

Location Dynamics: A Key Consideration for Urban Policy

BY JEFFREY BRINKMAN

The policies that cities adopt regarding such things as taxes, transportation infrastructure investment, zoning, schools, and police have important and often unpredictable effects on where businesses locate and individuals decide to live and work. In turn, these location decisions have real consequences for cities' general welfare and economic health. So to fully understand the long-term effects of their policies, cities must consider the complex ways by which firms, residents, and workers go about choosing where to locate.

Take, for example, London's decision in 2003 to implement a new plan to reduce congestion in the center of the city. At the time, development was booming and traffic congestion was becoming increasingly troublesome. Rather than try to increase capacity through construction of more highways and other automobile infrastructure, London introduced a congestion pricing policy. The idea of congestion pricing is simple and has wide support from economists and policy analysts. Because congestion has many negative social effects, including slower travel times, increased carbon emissions, and reduced local air quality, a tax on congestion can have net positive effects for society by encouraging people to travel by other modes or at different times.

London initially levied a charge of £5 on any car travelling into central London, with the price increas-

ing to £8 in 2005 and eventually to £10 (about \$15), where it stands now. There is some evidence that this policy has worked by initially reducing traffic volume by 27 percent and increasing vehicle speeds by 17 percent inside central London.¹ While London was one of the first major cities to implement congestion pricing, the idea has caught on with other European cities that are looking to the policy as both a source of revenue and a solution to ever-increasing traffic congestion.

However, the efficiency of congestion pricing is partially based on the assumption that the locations of people and businesses in a metropolitan area are fixed, an assumption that

¹ Jonathan Leape provides some analysis of the effects of congestion charges in London.

may be valid in the short term. However, in the long run, when faced with a new toll, people might not switch to transit. They might just choose to work or shop somewhere else, which could have negative economic consequences for the city.² This is one example of why location decisions are important in understanding the effects of urban policies.

THE COMPLEX INTERACTIONS OF LOCATION DECISIONS

The average person is familiar with the process of deciding where to live within a metro area. The decision, while sometimes difficult, seems fairly straightforward. People think about how much it costs to live in various neighborhoods and municipalities, how far they are from work and family, various amenities such as low crime rates and good schools, as well as access to services such as shopping or entertainment. They look at the city and its environs, weigh their options, and make a decision.

In an analogous way, businesses make decisions about where to locate in metro areas. They think about the cost and production advantages of various locations, certainly considering the cost of land and facilities, as well as access to customers or employees.

² In my working paper (2013), I present evidence suggesting that although congestion pricing does reduce traffic, the net effect on the economy is slightly negative. This outcome occurs because over the long run, congestion pricing reduces the concentration of businesses, which lowers productivity by reducing knowledge spillovers. Also see Gerald Carlino's 2001 *Business Review* article.



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These decision methods make perfect sense from an individual point of view. One individual's or firm's decision is unlikely to affect the overall characteristics of a large urban area. However, when we consider all of these people and businesses making decisions simultaneously or over the course of time, things get more complicated. For example, if the quality of a school depends on the educational level of the parents in the district or tax revenue drawn from the income of residents, then a question arises as to how high-quality school districts are formed in the first place and if they will continue at the same level of quality.

Another complication arises with the fact that business and residential decisions are connected. When a business moves, how does this affect where its customers or employees live? Conversely, when customers or potential employees move, how does this affect business location decisions? This simultaneous decision process complicates our understanding of the geographic distribution of population and employment in cities.

Finally, individual decisions may directly affect others in the form of an externality. In other words, one individual's or firm's actions may impose a cost on others or may deliver a benefit. The urban congestion described above creates a negative externality, since individual commuting decisions can cause congestion and slow everyone else down. Conversely, an example of a positive externality in urban areas is agglomeration. This is the idea that employment density has positive benefits for production, in that a firm's decision to locate near other firms leads to positive spillover effects. Externalities like these are of particular interest to economists and policymakers because they suggest that direct policy intervention has the potential to unambiguously improve efficiency in the economy.

HOW RESIDENTS SORT THEMSELVES INTO NEIGHBORHOODS

One important aspect of location decisions within cities revolves around how people self-sort into different local jurisdictions in a metro area for various reasons.³ This choice can be based on the innate characteristics of the various locations. For example, wealthy individuals will probably pay the most to live next to a beach. Or it might be the case that the characteristics of a neighborhood depend on the demographic composition of individuals living in that neighborhood. For example, the quality of the schools may depend on the education level of the parents living in that school district.

An early treatment of the role of sorting in cities was presented by Charles Tiebout in 1956. The key thrust of his paper is that, all else being equal, people will gravitate toward communities that provide the public services they desire. This is a powerful idea because it suggests that the existence of multiple local jurisdictions can possibly improve overall welfare by matching people with desired public amenities, not unlike the mechanism that drives the market for private goods.⁴

More recently, Dennis Epple, Thomas Romer, and Holger Sieg, among others, have more rigorously investigated the implications of sorting in cities and have also developed methods to test this implication empirically using observed sorting within cities. By considering that people have both different preferences for public services and different incomes, and recognizing that these two characteristics might be correlated, they are able to explain relative income and public service

³ For the purposes of this discussion, we are assuming that people are free to choose where to live. Of course, historically and currently, globally as well as in the United States, this right has often been denied.

provision across jurisdictions. They also show that people are sophisticated in their decision-making such as voting behavior, in the sense that residents recognize the effects of public service provision on their location choices.

BUSINESS LOCATION DECISIONS INVOLVE TRADEOFFS

Firms also make location decisions within cities. Ignoring for a moment the location of residents, who act as both customers and employees and thus are important in firms' decisions, firms still face tradeoffs in their location choices in urban areas. Firms must weigh the production advantages of a location versus the costs of a location, in particular, the land prices or rents.

The production advantages of a given location can be separated into two distinct types. The first type is the natural or innate production advantages of a location. This could include, for example, proximity to natural resources, desirable climate, or natural transportation hubs. The second type of production advantage arises from the concentration of firms and production. In its most general form, this is the idea that a firm's efficiency improves when it locates in close proximity to other firms. These are referred to as agglomeration economies or agglomeration externalities.

There is strong evidence that productivity rises in areas where employ-

⁴ It should be noted that providing all public services at a local level is not efficient. For example, when there are spillover effects, as is the case with public parks or law enforcement, where neighboring jurisdictions get benefits from the provision of services, or if there are returns to scale, as in transportation networks or public utilities, that require large fixed investment and network connectivity, the efficiency of fragmented jurisdictions comes into question. In other words, when public goods have certain characteristics, it is often more efficient for service provision or funding to happen at the regional, state, or national level.

ment is concentrated. The source of agglomeration economies has several explanations, including sharing of labor markets or inputs, or knowledge spillovers across firms resulting in improved technology.

Research on the source of agglomeration economies has been reviewed in previous *Business Review* articles by Jeffrey Lin and by Gerald Carlino. There is strong evidence of production advantages in dense areas in the form of high rents, wages, or more direct measures of productivity. However, one aspect of the research that both Carlino and Lin emphasize is the difficulty in identifying the different sources of production advantages. Lin suggests that an important consideration is the relative importance of natural advantage versus agglomeration effects, and he discusses methods for identifying these separately. Carlino makes the point that if people have different skills or educational levels, and these skills are correlated with location choice, then measured productivity in cities may be partially due to the sorting of high-productivity workers into cities, thus overstating the importance of agglomeration externalities.

Much of the research on firm location has focused on firm location decisions and agglomeration economies across metropolitan areas or on a citywide scale. However, there is strong evidence that the concentration of firms is important even at a neighborhood or district scale within urban areas, given that dense business districts are a prevalent feature of the urban landscape. Mohammad Arzaghi and Vernon Henderson, when looking at the advertising industry in New York, found that the production advantages of proximity to other firms declined rapidly across space even on a city-block scale. In their study, Stuart Rosenthal and William Strange also present evidence that the advantages of agglomeration externalities

decline significantly over a few miles.

In a joint paper, Daniele Coen-Pirani, Holger Sieg, and I study the dynamics of firm location in urban areas. By looking at location choices — including entry, exit, and relocation decisions of firms — in dense business districts versus sparse suburban locations, we are able to consider sorting effects simultaneously with the agglomeration productivity advantages. Using data from Pittsburgh, we find that more productive firms do, in fact, sort into dense business districts. However, they do so to take advantage

of agglomeration economies, which our estimates, based on select service industries, suggest can boost productivity by as much as 8 percent, implying that both sorting and productivity effects are important in urban areas. This productivity increase may seem large, but when one considers the high rents and wages that businesses pay in some neighborhoods relative to others, it is not surprising.

Table 1 shows some of the characteristics of firms in dense business districts versus more sparse locations in U.S. cities. Many of these business

TABLE 1

Establishment Characteristics Inside and Outside Dense Business Districts

Metro Area	Total Employment Outside Business Districts	Total Employment Inside Business Districts	Average Establishment Employment Outside Business Districts	Average Establishment Employment Inside Business Districts
Atlanta	1,115,398	229,002	15.79	29.25
Boston	1,728,075	531,349	15.66	39.01
Chicago	3,070,387	528,529	15.86	24.47
Columbus	705,534	63,278	18.69	23.73
Hartford	499,718	18,783	17.26	26.95
Houston	1,720,625	286,574	16.38	28.47
Jacksonville	491,959	24,315	15.24	25.38
Los Angeles	4,257,269	974,693	15.02	19.39
Philadelphia	1,921,626	196,428	15.91	27.66
Phoenix	1,551,921	64,793	18.31	27.78
Pittsburgh	822,013	157,009	14.58	40.04
Salt Lake City	440,239	53,086	15.22	21.08
San Antonio	655,740	26,572	17.21	20.49
Seattle	1,260,335	179,230	14.55	20.33
St. Louis	1,253,959	84,034	16.38	42.57
Washington, D.C.	1,930,848	303,770	15.42	21.68

Note: Business districts are defined as Zip codes with more than 10,000 workers per square mile. Sources: Data are drawn from the 2008 Zip code business patterns data. This table is taken from Brinkman, Coen-Pirani, and Sieg.

districts are the familiar downtown central business districts, although larger cities can have multiple dense business districts. For example, Los Angeles has 30 Zip codes spread throughout the metro area that meet the criteria of a dense business district. The evidence shows that establishments are larger in dense business districts.⁵ A familiar example might be banks, where larger banks are usually headquartered in downtowns of major metro areas, while smaller regional banks are often located in suburbs or smaller cities. Table 2 shows a more detailed comparison of establishments in the central business district of Pittsburgh versus the rest of the AL-

⁵ Establishments are single physical business locations, as opposed to firms, which may be composed of multiple establishments.

leggheny County for service industries.⁶ These data provide more insight into the production advantages of dense business districts as well as the sorting of firms. Establishments are not only larger in the central business district, but they are also older and have higher sales per employee. This evidence is robust across most industries.

INTERPLAY OF DECISIONS

Further complicating the spatial distribution of firms and workers in cities is the fact that their decisions are

⁶ Service industries here are defined by North American Industry Classification System (NAICS) codes 51-62, which correspond to fairly high-skill services such as finance, management, education, and health care. We focus on these industries because they are the most concentrated industries in dense business districts in cities. In addition, the relative importance of these industries has increased significantly over the past several decades.

mutually dependent. Firms must consider the location of customers as well as the location choices of employees. Likewise, workers want to be located close to their place of employment as well as to services. This makes the task of fully characterizing location in cities quite complicated.

First, let's consider the problem facing firms when residents act as customers, as in the retail sector. In this setup, we will think about cities' role in consumption. This problem was introduced in 1929 by Harold Hotelling, who proposed a theory on the location of firms with a fixed, uniform distribution of customers along a line. The basic idea is that multiple firms would strategically decide where to locate to capture the largest share of the market.⁷ The original framework proved to be neither rich enough nor rigorous enough to capture the real

TABLE 2

Pittsburgh Service Establishments: Central Business District vs. Rest of Allegheny County

Percentile	Inside Central Business District				Outside Central Business District			
	Age of Firms (years)	Number of Employees	Facility Size (sq. feet)	Annual Revenue/Employee	Age of Firms (years)	Number of Employees	Facility Size (sq. feet)	Annual Revenue/Employee
10th	2	2	1,432	\$47,481	2	1	1,565	\$40,000
25th	5	2	1,873	60,000	4	2	2,119	50,000
50th	13	3	2,499	70,000	10	2	2,474	64,000
75th	26	9	4,200	95,000	21	4	3,471	84,000
90th	42	28	8,470	140,000	34	11	5,276	116,077
95th	57	51	14,625	265,337	44	23	8,228	164,550
99th	108	288	53,563	890,257	76	99	22,841	495,803

Note: Business districts are defined as Zip codes with more than 10,000 employees per square mile.

Sources: Data come from the 2008 Dun and Bradstreet's Million Dollar Database and include only service industries (NAICS 51-62). This table is based on calculations by Brinkman, Coen-Pirani, and Sieg.

economy, but it paved the way for future work. For example, Timothy Bresnahan and Peter Reiss show the important tradeoff between customer access and competition in firm location decisions. This study looked across different cities, but the insight provided applies to location decisions within urban areas.

The retail location decision is further complicated by the fact that customers are free to move within cities as well. The models above assume that customer location is fixed, but in the long run, customers will move in order to be located close to retail or other services. Edward Glaeser, Jed Kolko, and Albert Saiz suggest that people are locating in cities increasingly for the culture, arts, retail, entertainment, and other amenities that cities provide. There might also be positive feedback in the sense that crowds of people attract more people, suggesting that there may be consumption externalities analogous to the production agglomeration externalities discussed above.

Another complication arises from the employer-employee relationship and its effect on firm and worker decisions. Here we are mostly concerned with cities' role in production and the costs associated with commuting to work. Early work by Edwin Mills and others analyzed where workers would live if all jobs were located at the center of a city. Later on, Masahisa Fujita and Hideaki Ogawa in 1982 and Robert Lucas and Esteban Rossi-Hansberg in 2002 developed models that freed firms and workers to locate anywhere within the city. These papers also consider the effect of ag-

⁷ Hotelling's model has mostly been applied as a metaphor for product differentiation, but in its literal sense, it is a useful framework in urban economics. The similarities are apparent given that location is a form of product differentiation and therefore leads to market power.

glomeration economies due to the density of firms. In that sense, these papers looked at the simultaneous location decisions of firms and workers in urban areas.

To understand how these simultaneous location decisions are made, it is important to understand all of the tradeoffs faced by both firms and

sumption is a vital determinant of city structure. In a current working paper, I look at the data from several cities to check the predictions of the theory described above and estimate the key determinants of city structure. Some of the important characteristics of location in cities are contained in Figure 1, which shows densities,

Firms must consider the tradeoff between the productivity of a location and the costs of being in that location, including rents and wages. Workers are concerned about the tradeoff between commuting times and costs on the one hand and the price of housing on the other.

workers in an urban economy. Firms must consider the tradeoff between the productivity of a location and the costs of being in that location, including rents and wages. For their part, workers are concerned about the tradeoff between commuting times and costs on the one hand and the price of housing on the other. In the presence of agglomeration economies, firms prefer to concentrate in dense areas, given that proximity to other firms increases productivity. However, this concentration leads to increased congestion, suggesting that workers would require higher wages to travel into these areas to offset their commuting costs. For the urban economy as a whole, the important consideration is whether the increased production is worth the extra costs of congestion.

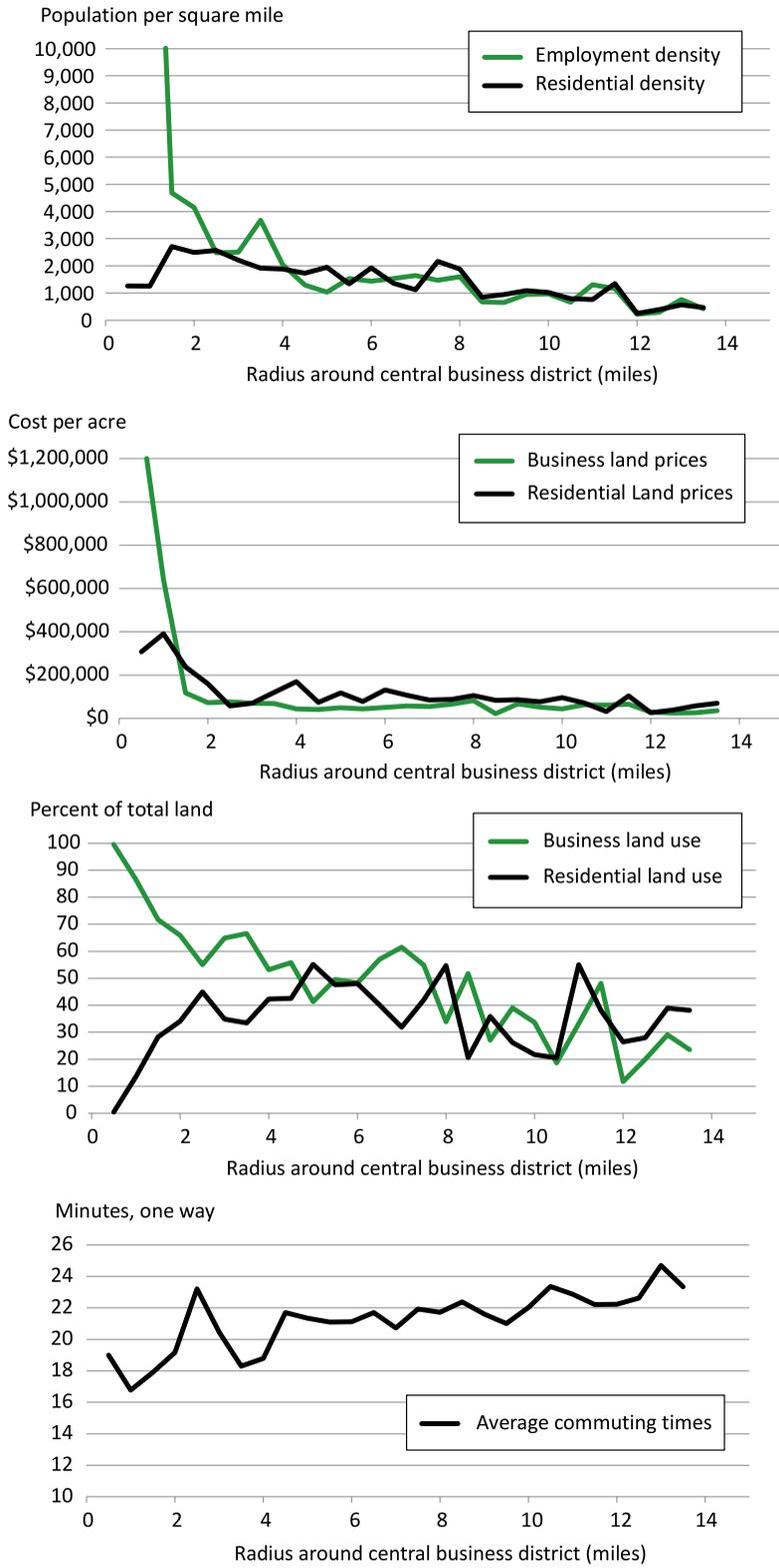
Ultimately, the final form of a metropolitan area, in terms of the spatial distribution of jobs and workers, will depend on the relative strength of agglomeration economies versus the cost of commuting into congested areas. Additionally, the relative value of land for production versus con-

land prices, land use, and commuting times for the area around the central business district of Columbus, OH. The features illustrated here are more or less common around business districts in cities and reflect the tension and tradeoffs that determine the structure of an entire city.

Indeed, as would be expected, employment density and residential density both decline as one moves away from business districts, although employment remains much more concentrated than residential population. This prevalence of dense business districts suggests that the strength of the agglomeration effects outweighs the cost of commuting and congestion. Otherwise, we would expect to see much more equally distributed employment across space. In addition, land prices decline away from dense business districts, while commercial use gives way to more residential use farther away from the business district. Finally, commuting times increase for residents away from business districts, consistent with the tradeoff faced by workers.

FIGURE 1

Tradeoffs in Location Decisions: Columbus, OH



Source: U.S. Census Bureau; Franklin County, OH, Auditor's Office. Data are for 2000.

CONCLUSION

Understanding all of these questions is important in the implementation of public policy in cities. Let's now return to the policy of congestion pricing implemented in London that was discussed earlier. At one level, congestion pricing seems to be a win-win proposition for policymakers. Consider that congestion is a negative externality, in the sense that one person's commuting decision places a cost on others. Then the idea behind congestion pricing is that by taxing congestion, people will make better commuting decisions, and this will improve efficiency. Given that congestion also has environmental consequences, and the fact that this policy is a potential source of revenue, it seems like a no-brainer.

However, once we consider business location decisions, the efficacy of this policy comes into question. The policy, by design, will make it more costly for people to travel into dense business districts, and workers will therefore require higher wages to do so. Paying these higher wages might not be worth it for businesses, and therefore, some businesses will leave the business district, reducing employment density. Given the strong evidence for agglomeration economies, or some proximity-related economies of scale, there will be some loss in production. Understood in this way, the efficiency of congestion pricing becomes ambiguous. This suggests that a better policy may be to reduce the costs associated with congestion rather than charge fees to discourage commuting into dense areas. 

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