space consumption based on macroeconomic, demographic, and freight flow variables.

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1. Introduction

The relationship between regional consumption of industrial space and freight flows has been of increasing interest to urban geographers, transportation researchers, and logistics and supply chain managers. With growing importance of logistics and supply chain economics to global industries, firms organizing their supply chains (through the location of warehouses and operational centers) increasingly consider the availability, quality, and cost of a range of transportation services as major decision factors. This makes regional freight hubs attractive to developers of major logistics facilities, predicated on the notion that robust freight activity is a good indicator of demand for industrial space. This approach to the development of logistics facilities – i.e., concentrating on regional freight hubs – has become an important, but rarely studied, element of the overall industrial economy. Generally, the geography of freight and logistics distribution, and its associated locational dimensions, has seen limited systematic investigation and scholarly research (Hesse & Rodrigue, 2004).

Motivated by the above considerations, this research explores the relationship between the consumption of industrial space and freight flows in U.S. metropolitan markets, and uses this relationship to help assess the relative potential demand for industrial space in these markets.

The interrelation between freight flows and industrial land consumption is considered in conjunction with the macroeconomic and demographic factors that influence consumption. Accordingly, the study objectives are to (a) identify determinants of industrial space consumption in metropolitan markets, and (b) develop an indicator of relative metropolitan market potential that would help predict likely development opportunities.

This research contributes to transportation business and management by providing some insight into industrial space consumption using relatively simple indicators of economic activity within a rigorous statistical framework. It provides a methodology for assessing development opportunities provided by different markets as indicated by macroeconomic, demographic, and freight flow variables. The results of this work have implications for (a) management professionals formulating development investment strategies, (b) logistics planners considering location opportunities, and (c) planners in metropolitan and state agencies interested in predicting likely development patterns or in formulating economic development strategies in a spatially competitive environment.

The remainder of the paper is organized as follows: First, some brief background information about the problem is given. Next, the research methodology is outlined along with a discussion of the data used for the study. This is followed by a discussion of the findings of the research. Lastly, the managerial implications and research contributions are discussed.

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1.1. Background

The theorized attractiveness of hub markets to firms making location decisions is firmly rooted in the field of regional science (Marshall, 1920) and transport geography (Bowen, 2008; Cidell, 2010; Sivitanidou, 1996). Marshall (1920) observed that the economic advantages gained from geographic proximity encourage firms to cluster together. Sheffi (2013) argued that logistics clusters are a unique type of cluster characterized by a collection of firms with logistics-intensive operations. Though they share many of the same characteristics that generally make industrial clusters attractive, logistics clusters particularly rely on the operational advantages gained from transportation and asset-sharing.

Access to transportation infrastructure plays an influential role in the location decisions of businesses across a wide range of industries (Targa, Clifton, & Mahmassani, 2005, 2006). For instance, in an empirical analysis of Wal-Mart store locations, Holmes (2011) found that a dense network of stores allowed Wal-Mart to achieve significant distribution costs. However, for businesses in the industrial sectors, accessibility to goods' movement infrastructure is particularly important (Sivitanidou, 1996). Both Bowen (2008) and Cidell (2010) observed that the distribution of firms' logistics facilities is heavily correlated with accessibility. Lindsey, Mahmassani, Mullarkey, Nash, and Rothberg (2014) showed that there is a positive and statistically significant relationship between the demand for industrial space and freight flows. The results suggested that as freight flows increase, so too does demand.

As centers of logistics activity and knowledge, hub markets allow firms to achieve lower transportation costs and greater supply chain flexibility (Nuzum, 2006). In hub markets, shippers have better opportunities to generate full truckload shipments (as opposed to less-than-truckload shipments and partial loads) and fewer empty miles, both of which allow carriers to offer better rates. Regarding supply chain flexibility, multimodal freight hubs allow customers' access to all of the major modes of freight transportation (rail, trucking, and air), which mitigates the risks associated with service disruptions in a single mode.

The contribution of this work is a methodology that identifies the metropolitan markets that are most desirable for industrial and logistics real-estate investment. The basic idea is that those areas that are regional logistics hubs are prime investment markets. This is supported with a methodology that uses a few relatively simple and easily observed variables to develop a single indicator. Developers of logistics facilities desire indicators because they help to distinguish better investment opportunities from inferior ones. We develop our indicator using the parameter estimates of an econometric analysis of real estate, demographic, macroeconomic, and freight flow data.

2. Research questions, methods, & data

This section discusses the specific research question we are examining, the methodology by which we will conduct this examination, and the data to be used in the study.

2.1. Research questions

This study hypothesizes that the total consumption of industrial space in a metropolitan market can be formulated as a function of a few relatively simple demographic-, macroeconomic-, and freight flow-based barometers of consumption; this relationship can then be used to formulate a single indicator that investors can then use to help identify and compare prime investment markets. Industrial space consumption is measured by gross absorption, the total amount of consumed space in a market (NAIOP, 2005).

Gross absorption can be considered a temporary equilibrium between supply and demand. It reflects the supply of land suitable for developing industrial and logistics facilities and the demand for those facilities. It is an appropriate measure for this research because it is

more useful from a developer's perspective than the year-to-year fluctuations in the difference between occupied and vacated space — net absorption (NAIOP, 2005). Gross absorption accurately reflects market size and can better inform investment strategies predicated on capturing market share of large and burgeoning markets; that is the goal of this research.

2.2. Data

The study is conducted using data on the real estate, demographic, macroeconomic, and transportation characteristics of several metropolitan markets. The study markets are comprised of regionally and nationally significant metropolitan areas. They can be characterized as either having significant levels of freight activity, large consumer bases, or both. The markets include:

· Atlanta, GA	· Los Angeles, CA
· Boston, MA	· Minneapolis, MN
· Chicago, IL	· New York, NY
· Cincinnati, OH	· Oakland, CA
· Cleveland, OH	· Orange County, CA
· Dallas, TX	· Philadelphia, PA
· Detroit, MI	· Phoenix, AZ
· Edison, NJ	· Riverside, CA
· Houston, TX	· St. Louis, MO
· Indianapolis, IN	· Seattle, WA.

Many of the included markets are historical freight hubs at both the regional and national levels. Los Angeles and New York are gateway markets for much of the U.S.'s imports and exports. The ports of New York/New Jersey and Los Angeles/Long Beach are the nation's busiest in terms of container traffic. In 2012, they accounted for approximately 45% of U.S. waterborne container traffic (U.S. Army Corp of Engineers, 2014). Chicago, IL has long been considered the hub of the U.S. freight rail system. Six of the seven Class I railroads converge on the metropolitan area. Additionally, the availability of intermodal services has spurred in the region the development of large logistics clusters that offer to shippers other essential freight services such as warehousing and last-mile deliveries. Examples include the Burlington Northern Santa Fe and Union Pacific facilities located in Joliet and Rochelle, IL, respectively.

Metropolitan areas such as Atlanta, Dallas and Seattle can be characterized as regional freight hubs, especially in regard to rail and intermodal services. Most have two Class I railroads operating within their areas and a few others have relatively large ports (e.g. Houston and Seattle). These markets are the economic and distribution centers of their respective regions. Smaller markets such as Riverside and Edison contain a predominant amount of the freight infrastructure used to service very large and populous regions (i.e. New York and Los Angeles). All of the markets, with the exceptions of Edison and Riverside, represent relatively large consumer bases as well.

Thus, the selection of markets was driven a number of criteria. Because there was a desire to have broad geographic representation, metropolitan areas from across the U.S. were targeted. Markets that are widely considered freight hubs, especially in regard to rail services, were included in the sample alongside large, economically significant metropolitan areas. Also selected were regional economic and freight hubs. Additionally, markets with large amounts of freight activity relative to their size were included. However, the sample size is limited by the availability and quality of the data, especially considering that every market is observed several years.

2.2.1. Summary of the data

The primary source of U.S. multimodal freight flow data is the Commodity Flow Survey (CFS). CFS data largely focuses on the most economically significant metropolitan areas in each state. Industrial

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