



Do firms flee traffic congestion?

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ABSTRACT

Much transport policy aims to use congestion relief measures to support economic activity, but planners know relatively little about how individual firms respond to traffic congestion. This study helps fill this gap by exploring individual firm location responses to traffic congestion within the Philadelphia metropolitan area between 2003 and 2007. This study tests whether existing, basic-industry firms flee congested areas to minimize exposure to the congestion externality. Relocation responses are estimated and compared for five separate industries (finance and insurance, health care, manufacturing, real estate and leasing, and wholesale trade) using firm-level data collected by InfoUSA and obtained from ESRI. Results suggest that congestion influences firm location decisions, but that the scale of congestion is important. While firms appear to relocate out of areas with high regionally-scaled congestion, areas with high local congestion are associated with a lower likelihood of relocating. In sum, while regional congestion appears to be a drag, local congestion appears to function as an amenity – implying that there is truth in the competing notions among engineers and economists of congestion as a diseconomy and among urban designers of congestion as an amenity.

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1. Introduction

There is much debate about whether traffic congestion and its spatial impacts are bad or good for the future of a local economy. While congestion is indicative of high activity levels in a finite amount of space, some suggest that roadway traffic congestion places a limit on how and where a city can grow. Some businesses and individuals may seek peripheral locations where unused roadway capacity is available in order to enjoy high-speed travel, lower land prices, and more space. Others may be dependent on high levels of interaction, and may benefit significantly from proximity to other firms, employees, and urban amenities. Can the access benefits of proximity be negated by traffic congestion's slower travel speeds? It is unclear whether (and to what extent) the very traffic congestion associated with dense urban areas may create diseconomies that reduce accessibility and induce economic disinvestment.

Research suggests that the links between traffic congestion, land use decisions, accessibility, and economic performance are important (Woudsma et al., 2008) and complex (Mondschein et al., 2010). This study builds upon past literature by explicitly estimating the influence of traffic congestion on individual firm location decisions within the Philadelphia metropolitan area between 2003 and 2007. In short, this study attempts to answer

the question: do existing firms flee congested areas in making location decisions?

2. Prior research

While accessibility patterns have long been held as important determinants of urban geographies, the economic literatures on *accessibility* and *traffic congestion* have remained largely separate. Few studies (Graham, 2007; Weisbrod et al., 2001; Woudsma et al., 2008) have explicitly operationalized accessibility patterns as a means through which traffic congestion impacts economic activity. Prior research in both fields suggests that the relationship is complex.

2.1. Accessibility research

Accessibility is possibly the most important factor in shaping urban form and function (Hanson and Schwab, 1987; Kwan, 1998; Song, 1996). The concept of accessibility has two basic components: the spatial distribution of opportunity locations (land use) and the connectivity of opportunity locations using a particular transport system (mobility) (Krizek, 2005). Much research has focused on the relative merits and trade-offs of land-use or mobility oriented policies to increase access to opportunities, but the answers are far from clear (Taylor, 2004). While some argue that high levels of mobility have rendered land-use distributions less important in determining the geography of accessibility (Giuliano,

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1995), others have argued that focusing exclusively on mobility oriented accessibility policies may lead to net reductions in social welfare and may even reduce accessibility (Cervero and Wu, 1997; Mogridge, 1997). Different conclusions have led to varying policy recommendations for applying the trade-offs of density-based or mobility-based accessibility policies in practice.

2.2. Traffic congestion in the urban economy

Studies on transportation infrastructure's role in economic development inform research on traffic congestion in the regional economy. Research suggests that while transportation investment induces private-sector economic growth, the magnitude of benefit has diminished as roads have become ubiquitous (Banister and Berechman, 2000) and highways have become congested (Fernald, 1999). Since transport infrastructure is not productive by itself, the incremental benefits of its services – particularly when altered by congestion – affect the marginal economic benefits to private capital (Boarnet, 1997).

Inter-metropolitan research that compares different counties or regions suggests that higher levels of traffic congestion lead to decreasing rates of productivity (Boarnet, 1997) or slower employment growth (Hymel, 2009). This literature implies that traffic congestion may act as a limiting factor in the size of cities and may contribute to slower growth rates as transport infrastructure is saturated.

Intra-metropolitan research suggests that traffic congestion reshapes urban geographies through inducing variable firm-to-firm agglomeration returns and inducing employer and employee suburbanization. Different industries experience varying degrees of diminishing returns on firm-to-firm agglomeration (Graham, 2007). Generally, financial and service industries appear to be less responsive to increases in congestion and retain high economic benefits from agglomeration. Manufacturing industries, on the other hand, appear to be more sensitive to increases in congestion (Fernald, 1999; Graham, 2007; Weisbrod et al., 2001).

Two differing schools of thought have emerged regarding employer and employee responses to traffic congestion. According to the co-location hypothesis, firms suburbanize to relocate closer to their labor inputs, thereby maintaining stable commuting times despite traffic congestion (Crane and Chatman, 2003; Gordon et al., 1989; Levinson and Kumar, 1994; Wachs et al., 1993). In contrast, research on spatial mismatch suggests that traffic congestion increases commuting times due to the jobs-housing imbalance associated with residential immobility, housing production lags, and regulatory limits on firm relocations (Cervero and Wu, 1997, 1998; Schwanen et al., 2004). According to this research, there may be a “maximum tolerance” at which residents and firms may be willing to substitute other amenities for reduced travel times (Levinson and Wu, 2005).

The existing body of research on traffic congestion, accessibility, and economic development suggests that traffic congestion slows metropolitan employment growth and productivity, and that it induces variable returns to agglomeration, which vary by industry. However, there is still much disagreement on how traffic congestion influences regional accessibility and changes metropolitan economic geographies. Previous findings largely have been based on studies of new-growth metropolitan areas in California, Washington, DC, and Minneapolis, while it is less clear whether or how slow-growth metropolitan areas are shaped by the geography of congestion.

3. Study area

Philadelphia is among the oldest and largest U.S. cities (ranked in the largest six metropolitan statistical areas during each of the

study years). The study area includes the nine-county region for which the Delaware Valley Regional Planning Commission (DVRPC), a regional Metropolitan Planning Organization, is responsible. Deindustrialization and manufacturing job losses brought historic depopulation to Philadelphia's core, but the county and region have experienced subsequent uneven growth. Philadelphia County, the regional employment hub, attracted the greatest increase in employees during the 2003–2007 study timeframe, but suburban counties experienced the greatest population growth.

According to the American Community Survey's population estimates (US Census, 2010), Philadelphia County had the largest absolute increase in employment over the four-year period (20,000 jobs), while the next largest increases were Chester (14,000), Bucks (11,000), and Gloucester (10,000) counties. Gloucester (3.0%) and Chester counties (1.6%) experienced the most rapid annual employment growth rates between 2003 and 2007. However, different patterns emerge when examining relative and absolute changes in residents. Chester County added the largest absolute increase in residents (37,000), while Philadelphia (31,000), Montgomery (26,000), Mercer (24,000), and Delaware (23,000) counties each added more than 20,000 residents between 2003 and 2007 (US Census, 2010). In comparison, Gloucester, Mercer and Chester counties experienced the fastest relative population growth rate during the study timeframe (greater than 1.5% annually), while Camden and Philadelphia counties, the two most urban, experienced the slowest population growth rates of approximately half a percent per year.

4. Methods

This study focuses on the question: *how does the influence of traffic congestion impact firm location decisions?* On the one hand, a weak association between congestion and firm locations would suggest that firm location decisions are determined more by other factors, and are weakly associated with the geography of traffic congestion. Such findings may be consistent with the literature on jobs-housing imbalances (Cervero and Wu, 1997, 1998), suggesting that congestion results in a longer commute that may be less feasible for segments of the population. In contrast, a strong net out-migration of firms from high-congestion areas to areas with lower congestion would imply that firms and employees jointly relocate in the Philadelphia region. This would be consistent with the co-location hypothesis (Gordon et al., 1989; Levinson and Kumar, 1994), suggesting that congestion reshapes urban geographies and may even induce sprawl and polycentricity.

4.1. Modeling approach

This study models firm-level location decisions (between 2003 and 2007) in response to traffic congestion and other key explanatory variables. The research estimates the role of congestion in shaping location decisions in two steps: (1) whether a firm remains in a location or moves elsewhere, and (2) where a firm relocates.

First, this study explores whether firms moved between 2003 and 2007 in response to the marginal congestion penalty. This study employs logistic regression to model individual firm-level decisions to move or stay within a given location in response to a congestion penalty and other explanatory variables. To estimate the probability that a firm will move or stay, the study independently estimates the following equation for each of the industry types (finance and insurance; health care and social assistance; manufacturing; real estate and rental and leasing; and wholesale trade):

$$r_{ak} = 1 / (1 + \exp(-(\beta_{k0} + \beta_{k1} \text{Cong} + \beta_{k2} \text{Explan}))) \quad (1)$$

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