

# The Downtown Parking Syndrome: Does Curing the Illness Kill the Patient?

*Richard Voith\**

**A**cross the central business districts (CBDs) of most large cities in America, consumers and businesses alike cite the lack of free parking as one of the major problems associated with working, playing, and shopping downtown. Confronted with an increasingly auto-dominated transportation system, CBDs find it difficult to match the ubiquitous free parking available at suburban malls and office parks. Those concerned with the health and vitality of the nation's CBDs are engaged in a vigorous debate about how best to respond to the challenge of free parking offered at competing suburban centers.

Public surveys and newspaper articles confirm the extent of concern with the availability, price, and regulation of parking in CBDs. In one recent survey of CBD retailers conducted by the Federal Reserve Bank of Philadelphia and the Philadelphia Center City District, 36 out of 98 respondents suggested that improving parking would be the most important change that could help their businesses. Improved parking was the most common suggestion, far exceeding reducing vagrancy (23 percent), improving security (13 percent), or reducing taxes (10 percent).

The limited availability of downtown parking spaces results not so much in parking shortages but rather in high parking prices. The *Wall Street Journal* (September 26, 1996) notes that “despite the widespread conviction that there

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are acute parking shortages not just in New York, but in San Francisco, Boston, Washington, Pittsburgh and Chicago, some urban planners and parking experts...argue that there is plenty of parking—if you are willing to pay or walk.” This statement holds true for Philadelphia as well. About 40 percent of the developed, nonresidential space in the CBD is used for parking, but prices for well-located parking spaces remain high.<sup>1</sup> The daily parking rate in a garage in the heart of the CBD, for example, may cost \$15.00 a day or more, but a space on the CBD’s fringe may cost less than \$3.00.

Seeking to avoid high prices for convenient spaces, drivers frequently violate local parking ordinances, and enforcement of parking regulations often increases people’s frustration. This frustration is evident in a dubious distinction bestowed on the Philadelphia Parking Authority: in its annual “best and worst” issue, the *Philadelphia Weekly* (March 19, 1997) cited the Philadelphia Parking Authority as the “Worst Reason to Shop Center City” because it made the town “a motorist’s nightmare.” While parking problems for their customers and their employees likely have caused some businesses to choose locations other than the CBD, people traveling to the CBD often do have another option, public transit, potentially a very efficient means of transportation for CBDs. Unfortunately, the quality of public transportation is often less than desirable to the consumer.

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<sup>1</sup>There is roughly 29 million square feet of occupied office space and 5 million square feet of retail space in the Philadelphia central business district for a total of 34 million square feet of commercial space. There are about 52,000 parking spaces in lots and garages, and assuming the standard of 300 square feet per space and required circulation, there is roughly 15 million square feet of CBD space devoted to parking. The sources for these data are Jackson Cross Real Estate (office space), Center City District (retail space), Philadelphia Planning Commission (parking spaces), and Joseph De Chiara and John Callender’s book *Time-Saver Standards for Building Types*, McGraw-Hill, Inc: 1990 (required total area per parking space).

In light of these widespread concerns about parking downtown, should large cities adopt policies to encourage more CBD parking, or should they seek to improve public transit as an alternative to driving? Answering this question is difficult because there is a complex dynamic between parking, transit, and the overall attractiveness of the CBD. One defining feature of successful CBDs is their high density of economic, social, and cultural activities. This density gives CBDs a unique market niche that is difficult to replicate in other parts of the metropolitan area. Abundant inexpensive parking would make the CBD more attractive if it had no other consequences; however, plentiful, low-cost parking may be at odds with the very aspect that makes a downtown area unique—high density. Effective parking policies, therefore, must strike a balance between convenient parking and maintenance of the dense urban fabric that makes the CBD unique.

#### THE DEMAND AND SUPPLY FOR CBD PARKING

Without extensive control by local government, prevailing CBD parking prices will depend on the demand for and supply of parking. Of course, public policies such as taxes, investment in public transit, and regulations about land use can affect both demand and supply.

The *demand* for parking is an example of what economists call a “derived demand.” Parking is not an end in itself; it simply allows people access to the places where they want to shop, play, or work. The demand for parking in the CBD thus depends on how many people want to drive to the CBD to do any of those things. The overall number of people who want to drive downtown, in turn, depends on the attractiveness of the CBD relative to other retail, recreational, or business centers, and on the fraction of people who choose to drive rather than use public transportation, ride a bike, or walk. Because more people will want to visit

highly attractive CBDs—whether by car or by other means of transportation—desirable CBDs are bound to have higher demand for parking. Greater parking demand will, in the absence of an increase in supply, result in higher parking prices than would prevail in less attractive CBDs. High parking prices simply reflect the success of the CBD in providing an environment that is sufficiently attractive so that people are willing to pay high parking prices, even when there is free parking available elsewhere.

While the total number of people working in or visiting the CBD depends on how attractive the CBD is, the share of people choosing to drive hinges on the availability, price, and quality of alternative means of transportation downtown as well as the costs associated with driving downtown, including parking. If transit services to downtown are widely available, of high quality, and reasonably priced, people will perceive transit as a viable alternative to cars for visits to the CBD and, hence, will lower the demand for parking. For highly attractive CBDs, good transit service increases the number of people who can visit without sending parking prices sky high because of increased demand.

In addition to the price and quality of public transit, other driving costs affect the demand for parking. If, for example, roads leading downtown are highly congested, thereby costing people time and aggravation when driving, or if tolls must be paid to enter downtown, some people may choose to use public transportation and others simply may choose to go elsewhere. In both cases, the demand for CBD parking will be lower because other driving costs are high.

The *supply* of parking in a CBD depends fundamentally on the cost of creating, maintaining, and operating parking lots in the city. Among the most important costs is the price that parking lot owners have to pay for the land. If land in a CBD is highly valued for residential or commercial uses, parking providers will have

to pay high prices for the land on which they build their parking facilities. As the price of CBD land rises, parking operators can construct multistory garages to increase the number of spaces on a parcel of land, and they can use valets to park cars at more distant locations where land may be cheaper. But while these actions partially offset the impact of high land prices, they are not perfect substitutes for cheap land. The more valuable the CBD destination, the more costly it is to provide parking.

Taxes and land-use restrictions also affect the supply of parking. City governments use parking taxes both to generate revenue and to reduce auto congestion. By taxing parking, cities increase the cost of providing additional parking spaces, effectively reducing parking supply. In addition to taxing parking, city governments regulate the uses of CBD land, often limiting the supply of parking.<sup>2</sup> Land-use regulations in CBDs are frequently very strict, in part because the high density of development increases the likelihood that one person's activities can adversely affect another's. Congestion is a classic example: one person's choice to drive affects the congestion experienced by all other drivers. Thus, city governments sometimes limit the use of land for parking because they want to lessen congestion or simply because they deem parking at a given location economically or aesthetically incompatible with other activities close by. Taken together, local policies—taxes and land-use regulations—often act to lower the

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<sup>2</sup>Portland, Oregon, for example, has had a cap on the total number of parking spaces in the CBD. The parking cap was intended to limit congestion and pollution associated with cars in the CBD and went hand-in-hand with investment in a new light-rail transit system. In response to retailers and other businesses that argued that a "perception of parking scarcity" was hurting business, Portland recently moved to relax the restrictions somewhat, which should allow the total number of spaces to increase from 42,000 to about 46,600 over the next 20 years. See Gordon Oliver, "Portland Casts Off Lid on Downtown Parking," *Planning*, March 1996, p. 26.

supply of parking. Lowering the supply of parking, without changing the demand, will increase parking prices. The price of parking that prevails in the market, however, is the outcome of both the supply and demand for parking.

The fundamental goal of parking policies is to make the downtown as attractive as possible. The problem is that when CBDs become very desirable locations, the demand for parking increases at the same time that the cost of supplying parking increases. Reflecting the growing attractiveness of a downtown location, land prices increase, and the need to re-think policies, such as parking taxes and land-use restrictions, that manage congestion increases as well. Therefore, choosing the parking and transportation policies that are best for the CBD requires an understanding of not only how the policies affect the demand and supply for parking but also how parking demand and supply affect the value of the CBD in the eyes of businesses and consumers.

#### WHAT DETERMINES THE VALUE OF A CBD LOCATION?

Over the past 50 years, the vast majority of growth in both metropolitan population and employment has been in the suburbs.<sup>3</sup> Despite the rapid decentralization of both people and jobs, however, the CBDs of many large American central cities remain vital economic centers.<sup>4</sup> What forces affect the CBD's ability to compete successfully with other economic centers, and how do parking policies specifically and trans-

portation policies generally affect these forces?

**Agglomeration, Access, and Congestion.** Three fundamental, interrelated factors strongly affect the attractiveness of a CBD location: agglomeration, access, and congestion. The dense concentration of social, recreational, and business activity is the CBD's unique attribute, and many economists believe that this density confers special advantages—termed agglomeration economies—on certain businesses and consumers. Historically, agglomeration economies were based on savings in transporting and distributing goods. Manufacturers sprang up in central areas, near ports and rail hubs, and retail stores were established in central areas accessible to the greatest number of customers. Technological changes have clearly obviated the need for central locations for manufacturing, and retailing has become increasingly centered in suburban shopping malls; nevertheless, CBDs have remained attractive to industries that benefit from personal interaction.<sup>5</sup> Law firms, for example, find CBDs attractive because they can be very close to both their clients and the courthouse, facilitating meetings, negotiations, and settlements. In addition, CBDs have

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Decentralization in the United States," Wharton Real Estate Center Working Paper, University of Pennsylvania, 1990. Their study, based on data for 60 U. S. cities for 1976, 1980, and 1986, found that CBDs performed significantly better in terms of employment growth than did the remainder of the central city.

<sup>3</sup>Edwin S. Mills and Luan S. Lubuele provide an excellent discussion of the forces behind population and employment decentralization in "Inner Cities," *Journal of Economic Literature*, Vol. 35 (June 1997) pp. 727-56.

<sup>4</sup>Reliable data on CBD employment trends are difficult to obtain, as most employment data are collected on the basis of the entire city jurisdiction. One exception is data collected by Anita Summers and Peter Linneman and presented in "Patterns and Processes of Urban Employment

<sup>5</sup>See John M. Clapp's book, *The Dynamics of Office Markets*, AREUEA Monograph Series, No. 1, New York: The Urban Institute Press (1993), for a discussion of the value of face-to-face contact for businesses. The extent to which technological changes are rendering face-to-face contacts obsolete is currently a topic of debate. For a contrary view, see Jess Gaspar and Edward Glaeser, "Information Technology and the Future of Cities," forthcoming, *Journal of Urban Economics*. They argue that improvements in telecommunications technology increase the demand for all interactions. So while technology may substitute for face-to-face contacts, this effect is offset by the greater desire for all kinds of interactions, including face-to-face contacts.

specialized in entertainment-oriented retailing, social and cultural endeavors, and tourism—activities in which high density can be a plus. People can go to the theater, eat at one of a wide variety of restaurants, and enjoy a nightcap, all within a relatively small area. As long as denser agglomerations continue to enhance the productivity of businesses and provide a variety of opportunities and experiences not available elsewhere, CBDs can maintain their unique position within the metropolitan area.

The extent to which CBDs can maintain and enhance their agglomeration economies, however, will also depend on how they manage issues of access and congestion. Because they are centrally located in the metropolitan area, CBDs offer good access geographically for both workers and consumers. The value of a central location is offset, in part, by the congestion associated with the density of CBD activity. So even though the CBD may have the best accessibility from a geographical perspective, people and firms may choose less central locations to avoid congestion.<sup>6</sup>

**The Role of Parking and Transit in CBD Agglomeration, Access, and Congestion.** Not only do CBDs tend to be in the geographic center of the metropolitan area, but as a result of historical patterns of development, they also tend to be focal points for regional transportation systems. Moreover, CBDs are unique in that they rely on both public transit and cars, unlike most suburban economic centers, which rely almost exclusively on automotive transportation. Public transit is well suited for access to

a CBD for two reasons. First, it is not land intensive and so conserves the CBD's primary scarce resource. Second, it is more efficient in dense areas, as the per passenger costs tend to fall as density increases. While transit is a competitive option for many people traveling to the CBD, it has limits. In particular, high-quality transit service is available to a relatively small fraction of residents of U.S. metropolitan areas, so that reliance solely on transit for access to the CBD would sharply limit the scope of the market for the CBD.

Cars, on the other hand, are less well suited for high density areas. Nevertheless, they remain crucial to a CBD's success because they allow access to the CBD from a much wider area than that typically served by transit. The usual list of attributes—unfettered traffic flow, high speeds, and free parking—that make cars the dominant mode of travel, however, is diminished for travel to the CBD. Streets and highways in dense areas are easily congested, reducing the attractiveness of the destination, especially if there are no alternative means of transportation. In addition, cars are land intensive, especially for parking, so the costs of driving and parking a car in the CBD are likely to be higher than those in most other areas. Finally, adding parking often requires shifting land from primary uses such as offices and retail stores to parking, reducing the density of primary activities. Because exclusive reliance on cars for access requires large amounts of land for roads and parking, excessive auto use is at odds with maintaining the CBD's agglomeration economies.

**Raising the Value of the CBD: Balancing Cars and Transit.** The value of CBD land depends on the number of people who want to live, shop, or work in the CBD. Through its effect on agglomeration, access, and congestion, the balance between transit and auto access to the CBD will influence the relative attractiveness of downtown and the price of land in the CBD. The relationship is complex, however,

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<sup>6</sup>Of course, people choose to avoid CBD locations for a wide variety of reasons. Peter Meiszkowski and Edwin Mills, in "The Causes of Metropolitan Suburbanization," *Journal of Economic Perspectives*, Vol. 7, (1993), pp. 135-47, discuss the roles of income growth, technological change, and social and economic problems concentrated in central cities. See also Mills and Lubuele (full citation is in footnote 5) for a discussion of the roles of poverty and race in decentralization.

because the price of CBD land will also affect the division of land between primary uses and parking. The supply of parking, of course, will affect parking prices, and so it will affect the share of people choosing to use transit rather than drive to the CBD.<sup>7</sup> This set of interrelationships among land prices, how people travel, and land uses implies that CBD land prices must adjust so that: (1) people and firms find the CBD and other locations in the region equally attractive and (2) land owners find that using property for primary uses and parking is equally profitable.

Land prices reflect not only the benefits associated with the CBD's high density and accessibility but also the costs associated with congestion. If the benefits of a CBD location increase, more people and firms choose CBD locations, and land prices increase but congestion also increases. Land prices and congestion both increase until locations outside of downtown become as attractive as the CBD. At the same time, as land in the CBD becomes more valuable for offices or other primary uses, less land is devoted to parking, which lowers the supply. Lowering the supply of parking has

the positive effects of increasing the density of primary activities and lowering congestion by shifting people to transit, but it also has a negative effect because the higher parking costs make auto access more expensive.

Office rents—and, therefore, the value of CBD land—the share of people using cars and transit, and the fraction of CBD land devoted to primary activities versus parking are all influenced by policies that affect the supply and demand for parking. For example, cities could tax parking and subsidize public transit, or the CBD could institute a tax that would be used to construct more parking. Whether these policies have positive or negative impacts on the vitality and value of the CBD depends on how they affect CBD agglomeration, access, and congestion. Specific parking and transit policies are examined under alternative scenarios in the Appendix, "A Theory of Parking, Transit and Land Values," which helps set the stage for evaluating recent trends in the Philadelphia CBD.

#### **PARKING, TRANSIT, AND LAND VALUES IN CENTER CITY PHILADELPHIA**

CBDs like Philadelphia's face competitive environments that are constantly changing, so parking and transit policies must be re-evaluated over time to make sure they are consistent with maximizing the value of a CBD location. In recent decades, improvements in automotive transportation and communication technologies have made suburban and exurban locations more attractive for residences and businesses. Despite these long-run changes, the Philadelphia CBD enjoyed dynamic growth in the middle 1980s, but unfortunately, the 1990s have seen a reversal of these positive trends. Have parking shortages been a major contributor to the weak growth of the 1990s?

Against a backdrop of moderate city employment growth between 1984 and 1988 followed by a sharp citywide job decline between 1989 and 1996, CBD parking capacity, use, and ex-

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<sup>7</sup>Although many believe that Americans simply will not use transit, in "Employer Paid Parking: The Problem and Proposed Solutions," *Transportation Quarterly*, Vol. 46 (April 1992) pp. 169-92, Donald Shoup and Richard Willson found that parking prices strongly affect the choice of driving versus transit. But as Shoup and Willson argue in the above article and as Shoup (in "An Opportunity to Reduce Minimum Parking Requirements," *Journal of the American Planning Association*, Vol. 61, Winter 1995, pp. 14-28) argues, the parking prices that consumers pay often do not reflect the underlying costs of the land because employers very frequently subsidize employee parking (but employers rarely subsidize employees' public transit use). Employer-paid parking tilts the relative attractiveness of cars versus transit toward cars, but the high underlying cost of parking in the CBD instead is reflected in higher costs to businesses, which offset the value of CBD agglomeration. Businesses could lower their costs by shifting commutation subsidies from parking to transit if public transit were perceived as an acceptable substitute to driving.

penditures have demonstrated a strong upward trend throughout the 1980s and 1990s.<sup>8</sup> Parking capacity increased from about 41,000 spaces in 1984 to nearly 52,000 in 1996, an increase of about 25 percent (Figure 1). Coincident with the increase in parking supply, estimated parking use increased 30 percent, with the most rapid expansion occurring in the 1990s, despite the adverse economic climate in the CBD.<sup>9</sup>

The period with the most rapid growth in parking supply—1984 to 1989—corresponded with a period of relatively stable levels of public transit service and a modest decline in transit rider-

ship of 5.8 percent.<sup>10</sup> In the period that followed—1989-96—the level of transit service declined significantly: a 7.7 percent drop in public transit vehicle miles of service. As levels of transit service fell, autos captured a larger share of the CBD travel market, transit ridership fell 22.1 percent, and parking use increased at a rapid pace (Figure 2).

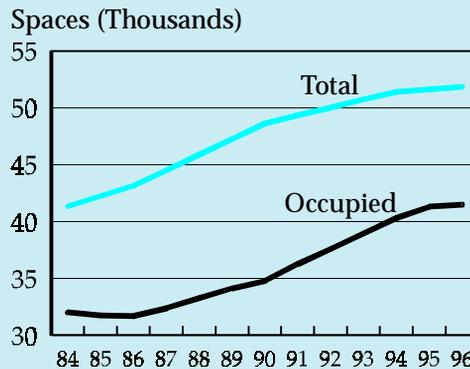
As parking capacity and auto use expanded

<sup>8</sup>The employment data are for the entire city of Philadelphia; trends in the CBD may not match overall city trends. It is likely the CBD grew more rapidly than the rest of the city in the 1980s, and that CBD employment was stable in the 1990s rather than declining as it did in the rest of the city. The data on parking supply and use are from surveys of CBD parking conducted for the Philadelphia Planning Commission in 1980, 1986, 1990, 1994, and 1995. The parking data do not include parking on the fringe of the CBD; that is, parking north of Vine Street, south of South Street, east of Columbus Boulevard, and west of the Schuylkill River is excluded.

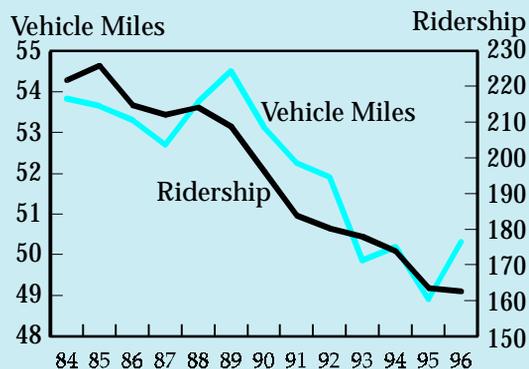
<sup>9</sup>It would be interesting to examine the changes in parking prices over this period; unfortunately, no reliable data are available on parking prices.

<sup>10</sup>Transit service and ridership data are published in the Ridership and Statistics Report, 1996, provided by the Southeastern Pennsylvania Transportation Authority (SEPTA). SEPTA's city transit division carries the lion's share of public transit travelers to the CBD. During the 1990s, ridership on SEPTA's CBD-oriented commuter rail system had flat ridership and little change in service levels.

**FIGURE 1**  
**Parking Spaces**  
Philadelphia CBD



**FIGURE 2**  
**Public Transit Vehicle Miles and Ridership**  
(in Millions)  
SEPTA City Transit Division

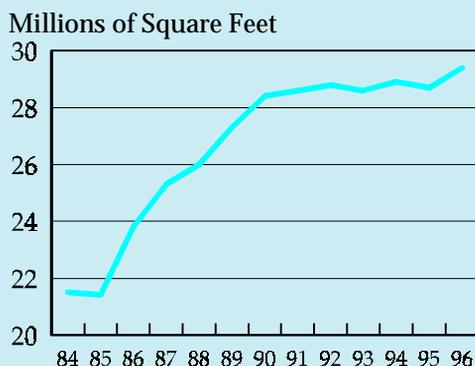


and transit supply and use declined, what happened to the intensity of land use and land prices? Occupied CBD office space grew rapidly—more than 32.5 percent from 1985 to 1990—but was basically flat thereafter (Figures 3 and 4).<sup>11</sup> Inflation-adjusted rents changed little from 1984 to 1988, but dropped sharply in the following years. In 1996 inflation-adjusted rents were a little more than half of the peak level

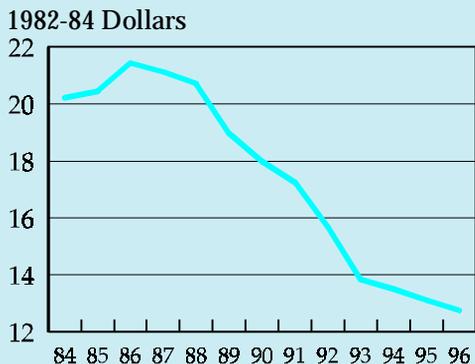
that prevailed in 1986.<sup>12</sup> As office buildings have become less valuable for commercial uses and rental rates have fallen, a number of existing buildings have been converted or demolished to add parking.

Taken together, the data on parking, transit, intensity of land use, and real office rents are consistent with at least two hypotheses.<sup>13</sup> One is that people no longer gain unique benefits from the dense concentrations of activities that the CBD offers, so the value of the CBD relative to suburban centers is permanently lower. As a result, office rents are down and land is being converted from productive primary uses to parking. The second hypothesis states that policies affecting the percentage of people choosing to drive rather than use transit—in particular, the supply of public transit and convenience

**FIGURE 3**  
**Occupied Office Space**  
Philadelphia CBD



**FIGURE 4**  
**Class A Office Rental Rates (real)**  
Philadelphia CBD



<sup>11</sup>Office occupancy and rental rates are based on data compiled by Jackson Cross Real Estate and ONCOR International.

<sup>12</sup>Much of the decline in rental rates during this period is due to overbuilding in the 1980s and the recession in the early 1990s. Still, suburban rents fell at a much less rapid pace than in the CBD, suggesting a shift in the relative attractiveness of the CBD versus suburban economic centers. Suburban rents in 1996 were 13.1 percent lower than in 1986.

<sup>13</sup>Here we focus on factors affecting the attractiveness of the CBD that we have considered in this analysis. Of course, numerous other factors—for example, changes in tax rates or crime rates—affect the viability and attractiveness of the CBD over time. We focus on agglomeration, access, and congestion because these are defining factors that make the CBD unique and are difficult to replicate elsewhere.

of auto travel relative to transit—have resulted in a shift toward cars, which increases congestion and parking demand and, in the long run, lowers agglomeration economies.<sup>14</sup> These factors lower the attractiveness of the CBD relative to other centers and, hence, lower land values and rents and reduce the intensity of land use by shifting land from primary uses to parking. Of course, these two hypotheses are not mutually exclusive; each could be partially responsible for the downward trend in the value of the CBD in the 1990s.

### **GOOD POLICIES FOR THE CBD: THE ROLES OF CARS AND TRANSIT**

The best choice of parking and transit policies for CBDs like Philadelphia's depends on how one interprets the competitive position of the CBD. If agglomeration economies associated with CBD densities have greatly diminished, adopting policies to encourage more parking would be appropriate. This strategy would make downtown more competitive with other economic centers in terms of auto access but, at the same time, would lead to lower density development downtown and lower land values than have historically prevailed.

Competing with suburban locations by providing better automotive access may be the best strategy for the CBD if the value of density has fallen. However, this approach is unlikely to dramatically improve a downtown's competitive position because the suburbs have a comparative advantage in land uses that demand a lot of space, such as parking lots and roads. Increased parking in a downtown area will result in increased congestion on city streets not designed for high traffic volumes, which will partially offset the benefits of increased, less expensive parking. Furthermore, given physical constraints and existing structures, recreat-

ing suburban-style amenities downtown would be difficult. Thus, the CBD is likely to prove a weak competitor to suburban economic centers when competing on suburban terms.

Alternatively, if enough people and firms still find that the dense development found in CBDs is as valuable as ever, adopting policies to increase parking is likely to be counterproductive. Rather, policies should seek to provide high-quality alternatives to driving and parking while accommodating those potential visitors and commuters who must drive, but at prices reflective of both the high value of CBD land and the costs of increased congestion associated with cars in the CBD. Basically, this means improving transit access to the CBD by broadening markets served and improving the price and quality of transit. Note that improving transit service will reduce the demand for parking, and if nothing else changes, parking prices will fall. However, this beneficial side effect of improved transit service may be short-lived if it ultimately makes the downtown area more attractive. If the CBD becomes more attractive, land prices will rise, and more land will be devoted to primary uses rather than to parking. Therefore, parking rates will increase. But as the intensity of CBD land use increases and parking prices rise, the cost efficiency of transit improves. This approach to CBD transportation policy can succeed only if sufficient benefits of downtown agglomerations justify the added costs of auto access and if public transit is perceived as a sufficiently attractive alternative to cars.

Regardless of which view of the value of CBD agglomerations one subscribes to, increasing the parking supply is not a panacea for CBDs. In fact, parking prices in highly successful CBDs are bound to be high relative to those of other competing economic centers. Low parking prices in the CBD are more likely to reflect the failure of the CBD to maintain its unique position as a regional center than to reflect successful parking policies.

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<sup>14</sup>The effects of increasing parking demand on parking prices in this case are unclear because rents also fall, thereby increasing parking supply.

## APPENDIX

### A Theory of Parking, Transit, and CBD Land Values

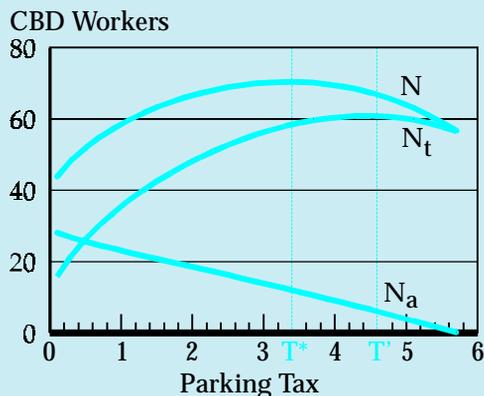
The complexity of the interrelationships among land prices, how people travel to the CBD, and how people value dense concentrations makes it difficult to formulate parking and transit policies without more formal analysis. In a recent paper, I systematically evaluated the link between parking and transit policies and CBD land prices and land use.<sup>a</sup> This analysis provides a useful framework for evaluating parking and transit policies and interpreting trends in CBDs like Philadelphia's.

To evaluate the effects of parking and transit policies on land values, community size, and means of transportation, I set up an equilibrium model of labor, land, and transportation markets. The model examines a specific policy: a parking tax used to subsidize public transit, but the framework can be viewed as a way to analyze general policies that tilt the balance between auto and transit use. Figure A illustrates the basic insights of the model.

The three curves in Figure A show how the total number of workers in the CBD, denoted by  $N$ ; total commuting by auto,  $N_a$ ; and total using transit,  $N_t$  varies with parking taxes. The effect of parking taxes on driving is straightforward; increases in parking taxes increase the cost of driving and lower the number of people driving to the CBD ( $N_a$ ). Because the revenues from the parking tax are used to subsidize transit fares, the cost to the rider falls and transit use ( $N_t$ ) generally rises with parking taxes. When parking taxes become too high, however, further increases may actually result in lower tax revenues and higher transit prices. This situation occurs because the loss in revenue due to a decline in the number of drivers will more than offset any extra revenue derived from those who continue to drive. Thus, when parking taxes exceed  $T'$ , increases in the parking tax result in fewer transit users because the total subsidies for transit use decline.

The shape of the curve for the total number of workers in the CBD, which is the sum of drivers and transit users, reflects the interaction of the forces of agglomeration and congestion with the parking tax. Initially, raising the parking tax enhances the attractiveness of the CBD because it shifts workers from cars to transit, reducing congestion. The positive effect of reduced congestion is reinforced by agglomeration economies that increase with the density of the CBD. A parking tax equal to  $T^*$  is the rate that yields the highest number of CBD workers and approximately corresponds to the tax giving the maximum value for CBD land.<sup>b</sup> As taxes on parking

**FIGURE A**  
**Choosing the Best Parking Tax**



<sup>a</sup>See Richard Voith, "Parking, Transit, and Employment in a CBD," forthcoming, *Journal of Urban Economics*, 1997; or Federal Reserve Bank of Philadelphia Working Paper No. 95-11.

<sup>b</sup>The relationship between parking taxes and CBD land values is similar to the relationship between the number of workers and parking taxes except the tax that yields the maximum value for CBD land is slightly less than the tax that yields the maximum number of workers. When parking taxes are at the level that maximizes the number of CBD workers, land demand for all uses is less than it would be if the tax were lowered slightly, because the increase in land demanded for parking would be greater than the decline in land demanded for commercial purposes.

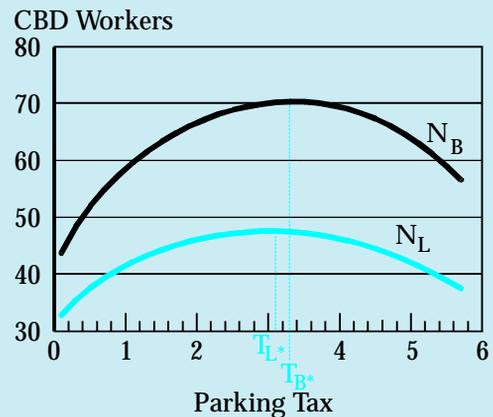
increase toward  $T^*$ , the number of people choosing to drive decreases, the number of people using transit rises, and the number of people working in the CBD increases. Any tax less than  $T^*$  will result in excess auto use in which the costs associated with auto congestion are greater than the cost of the parking tax.

If parking taxes become too high, however, the benefits of reduced congestion are less than the cost of the taxes, so that further increases in taxes reduce the attractiveness of the CBD. When taxes are greater than  $T^*$ , lowering the parking tax will increase the number of CBD workers and result in higher land values.

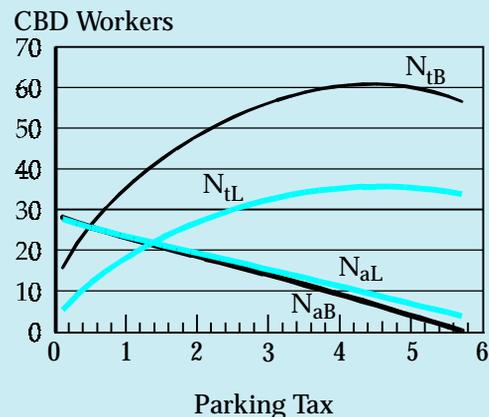
The framework can be used to evaluate the effects of changes in the value of agglomeration economies and changes in the convenience of cars relative to transit. Figures B1 and B2 show the impact of a decline in the value of agglomeration, compared with the baseline simulation shown in Figure A. The curves shown in black correspond to the baseline relationships between parking taxes and number of workers in the CBD,  $N_B$ ; the number using transit  $N_{tB}$ ; and the number using cars,  $N_{aB}$ . The blue line in Figure B1 shows the new relationship between parking taxes and community size,  $N_L$ , while the blue lines in Figure B2 show the relationships for auto use,  $N_{aL}$ , and transit use,  $N_{tL}$ . Lower agglomeration economies will reduce the size of the CBD (and CBD land values), reduce transit use, and slightly increase car use for all levels of parking taxes.<sup>6</sup> Note that a reduction in the value of agglomeration implies that the parking tax yielding the highest land values falls from the baseline optimal parking tax,  $T_{B^*}$ , to  $T_{L^*}$ . The best response to the declining value of density is to accommodate car travel by lowering parking taxes, but this will only partially offset the fundamental loss in value of density.

Increases in the convenience of car travel relative to transit have similar consequences for the CBD, but surprisingly, the policy implications are completely

**FIGURE B1**  
**Decline in Agglomeration**

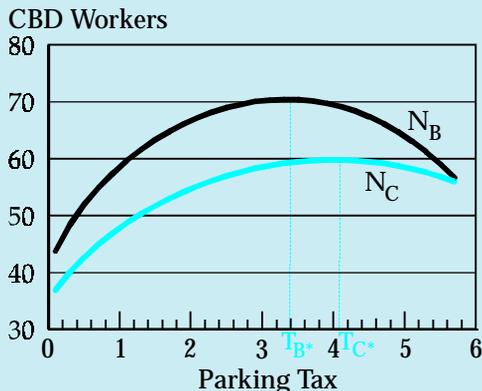


**FIGURE B2**

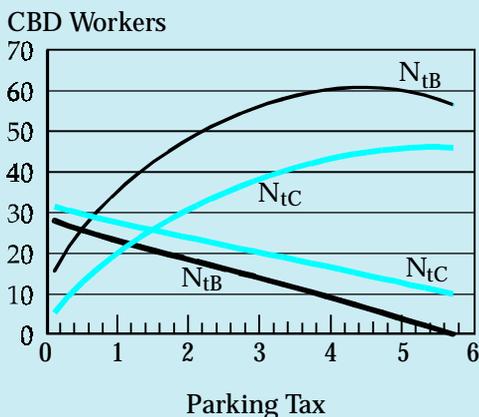


<sup>6</sup>This simplified model does not consider the possibility that capital can be substituted for land in the production of space for either primary or parking uses. In a more complex model that would allow this substitution, an increase in agglomeration economies could well increase both primary space and parking. However, because capital is not a perfect substitute for land, parking will become more expensive relative to transit, and there would be less land devoted to parking and more to primary space. The best policy response to a downward shift in agglomeration would be a reduction in parking taxes, and the reverse would be true for an increase in agglomeration economies.

**FIGURE C1**  
**Better Cars, Worse Transit**



**FIGURE C2**



<sup>e</sup>This analysis is limited to evaluating the response to a single policy—parking taxes—that changes relative attractiveness of cars and transit, but there may be a much larger set of policies that can affect the balance between cars and transit. In addition, the greater the agglomeration economies are, the greater the adverse consequences of choosing the wrong parking tax. So if agglomeration economies are strong, selecting a tax that is too high or too low could have very large effects on CBD size and CBD land values.

different.<sup>d</sup> The blue line in Figure C1 shows the effect of increasing the convenience of cars relative to transit on CBD jobs when compared with the baseline, again shown in black. The effects on auto and transit use are shown by the blue lines in Figure C2. Just as was the case for reduced agglomeration economies, the size (and hence land values) of the CBD falls, transit use falls, and car use increases relative to the baseline. In this case, the size of the CBD falls because of increased congestion and corresponding losses in agglomeration resulting from the shift from transit to cars. Unlike the case of a reduction in agglomeration economies, however, the best policy response is to increase parking taxes from the baseline rate of  $T_{B^*}$  to  $T_{C^*}$  — the rate that yields the highest land values when there has been an increase in the relative attractiveness of cars.<sup>e</sup> The reason parking taxes should increase is that drivers are willing to endure more congestion before they shift to transit, resulting in unrealized potential agglomeration benefits. As was the case with declining value of density, increases in the parking tax can only partly offset the consequences of an increase in the attractiveness of cars. Thus, while declines in agglomeration and increases in the relative attractiveness of cars may have similar effects on the CBD, the best policy responses to these shifts are quite different.

<sup>d</sup>Shifts in the relative quality of auto and transit use could be caused by more rapid technological progress in the automotive sector, poor management of transit systems, or a shift in national policies that favor cars over transit.