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Hedonic Price Effects of Pedestrian- and Transit-Oriented Development

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Abstract

Recent consumer surveys and demographic analyses have indicated a growing market for pedestrian- and transit-designed development. Theoretically, this market shift should be reflected in the price people are willing to pay for those styles of development. This article traces the literature that uses hedonic price methods for testing this hypothesis, either by assessing pedestrian/transit-design development holistically or by evaluating its component parts. The literature confirms that the market shift is, indeed, being capitalized into real estate prices and demonstrates that the amenity-based elements of transit-designed development play an important positive role in urban land markets, independent of the accessibility benefits provided by transit.

Keywords

hedonic, real estate, transit, pedestrian, design

Over the past 10 years, a number of studies have reported growing market demand for pedestrian- and transit-oriented development. Some of this literature, based on surveys of the general public (Belden Russonello and Stewart 2003; Handy et al. 2008; Lewis and Baldassare 2010) and of persons likely to be active in the home-buying market (Belden Russonello and Stewart 2004), indicate significant current demand for these styles of development. Another branch of the literature, based on demographic projections, suggests the potential of even stronger demand in the future (Myers and Gearin 2002; Nelson 2006). Theoretically, if the market favors pedestrian- and transit-oriented development, as suggested by this literature, that demand should be reflected in the price people are willing to pay for those development types. Given that developments containing pedestrian- and transit-oriented features are in relatively short supply (Leinberger 2008; Levine 2005; Levine, Inam, and Torng 2005), the demand for those features should be reflected by a price premium that buyers or renters are willing to pay for those attributes. In the words of an economist, the pedestrian- and transit-oriented design features should be capitalized into the purchase or rental price (Landis, Guhathakurta, and Zhang n.d.), and indeed, characteristics such as land use mix (Cao and Cory 1981; Song and Knaap 2004), street pattern (Guttery 2002), municipal amenities (Shultz and King 2001; Benson et al. 1998), and proximity to transit stations and commercial centers (Bowes and Ihlanfeldt 2001; Song and Knaap 2004) have been shown to affect the value of residential properties located nearby.

Much of the prior research in this area, however, offers only brief descriptions of the literature or focuses on either the access-related effects of development located near transit or the effects associated with pedestrian-/transit-oriented design. This article provides a review of both branches of the literature and offers a rough synthesis. The first part of the article outlines the basic elements of hedonic analysis, the primary analytical tool used in this area, and situates the method in the context of broader approaches toward assessing the value of public goods. The article then surveys and summarizes the literature for each of the two areas noted above: studies focused on the accessibility effects of transit proximity and those aimed at the design-related features of pedestrian- and transit-oriented developments. The article concludes with a synthesis of the literature and offers suggestions on possible future directions for research.

Hedonic Price Analysis

The hedonic method for assessing real estate prices is based on the intuitive understanding that the value of an individual piece of real property is neither monolithic nor completely intrinsic to the property itself but is the result of a multitude of characteristics, many of which come from the context in which the property is situated (Kestens, Theriault, and des Rosiers 2004; Rosen 1974). Each of those characteristics adds to or detracts from the property's total price according to the positive or negative value that potential buyers associate with that characteristic.

The hedonic method is classified as one of several revealed-preference (RP) approaches for determining the value of public

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goods. RP methods are characterized by their use of empirical data from economic transactions and other behaviors to determine, ex post, people's willingness to pay for those goods (Whitehead et al. 2008). Other RP-based approaches include travel cost analysis—which measures the out-of-pocket and time costs people are willing to pay to access an amenity (e.g., a national park; Herriges and Kling 1999; Parsons 2003)—and averting behavior analysis—which assesses the degree to which people engage in behaviors to avoid a disamenity (e.g., choosing bottled water instead of off-colored tap water; Dickie 2003; Smith 1991).

Stated-preference (SP) methods comprise another primary category of approaches for measuring the value of public goods. In contrast to RP, SP methods use assertions of preference, usually derived from public surveys, to gauge, ex ante, willingness to pay for a good (Whitehead et al. 2008). In contingent valuation method, the most often used SP approach, researchers ask respondents directly about their willingness to pay, usually in the context of a set of hypothetical choices between competing goods (Bateman et al. 2003; Mitchell and Carson 1989). Contingent behavior approach similarly uses a set of hypothetical situations, but researchers ask respondents to choose between various behaviors rather than to directly state their willingness to pay (Louviere, Hensher, and Swait 2000).

Naturally, RP- and SP-based approaches each contain a set of strengths and weaknesses. One fundamental limitation common to all RP approaches is their inability to test demand for goods that do not yet exist. Being based on choices people have already made, RP methods are inherently focused on the past, making the approach ineffectual for assessing policy or investment options not already represented in the market. A classic example is the new subway line proposed for a city that currently has only bus service. Because the subway represents a technology and class of service that is foreign to that market, empirical data of past or present bus patronage is unlikely to provide a reliable basis for estimating subway ridership.

RP methods are also limited in their ability to tease out the various influences that motivate people's choices (Bristow and Wardman 2006; Hess, Adler, and Polak 2007). For example, the level of ridership observed after the opening of a new subway line might be a reflection of the subway's level of comfort, its speed of travel, the level of geographic accessibility it provides, the level of traffic congestion on parallel street networks, a combination of these factors, or none of the above. A standard RP-based data set, because it would contain information only about the basic facts of the travel choices being made, would likely be incapable of differentiating between these possible variables. Attempts to use statistical models to test RP-based data for the influence of such factors often end with results that contain limited variation among factors and high levels of collinearity (Brownstone, Bunch, and Train 2000; Nestor 1998).

SP methods can overcome both of these limitations. Because SP approaches dwell on hypothetical situations, they are much more flexible, allowing researchers to focus on precisely those questions of interest, including those containing elements that do not yet exist in the market (Whitehead et al. 2008). SP methods also allow analysts to construct survey instruments designed to elicit motivations and influences behind respondents' choices (Hensher and Bradley 1993; Hess and Almeida 2007).

These strengths, nevertheless, are also a source of weakness. Because respondents have to only state a preference to a set of hypothetical possibilities, rather than having to make an actual choice with its attendant consequences, their responses are apt to be biased. These biases arise in respondents frequently having incomplete information about the hypothetical alternatives (Nestor 1998), a sense of triviality due to the lack of real consequences (Whitehead et al. 2008), preexisting political views (Ben-Akiva and Morikawa 1990), an intention to strategically affect the outcome of the survey (Tongzon and Sawant 2007), and a tendency to maintain idealized notions of how they might act under the hypothesized conditions (Brownstone, Bunch, and Train 2000). This last situation is particularly problematic when the public goods being tested incorporate "politically correct" attributes. For example, in contingent response surveys testing public support for a proposed extension to a public transit system, respondents might express a much higher level of projected use than they would actually exhibit once the extension was constructed.

Because RP methods use data drawn from empirically observed behavior, they have the intuitive strength of being able to demonstrate what people actually choose when they are required to prioritize competing demands for time and money (Whitehead et al. 2008). For this reason, researchers have tended to rely more heavily on RP approaches, in particular hedonic price analysis, for assessing the relative market support of various characteristics of urban development. To understand the relative value of these characteristics, a typical hedonic price study will use sales data from a large number of real estate transactions across a wide range of development conditions to tease out the amount that buyers are willing to pay for the individual features that make up the total price of a piece of real estate (Can 1990, 1992; Dubin 1998).

The characteristics included as explanatory variables in hedonic models are of two basic types—those related to structures built on the land and those related to the land itself (Bowes and Ihlaneldt 2001; Fujita 1989; Debrezion, Pels, and Rietveld 2007). In the case of residential hedonic studies, which are the most common type, structural characteristics often include features such as the square footage of living space, the number of bedrooms and bathrooms, the presence of a garage, the age of the house, the presence of a pool, and other features known to influence sales transactions.

Land-related characteristics are frequently segregated into two sub categories: those that reflect the land's location and those related to its surroundings. Locational attributes will often include the land's distance from perceived amenities, such as regional business districts and parks, as well as its proximity to disamenities, such as landfills and heavy manufacturing uses. Environmental attributes will sometimes include measurements of noise and air pollution, crime rates, and development densities.

Another way to categorize nonstructural attributes, one that is more aligned with the purpose of this article, is to group them into access-related characteristics and design-related characteristics.

Access-Related Price Effects

The old adage that real estate is about location, location, location is really a statement about the role that accessibility plays in the development potential of property and, hence, its value. Any discussion about the urban economic influence of accessibility invariably starts with the work of Johann von Thünen, who in 1863 theorized about the value of farmland as a function of the land's relative proximity and, thus, its accessibility to the market place. The closer (and more accessible) the land, the higher the value. Assuming equal levels of soil productivity, as values rise, farmers are induced to plant crops that yield higher returns per unit of land. Thus, accessibility to the market place not only influences the relative price of land but also the intensity to which the land is used. Later research translated von Thünen's work beyond the farmland context to other types of land use categories, showing similar relationships between accessibility, property value, and development intensity (Alonso 1964; Mills 1967; Muth 1969). As land becomes more accessible, its perceived usefulness as a location for business or residential activity increases, leading to increased demand for the land, which raises its value and induces the ultimate land developer/user to use the land more intensely (Landis and Huang 1995).

Proximity to the Central Business District (CBD)

Traditionally, these relationships between accessibility, property value, and land use intensity have been explained by physical proximity to a city's or region's CBD. Because CBDs have, at least historically, been the areas with the greatest accessibility to the largest number and variety of activities, land values were observed to be inversely proportional to distance to the CBD—the shorter the distance to the CBD, the higher the land values, and vice versa. The high levels of accessibility in central locations mean that the transportation and convenience costs of getting to and from those locations are lower compared to other locations in a region. This increases demand for central locations, thereby driving up the price. On the other hand, more distant locations are generally less accessible, meaning that their transportation and convenience costs are higher, which reduces the demand for those locations and, hence, the price (Fujita 1989).

Although these effects have been reduced somewhat by the replacement of the pre-1950s single-centered metropolitan pattern with a modern multicentered urban form (Anjomani and Chimene 1982), they are still observable, particularly in older metro regions that retain some of their monocentric past. A 1997 analysis of the price effects of agricultural open space in the Washington, D.C. region, for example, shows a 1.7 percent decrease in the sales prices of single-family homes for every 10 percent increase in the distance from DC, all else being equal (Geoghegan, Wainger, and Bockstael 1997). Similar relationships have recently been observed in London (Gibbons and Machin 2008), Quebec City (Kestens, Theriault, and des Rosiers 2004), Dallas (Peiser 1989), Bangkok (Chalermpong 2007), Rogaland, Norway (Osland and Thorsen 2008), Seattle (Mathur 2008), and Atlanta (Bowes and Ihlanfeldt 2001). As expected, the higher land costs associated with central locations usually result in greater development densities (Hansen 1959; Peiser 1989; Wassmer and Baass 2006). Hence, central locations not only benefit from the destination accessibility effects on travel behavior outlined in the land use-travel literature (Ewing and Cervero 2001; Ewing and Cervero 2010) but also from higher density and, not infrequently, other land use variables that tend to co-vary.

The Transit Effect

The introduction of transit service to an area increases travel options for residents and employees of the area and can reduce travel times to the CBD and other activity centers, particularly if the service operates in its own right way (Fejarang 1994). This has the net effect of increasing the relative accessibility of that area compared to other areas at the same distance from the CBD/activity centers but without transit (Baum-Snow and Kahn 2000). In theory, the increase in relative accessibility translates into increased development potential and land values (Hess and Almeida 2007; Nelson 1992, 1999; Nelson and McClesky 1990).

Results from empirical studies of these relationships are varied and at times contradictory. The majority of the evidence, nevertheless, points to the introduction of transit service leading to enhanced land values, as the theory predicts (Bowes and Ihlanfeldt 2001). Most of the studies use some continuous measure of distance to the transit platform, either as the crow flies or the actual walking distance, as the primary explanatory variable, while controlling for structural and other locational variables (Landis, Guhathakurta, and Zhang n.d.). Some studies make simpler assessments by comparing prices of real estate located within a certain cordon around a transit station (e.g., ½ mile) with real estate outside that cordon. The volume of this literature is substantial, with one researcher counting at least 50 studies on the topic since the 1970s (Duncan in press); even the literature reviews are becoming numerous (Anas 1982; Cambridge Systematics 1998; Cervero, Ferrell, and Murphy 2002; Cervero et al. 2004; Huang 1994; Knaap 1998; Landis and Zhang 1995; Parsons Brinckerhoff 2001; Ryan 1999; Smith and Gihring 2006; Vessali 1996). The 2004 review by Cervero et al. synthesizes studies completed since 1993, showing price premiums for housing located within a ¼ to ½ mile radius of rail transit stations of between 6.4 percent and 45 percent, compared to equivalent housing outside of the station areas. The same review shows premiums for commercial property values ranging from 8 percent along Denver's 16th Street Mall to 40 percent for the area surrounding Dallas' Mockingbird light rail station.

Not all of the studies show such strong value/transit relationships, and in a small number of cases the data indicate a negative relationship (i.e., proximity to the transit station results in a price penalty). In an effort to rationalize the wide ranging results, Debrezion, Pels, and Rietveld (2007) conducted a meta-analysis using data drawn from 57 other studies. The conclusion from their regression analysis is that transit proximity still matters, with residential property values increasing 2.4 percent for every 250 m closer to a station and commercial properties increasing 0.1 percent for every 250 m. The effects are greater for stations served by commuter rail than for those served by heavy rail. In the case of bus rapid transit stations, the data show a price discount for nearby properties. These results are, in all likelihood, conservative estimates, given the number of potentially confounding factors that could not be controlled, including housing types, local real estate market conditions, possible negative disamenities (e.g., crime and noise), and whether other complementary planning features were present (e.g., pedestrian-oriented street design, mixed-use zoning).

Some of these effects have been teased out in the more recent studies. Consistent with Debrezion et al., Cervero and Duncan (2002) show that price premiums for commercial property vary with the degree of regional access provided by different transit technologies. Using the San Jose, California area, which is served by both commuter and light rail, they show that downtown properties within a ¼ mile of a station in the regional commuter rail system command a $25 per sq. ft. premium, while downtown properties within a ¼ mile of a station for the city-wide light rail system show only a $4/sq. ft. advantage. Duncan (2008), in his analysis of the San Diego light rail system, shows that the "rail proximity premium" for multifamily housing is three times higher (16.6 percent) than that for single-family housing (5.7 percent), supporting the notion that buyers in the condominium market have a stronger demand for transit access than buyers of single-family homes. In their assessment of the light rail system in Buffalo, New York, where both population and transit ridership are declining, Hess and Almeida (2007) show that the price advantages of transit-served properties appear to withstand adverse market conditions.

Bowes and Ihlanfeldt (2001) demonstrate that with heavy rail systems there can be a "disamenity zone" close to the station where noise and potential crime effects offset the transit accessibility benefits. Their findings show that properties within the first ¼ mile of a MARTA station in Atlanta are discounted by19 percent compared to properties more than 3 miles away, while properties within 1−3 miles of the station command a significant price premium. Similarly, Landis, Guhathakurta, and Zhang (n.d.) show that residential properties outside of downtown San Jose and within 300 ft. of the same commuter rail line observed by Cervero and Duncan are discounted by as much as $51,011. Goetz et al. (2010) show that proximity to light rail tracks can have a similar disamenity effect on residential prices, but at a much lower level, perhaps reflecting light rail's lower noise and vibration levels. Moreover, the disamenity effect—starting at $16 for every meter closer to the tracks—is, in most cases, outweighed by positive accessibility benefits—which start at $30 for every meter closer to a light rail station.

In a soon to be published study of the new Phoenix light rail system, Atkinson-Palombo (2010) shows distinct impacts of transit-oriented development (TOD) zoning, apart from the accessibility effects of the transit system. In single-use residential neighborhoods, the adoption of TOD zoning has a negative effect on real estate prices, whereas TOD zoning is accompanied by a 37 percent premium for condos located in mixed-use areas.

As outlined above, theory predicts that the increased property values in transit station areas should translate into higher intensity/higher value developments. Evidence from the land use and transit development history of the London region supports the theory, showing that as the network of surface and underground transit facilities were constructed over a 150-year period, the residential densities of the station areas outside the central core increased, while the commercial densities proximate to core area stations also increased (Levinson 2008). Another leading example of this effect is the Pearl District, near downtown Portland, Oregon, where the city constructed a streetcar line in 1997 (City of Portland 2008). Before the streetcar was built, development in the area was constructed at less than half the density (as measured by floor-area ratio [FAR]) allowed by zoning. Projects built since 1997, however, have been constructed at 60 percent to 90 percent of the allowable density, with the highest densities immediately adjacent to the tracks. To date, more than $3.5 billion in private capital has been invested within two blocks of the streetcar alignment, including more than 10,000 units of new housing and 5 million sq. ft. of commercial space.

Another example is the Rosslyn-Ballston corridor of Arlington County, Virginia, which includes five stations along the Washington Metrorail system's Orange Line. In the 1960s, this corridor was characterized by failing low-density strip-malls, but by 2004, the corridor had become host to more than 58 million sq. ft. of new commercial and residential development (Fairfax County 2005). Planning for the corridor's station areas, which began well before the Orange Line's opening in 1979, focuses high-intensity development in Primary Intensification Areas that include lands within 1000 ft. of each station. Secondary Intensification Areas, running from 1000 to 1600 ft. of the station, step down density levels in stages, both to facilitate blending with surrounding neighborhoods and to help focus the market for high-density development in the primary areas. By 2004, development in these planning areas had resulted in the construction of more than 21 million sq. ft. of office space (plus another 2 million approved), 2.8 million sq. ft. of retail space, and 26,000 units of housing. As with Portland's Pearl District, the Rosslyn-Ballston Corridor shows how the accessibility advantages provided by a transit investment can, when supported by appropriate planning and zoning, result in higher intensity/higher value developments.

Another phenomenon suggested by the Arlington example is the tapering off of the accessibility-related property value impacts as the transit station distance from the CBD increases. Zoning around the Rosslyn station—the closest station in the corridor to the Washington, D.C. CBD—generally allows for FARs of 3.8 to 4.8. In recent years, however, the county board has allowed denser projects to be built, some of which are as high as 9.9 FAR. This has effectively bumped up the average FAR of development constructed or permitted in the station area to 1.78, which is 23 percent higher than the built FAR in the next station area in the corridor (Courthouse) and 36 percent higher than the corridor average. Studies of other Metrorail station areas show similar effects: the further a station is from the CBD, the lower the property value, other things being equal (Federal Transit Administration [FTA] 2000). These findings agree with theory-based expectations, which posit that the capitalization of accessibility benefits in transit station area property values is not only a function of a property's proximity to a station, but also the station's proximity to the center of the region. Similar studies in other metropolitan areas confirm these expectations (Bowes and Ihlanfeldt 2001; Cervero and Duncan 2002; Chalermpong 2007; Debrezion, Pels, and Rietveld 2007; Pan and Zhang 2008).

The principal accessibility-related hedonic transit studies discussed above are presented in table 1. The wide ranging results from this literature are not easy to synthesize. As noted by Landis, Guhathakurta, and Zhang (n.d.), variations in methodology, market conditions, transit service, and time periods across the studies make it difficult "to draw any generalizations ... regarding the magnitude, extent, or duration of the capitalization effect." Nevertheless, the following broad points can be made:

- The mainly positive price effects reported in these studies support the widely subscribed assertion (e.g., Government Accounting Office [GAO] 2010) that transit access is perceived as a desired good. The breadth of the range in results, however, suggests that factors other than simple distance to a transit station are in operation.
- One variable suggested by theory and supported in the literature is the degree of relative accessibility being provided by transit. Factors relevant here would include the frequency, geographic extant, and speed of the transit service and the length, intensity, and geographic extent of traffic congestion on parallel road systems.
- Another related factor borne out by the literature is the relative distance of the transit station from the CBD and other activity centers. The closer a station is to the CBD, the larger the effect of proximity to the station.
- Some literature points to a disamenity effect associated with residential proximity to rail lines, presumably because of the noise and vibration associated with rail operations. Although the literature on the issue is sparse, the degree of effect seems to vary with the type of rail technology, commuter rail having the biggest effect and light rail the smallest. Whether the disamenity effect is offset by the accessibility benefits of transit appears to vary with proximity to a station.
- Finally, the literature supports the idea that transit-based influences on land price seem to co-vary with development densities—as one rises, so does the other. One would expect this as developers seek to recoup higher land costs with more product.

Design-Related Price Effects

An additional factor that may account for some of the variation in study results is the degree to which the design elements of TOD are present or absent in a particular station area. Most of the hedonic price studies cited in the previous section focused on the accessibility benefits of TOD, not on the pedestrian design and mixed-use attributes that are commonly understood to be central to the TOD concept. In fact, very few studies have sought to separate out the effect of TOD design/mixed-use amenities on real estate prices, apart from the transit accessibility benefits. Mindful of the distinction now recognized between transit-*oriented* development and transit-*adjacent* development (Cervero et al. 2004), the differences in real estate price effects between accessibility and design-based benefits are important.

Design of Transit Station Areas

Probably the first hint of the importance of design comes from studies suggesting that the construction of transit—even high-capacity heavy rail—into auto-oriented suburban environments without supportive pedestrian-oriented design, planning, and zoning provisions has a negligible effect on station area land development. Landis and Zhang's (1995) evaluation of suburban station areas in the San Francisco Bay Area BART system shows that sites closer to stations are *less* likely to be developed than sites further away. This finding was true for both the period of time when BART was under construction (1965–1975) and the system's first 15 years of operation (1975–1990). In the same study, Landis and Zhang analyze station areas along the San Diego Trolley light rail system, finding that although sites closer to those stations are more likely to have been developed than sites further away, the effect was weak, leading the authors to conclude, "neither BART nor the San Diego Trolley has had a significant effect on land use patterns in their immediate station areas" (p. 79). One of the compelling reasons the authors cite for this outcome is the presence of significant institutional barriers to change, including a lack of supportive local government planning and zoning provisions. Bollinger and Ihlanfeldt (1997) and Gatzlaff and Smith (1993) reach similar conclusions with respect to Atlanta's MARTA rail system and Miami's Metrorail, respectively.

Another strand suggesting an independent effect of pedestrian-oriented design is the variation in real estate price effects between "park and ride" and "walk and ride" transit stations. The former are, at least in American practice, almost uniformly auto-oriented in their designs, while the latter are more likely to be pedestrian-oriented. In his extensive study of gentrification trends in transit station areas across 14 metropolitan areas, Kahn (2007) shows that, over a 10-year period,

Table 1. Studies of Access-Related Price Effects

Authors	City	Property Type	Tranist Type	Period of Overservations	Number of Observations	Result
Baum-Snow and Kahn 2000	Atlanta, Boston, Chicago, Portland, Washington	Residential rents and sales	Heavy rail, light rail	1990	3,499 (rental), 3,369 (sales)	Houses 1 km from transit rent for $19 more a month and sell for $4972 more than those 3 km from transit.
Bowes and Ihlanfeldt 2001	Atlanta	Residential sales	Heavy rail	1991–1994	22,388	Properties within ¼ mile of transit sell for 19 percent less than those more than 3 miles away, but those 1 to 3 miles away sell for 3.5 percent more.
Cervero and Duncan 2002	San Jose	Commercial/ Industrial sales	Commuter rail	1998–1999	1,197	Parcels within ¼ mile of commuter rail sell for $25/sq. ft. more; parcels within ¼ mile of LRT sell for $4/sq. ft. more.
Debrezion, Pels, and Rietveld 2007	Various	Residential & Commercial	Commuter rail, heavy rail, light rail	N/A	Data from 57 studies	House prices increase 2.4 percent and commercial prices. 0.1 percent for every 250 m closer to a station.
Duncan 2008	San Diego	Condo & single-family residential sales	Light rail	1997–2001	139,000	Condos ¼ mile from station sell for $22,000 more and houses $12,000 more than those 1 mile away.
FTA 2000	Washington	Commercial assessed values	Heavy rail	N/A	2,842	A 1,000 ft. reduction in distance to station increases value by $2.30/sq. ft.
Goetz et al. 2010	Minneapolis	Condo & single-family residential sales	Light rail	1997–2007	14,943	Homes within 1/2 mile of a station sold at 16.4 percent less than the surrounding area before light rail, but 4.2 percent more after.
Hess and Almeida 2007	Buffalo	Residential assessed values	Light rail	2002	7,357	Homes within ¼ mile sell for $1,300–3,000 more than those further away.
Kahn 2007	14 Cities	Residential sales	Commuter rail, heavy rail, light rail	2000	26,514	Across all 14 cities, no change for homes in census tracts within 1 mile of a transit station and lower than area median income, but wide varition between cities of between +33 percent and −14 percent.
Landis, Guhathakurta, and Zhang n.d.	San Francisco, San Jose, Sacramento, San Jose	Residential sales	Commuter rail (CalTrain), heavy rail (BART), light rail	1990	4,180	Homes in Alameda County sell for $2.29 more for every meter closer to a BART station; homes within 300 m of the CalTrain sell for $51,011 less; proximity to light rail was mixed with San Jose showing a negative effect, San Diego a positive effect, and Sacramento no effect.
Weinberger 2001	San Jose	Commercial lease transactions	Light rail	1984–2000	4,600	Rents within ¼ mile are 13 percent higher than those beyond ¾ mile

the prices of homes in park and ride station areas suffer a 1.9 percent price decrease, while those in walk and ride station areas enjoy a 5.4 percent increase. Over 20 years, the walk and ride premium increases to 10.8 percent. Bowes and Ihlanfeldt (2001) show a similar effect in their study of the Atlanta MARTA system. The price of homes located between ½ and 1 mile of a park and ride MARTA station shows a 1.4 percent discount, while homes more than 3 miles from a park and ride station show a 4.7 percent price premium. These results suggest that for close-in residents the disamenity of being near a parking lot (that they probably do not need to use to access the transit system) outweighs the accessibility benefits of the transit service itself. On the other hand, the more distant residents are able to enjoy the benefit of using the parking lot to access the transit system, while being far enough away to avoid the disamenity of living near a large parking lot. Atkinson-Palombo's study (2010) of Phoenix presents comparable results.

These findings are bolstered by Goetz et al.'s (2010) study of the Hiawatha light rail line in Minneapolis, which shows substantial differences in residential prices between properties on the west side of the rail line—which have direct access to station platforms—and those on the east side—which are separated from the stations by an arterial and industrial buildings. In the west side station areas, condos and single-family houses receive price premiums of $350 and $45 per meter of proximity to station platforms, respectively. On the east side, however, the disamenity effects of the arterial and industrial uses overwhelm the transit accessibility benefits. Interestingly, because the researchers make calculations both before and after the construction of the rail line, they are able to identify a moderating of the negative impacts from the arterial and industrial uses as a result of transit accessibility. In other words, having transit nearby, while not overcoming the negative attributes on the east side neighborhoods, makes them less onerous.

Mixed Uses

The presence of a relatively high degree of mixed land uses within a walkable area is central to most definitions of pedestrian and transit orientation (Congress for the New Urbanism 1996; Smart Growth Network 2009). From a planning perspective, the principal reason for mixing uses is to provide the residents and workers in a neighborhood with easy access to at least some of the destinations on their daily itineraries, such as employment, housing, schools, shopping, local services, and cultural and recreation facilities. This increase in proximity and convenience has been linked to smaller daily activity spaces, shorter daily travel distances, lower average vehicle trip rates, and fewer total vehicle miles of travel (Ewing and Cervero 2001; Ewing and Cervero 2010; Fan and Khattak 2008). Logically, the increased convenience should also find favor in real estate markets. Anecdotally, we observe this logic when we read real estate ads that list things like "close to shopping" and "easy walk to elementary school" as positive selling points. We should then expect to see these advantages capitalized in the prices of properties within or close to a mixed-use environment. There is evidence that this is the case, although the literature is sparse.

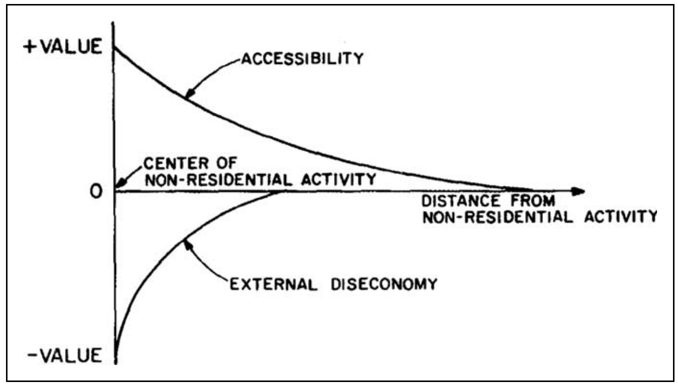

Figure 1. Postive and negative influences on residential land prices of proximity to non-residential land uses (source: Li and Brown 1980).

One of the early studies of mixed use is Grether and Mieszkowski's (1980) analysis of the impacts of nonresidential land uses on the prices of nearby housing in New Haven, Connecticut. Their objective was not to assess the effects of mixed-use development, per se, but to test a central pillar of modern, single-use zoning—that allowing non-single-family residential uses within single-family neighborhoods depresses the value of the homes in those neighborhoods. To test the assumption, the authors conducted 16 "experiments" using hedonic methods to assess price impacts on single-family homes located in homogeneous neighborhoods within ¼ mile of a variety of non-single-family residential uses, including an elevated highway, garden apartments, public housing projects, light industrial uses, strip commercial uses, and neighborhood commercial districts. Of the 16 areas tested, proximity to the nonresidential uses was statistically significant at the 0.01 percent level in only three areas, suggesting that proximity to most nonresidential uses has little effect on home prices. Of the three significant tests, two showed proximity (to an industrial district and a public housing project) had a negative price effect. The other test, however, showed proximity to neighborhood commercial had a positive price effect. Cao and Cory (1981) reach similar conclusions in their analysis of Tucson, Arizona.

Similar to Grether and Mieszkowski, another early analysis by Li and Brown (1980) focuses on the "micro-scale" externalities of noise and visual pollution, as well as proximity to nonresidential uses. While acknowledging the accessibility benefits of proximity to daily destinations such as shopping, Li and Brown recognize that such destinations frequently have noise and congestion elements associated with them that may have a negative impact on the prices of surrounding housing. In a manner consistent with the discussion above about proximity to transit, Li and Brown postulate that the impacts of the negative externalities decrease more rapidly with distance than the positive effects of accessibility (see Figure 1). In other words, the disamenities of the commercial uses tend to be "next door" phenomena, experienced primarily by those immediately adjacent to the shops, while the benefits of having easy access to shopping are enjoyed by residents in a wider geographic area. Although their analysis of single-family home sales in suburban Boston is inconclusive regarding disamenities, the results do show a relationship to accessibility that is significant and positive. In other words, as distance to the commercial use decreases, the home price increases. The authors estimate the magnitude of this effect at $1,486 for every 10 m.

Among the more recent studies of mixed uses, Din, Hoesli, and Bender's (2001) analysis of a variety of environmental variables, including proximity to shopping, produced inconclusive results. De Graaff et al. (2007) assessed the values that employees of an "edge city" outside Amsterdam place on shopping, day care, and other facilities near their places of work. The analysis, while showing that many employees find the availability of such services important, used a "willingness to pay" SP methodology, which, as outlined above, is generally considered less reliable than hedonic model approaches (Federal Transit Administration 2000; Tajima 2003). Mathur's (2008) analysis of King County, Washington, shows accessibility to retail jobs increasing the price of "low-quality" housing while decreasing the price of "high-quality" housing. As the study measures accessibility only to retail jobs, and does so on the basis of auto driving time, its value to assessing the impacts of TOD-style mixed use is limited.

Among recent hedonic price studies, Matthews and Turnbull (2007) find that the price effect of mixed uses depends on the development pattern of the neighborhood. In automobile-oriented neighborhoods with curvilinear and cul-de-sac street patterns, the presence of retail uses within walking distance has no significant effect. In pedestrian-oriented neighborhoods with interconnected streets, however, retail proximity has both positive and negative effects relating, respectively, to the accessibility and disamenity influences postulated by Li and Brown (1980): the negative externalities associated with retail uses (noise, light, traffic, trash, etc.) depress the price of immediately adjacent houses by as much as $14,453, while the accessibility benefits result in a $9,675 premium. The negative effects fall off quickly with distance, though, and at approximately 235 ft. from the retail use, they are overwhelmed by the accessibility effects.

Song and Knapp (2004) make similar findings in their analysis of Washington County, Oregon:

> Our fundamental conclusion is that mixing certain types of land uses with single family residential housing has the effect of increasing residential property values. This is especially true for houses that are closer to public parks or are located in neighborhoods with a relatively large amount of land devoted to public parks. Housing prices also increase when they are close to neighborhood-scale commercial uses, or are part of a community with a relatively large amount of neighborhood-scale commercial uses. In other words, a house tends to be sold at a higher price if it is closer to a public park or a neighborhood store. Additional premium exists when the neighborhood store is situated within pedestrian walkable distance. It is important to note that the research indicates that the size and scale of the commercial development is important to consumers. The larger or more intense the commercial development, the more it can have a negative effect on housing prices (pp. 675-6).

In a new study of the San Diego Trolley light rail system, Duncan (in press) makes comparisons between station areas containing various levels of "population serving employment" (i.e., entertainment, food-related, retail, and service businesses). The results show that proximity to a light rail station has no significant effect in condo sales prices in neighborhoods with average levels of population serving employment. With higher levels of these types of uses (above the 68th percentile of the variable's range), station proximity significantly increases sales prices, suggesting that the capitalization of accessibility benefits of transit is conditioned, in part, on the presence of mixed uses.

Open and Public Spaces

While the effects of mixed uses on home prices have not been studied extensively, the literature on the hedonic price effects of urban parks and open space is substantial (Benson et al. 1998; Bolitzera and Netusilb 2000; Irwin 2002; Shultz and King 2001). Studies in Washington County, Oregon; Austin, Texas; Minneapolis–St. Paul; and other areas use residential sales data, census data, and Geographic Information Systems (GIS) to examine the marginal values of different types of open space (Anderson and West 2006; Nicholls and Crompton 2005; Song and Knaap 2004). These studies find that urban parks, natural areas, and preserved open spaces have positive effects on property values.

A recent review of more than 60 published articles concludes that while most types of open space are associated with increased real estate prices, the magnitude of effect depends on the size of the area, the proximity of the open space to residences, the type of open space, and the method of analysis. The review finds the marginal implicit price of being located 200 m closer to a given open space area ranges from negative to +2.8 percent of the average house price (McConnell and Walls 2005). The economic boost in property value exists up to 500–600 ft. away from the park. In the case of community-sized parks over 30 acres, the effect may be measurable out to 1,500 ft., but 75 percent of the premium generally occurs within the 500- to 600-ft. zone (Crompton 2004). Walsh (2007) calculates that the average household living ½ mile from open space is willing to pay a one-time amount of $4,104 to reduce its distance from open space by ¼ mile.

The size of the park itself may have a bearing on the magnitude and proximity of the economic effect. Using data from Portland, Oregon, Lutzenhiser and Netusil (2001) find that house prices increase with the size of the natural area nearby and estimate the optimal size of parks and natural areas to be similar to that of a golf course. Increasing the percentage of open space land surrounding a property tends to increase average house prices between 0 and 1 percent of the total property value (Acharya and Bennett 2001; Geoghegan, Lynch, and Bucholtz 2003; Irwin 2002).

The type of open space providing the highest economic value to the surrounding property may depend on location (Anderson and West 2006). In rural and suburban areas, preserved farmland has greater value on surrounding real estate values than potentially developable land. Although the evidence is mixed on how much households are willing to pay to preserve farmland, studies do find that the price of properties near farmland threatened by development increases when that farmland is subsequently preserved (Geoghegan 2002; Geoghegan, Lynch, and Bucholtz 2003; Irwin 2002; Irwin and Bockstael 2003).

The value of all kinds of open space may be higher in urban areas than in suburban locations, with parks, greenways, forests, and other natural areas providing increased economic benefits as density increases (Acharya and Bennett 2001; Anderson and West 2006). Greenbelts, urban growth boundaries, and open spaces in clustered subdivisions also appear to have value, but the relationship is difficult to distinguish from the effect of supply of buildable land (Knaap 1985; Nelson 1985, 1986).

Although most of the literature in this area is focused on medium-to-large scale open and green spaces, the market also seems to value smaller amounts of greenery. In an analysis recently completed by the Forest Service's Pacific Northwest Research Station, researchers estimate the impact of street trees on neighborhood real estate prices (Donovan and Butry 2010). Analyzing more than 3000 residential properties in the Portland metropolitan area, the researchers determine that two-tree-related variables—the number of trees fronting a property and the crown area within 100 ft. of a house—are statistically significant. Together, these two variables can add more than \$8000 to the price of a house, the equivalent of adding 129 finished sq. ft. to the floor plan.

Street Design

A final feature common to most definitions of pedestrian and transit orientation is the design of public streets. Key to these definitions is the degree to which street patterns are interconnected rather than dominated by loops and cul-de-sacs. Similar to their finding regarding mixed uses, Matthews and Turnbull (2007) report that the effect of gridded street patterns depends on the nature of other design features. In neighborhoods containing other pedestrian-oriented features—narrow street cross-sections, neighborhood retail—a more grid-like pattern increases house prices, while the opposite is true in more auto-oriented neighborhoods. Focusing more broadly on street connections and block size, Song and Knaap (2003) find that home buyers in Portland, Oregon, are willing to pay a premium for houses in neighborhoods containing interconnected streets and smaller blocks. Duncan's (in press) study of San Diego light rail, outlined above, similarly shows that condo buyers will pay more for proximity to light rail stations if the neighborhood contains higher levels of street intersections per hectare.

On the other hand, in his study of Dallas-Fort Worth, Guttery (2002) finds negative price impacts from having rear-entry alleyways, a feature characteristic of TOD and other traditional development styles. Likewise, Asabere (1990), using data from Halifax, Nova Scotia, shows that location on a cul-de-sac yields a 29 percent price premium over houses located on a grid street pattern.

The impact of bicycle facilities on house prices is mixed and appears to depend on the neighborhood location within a region and on the type of facility. Krizek's (2006) analysis of on-road and off-road bicycle lanes and paths in the Twin-Cities region shows that city residents will pay more for a house close to an off-road path, but less for a house near a road-side path, even after controlling for the disamenity of being proximate to the busy streets where these facilities tend to be located. On-road bike lanes, meanwhile, have no significant effect on city house prices. In the suburbs, all three facility types have a significant and negative impact on house prices, with a discount of between \$364 and \$1058 for locating 400 m closer to these facilities.

Traffic calming, one type of street design treatment, uses changes in street alignments, the installation of barriers, and other physical measures "to reduce traffic speeds and/or cut-through volumes, in the interest of street safety, livability, and other public purposes" (Fehr and Peers 2008). There are two theories relating traffic calming to property values. One theory is that traffic calming eliminates or lessens negative externalities of motor vehicle use. Property values rise in response. The other theory is that traffic calming stigmatizes a street, announcing to all prospective property owners that traffic is a problem. Property values fall in reaction. Absent much empirical evidence one way or the other, property values might be expected to depend on the aesthetics and functionality of measures and the severity of preexisting traffic problems. A series of over-marked and oversigned speed humps on a low-volume residential street may detract from the appearance of the street and advertise a problem. Nicely landscaped devices that eliminate some or all through traffic from a street previously overrun are bound to enhance residential amenity.

The two rigorous studies of the property value impacts from traffic calming in the literature point in different directions. This is doubtless for the reason just cited—different measures were employed under different conditions. In one study (Bagby 1980), one neighborhood was traffic calmed with diagonal diverters in the aftermath of a fatal traffic accident, while another with a nearly identical street network and land use pattern was not calmed. In the period following treatment, residential property appreciated at a much faster rate in the neighborhood with the traffic calming than in the noncalmed neighborhood. In the other study (Edwards and Bretherton 1998), neighborhoods treated with speed tables were paired with similar neighborhoods left untreated. The rate of price appreciation was compared for arms-length home sales. For six pairs, the neighborhoods with tables showed more appreciation. For three, they showed less. For one pair, the rate of appreciation was the same. In most cases, the differences were slight.

Beyond these two studies, only anecdotal evidence is available. In the Old Northwood neighborhood of West Palm Beach, streets were closed and traffic circles, neckdowns, and humps installed for speed control. Home sale prices, which averaged $65,000 in 1994, averaged $106,000 a few years later. For the first time in years, real estate agents had lists of potential home buyers just waiting for the right resale unit to come on the market (Lockwood 1998).

If the evidence of the price effects from pedestrian-friendly street design are ambiguous, the price-effects from the presumed opposite treatment—auto-oriented street design—are less equivocal. It is intuitive that houses located on busy, noisy, high-trafficked streets sell at lower prices than houses on quieter—calmer—streets, and the literature says as much (Hughes and Simans 1992; Kawamura and Mahajan 2005; Nelson 1982). Wilhelmsson (2000) reports a 0.6 percent discount in house price for each increase in decibel (dB) from traffic noise, resulting in a 30 percent price differential between a house on a noisy street and one on a quiet street. Bateman et al. (2001) estimate the per dB discount at 0.2 percent, while Kim, Park, and Kweon (2007) find the rate to be −1.3 percent for every 1 percent increase in volume. Theebe (2004) asserts that the noise discount does not rise linearly with the sound level, finding that sound levels below 55 dB do not result in a price discount, but levels above 65 dB "appear to be capitalized into prices, with a maximum discount of approximately 12 percent" (p. 227).

Perhaps the final word on this topic belongs to the two studies analyzing the real estate price effects of replacing major highways with boulevards and parks. Tajima (2003) estimates the price impacts on real estate surrounding Boston's "Big Dig"—the replacement of the elevated Central Artery freeway with an underground facility and the transformation of the surface to a linear parkway and boulevard. Though written while the project was still under construction, Tajima uses coefficients of the price impacts from the proximity to parks in Boston neighborhoods to conclude that "the demolition of the highway should result in $732 million increase in property values, and the new parks should increase property values by at least $252 million" (p. 649). More convincing is Cervero, Kang, and Shively's (2009) analysis of the price effects resulting from the demolition of the Embarcadero and Central freeways in San Francisco after the Loma Prieta earthquake made the two elevated freeways structurally unstable. Both freeways were replaced with surface boulevards that, while having important pedestrian amenities, still carry large volumes of traffic. In the case of the Embarcadero Freeway, real estate prices tended to decrease with distance from the freeway before the earthquake because of the amenity value of the waterfront just on the other side of the freeway. After the replacement of the freeway with the new boulevard, that effect was amplified, suggesting the freeway had had a disamenity effect mitigating the benefit of being proximate to the waterfront. The authors find that this effect was about $118,000 (in inflation adjusted dollars) for a typical residential unit. In the case of the Central Freeway, real estate prices tend to climb with distance from both the freeway and the boulevard that replaced it. However, the steepness of the curve is significantly less with the boulevard. The authors estimate that the price of the typical residential unit in the corridor increased by $116,000 the year that the boulevard opened.

The principal studies reviewed in this section are presented in table 2. As with the previous section on accessibility benefits, the large variation in conditions across studies makes them difficult to synthesize. Nevertheless, the literature suggests the following general points:

- Auto-oriented design in transit station areas undermines the potential accessibility price benefits to residential properties of transit proximity; in some cases, the negative impacts from the design features completely overwhelm the positive accessibility effects.
- Residential price benefits for proximity to mixed use depend on the type of nonresidential uses involved, with pedestrian-oriented neighborhood commercial uses providing the highest benefit and auto-oriented commercial and industrial uses the least benefit or a price penalty.
- Nonresidential uses have a "disamenity zone" where the negative effects associated with the use (e.g., noise, light, and traffic) create a price discount for adjacent residential properties; the size of the zone varies with the intensity and nature of the nonresidential use.
- Proximity to protected open space provides a price premium for nearby residential properties; the size of the premium depends, in part, on the size of the open space, proximity to the CBD, and the density of development.
- Smaller blocks and connected streets may provide a price premium to residential properties, but the effect appears to depend on the presence of other pedestrian design features.
- High-speed/-volume roads nearly always depress the values of nearby residential properties.

Synergistic Effects

The studies reported above tend to address individual features of pedestrian- and transit-oriented design independently and in isolation from other features. There is, however, a growing body of literature, summarized in Table 3, that addresses the subject of design more holistically. Understanding that design is probably perceived in an integrated way by most consumers, this literature makes intuitive sense.

Consumers seem willing to pay a premium to locate in New Urbanist developments that feature higher-than-average densities, a mix of housing types, commercial centers, interconnected streets, and prominent public spaces (Eppli and Tu 1999, 2002, 2007; Plaut and Boarnet 2003). Compact developments can command a price premium of as much as 40 percent to 100 percent compared to houses in nearby single-use subdivisions, according to Chris Leinberger of the Brookings Institution (2008). The homes at Kentlands, Maryland, for example, sell at a $25,000 (12 percent) premium over

Table 2. Studies of Design-Related Price Effects

Authors	City	Property Type	Tranist Type	Period of Overservations	Number of Observations	Result
Auto-oriented design in station areas						
Bowes and Ihlanfeldt 2001	Atlanta	Residential sales	Heavy rail	1991–1994	22,388	Properties within ¼ mile of transit sell for 19 percent less than those more than 3 miles away, but those 1–3 miles away sell for 3.5 percent more.
Goetz et al. 2010	Minneapolis	Condo & single family residential sales	Light rail	1997–2007	14,943	Condos and homes with good access to station platforms have price premiums of $350 and $45/m of proximity, respectively; condos and homes separated from stations by an arterial and industrial uses show no benefit.
Mixed uses						
Grether and Mieszkowski 1980	New Haven	Single-family residential sales	N/A	1955–1970	1,946	Proximity to nonresidential uses significantly affects residential prices in 3 of 16 tested neighborhoods.
Li and Brown 1980	Boston	Single-family residential sales	N/A	1971	781	Home prices increase by $1,486 for every meter closer to retail uses.
Matthews and Turnball 2007	Seattle	Single-family residential sales	N/A	1989–2003	25,825	Home prices in auto-oriented neighborhoods are not signficantly affected by the presence of retail. In pedestrian neighborhoods, retail proximity results in both positive and negative effects, with the former overwheliming the latter at about 235 ft. from the retail use.
Song and Knaap 2004	Portland, OR	Single-family residential sales	N/A	2000	4,314	Proximity to neighborhood retail uses increases residential sales prices
Greenspace/openspace						
Anderson and West 2006	Minneapolis	Single-family residential sales	N/A	1997	24,862	Home prices increase by 0.0035 percent for every percentage decrease in distance to neighborhood parks; the effect increases with proximity to the CBD and higher densities.
Irwin 2002	Baltimore–Washington	Residential sales	N/A	1995–1999	55,799	Preserving farmland through easements or purchase significantly increases the price premiums of surrounding properties compared to unpreserved farmland.
Donovan and Butry 2010	Portland, OR	Single-family residential sales	N/A	2006–2007	3,479	Street trees fronting and within 100 ft. of a residential property can add up to $8,870 in sales price.
Street design						
Matthews and Turnball 2007	Seattle	Single-family residential sales	N/A	1989–2003	25,825	A gridded street pattern increases sales prices in neighborhoods with other pedestrian features but decreases prices in more auto-oriented neighborhoods.
Song and Knaap 2003	Portland, OR	Single-family residential sales	N/A	1999–2000	48,070	Home prices increase with increases in street connectivity and reductions in block size.
Krizek 2006	Minneapolis	Single-family residential sales	N/A	2001	35,002	City residents will pay more for proximity to off-road bike path but less for a roadside path; suburban residents will pay up to $1,058 less for locating 400 m closer to any bike path.

Table 3. Studies of Synergistic Price Effects

Authors	City	Property Type	Tranist Type	Period of Overservations	Number of Observations	Result
Atkinson-Palombo 2010	Phoenix	Condo & single family residential sales	Light rail	1995–2007	12,537	For houses and condos within walking distance to transit, those in mixed-use neighborhoods receive premiums of 6 percent and 28 percent, respectively; those in residential-only neighborhoods receive a 12 percent–13 percent discount.
Duncan in press	San Diego	Condo sales	Light rail	1997–2001	3,374	Condos 0.3 km from the station in neighborhoods with good pedestrian quality receive a 15.3 percent ($19,404) premium; those 0.3 km from the station in areas with poor pedestrian quality receive a −7.6 percent (−$9,962) discount.
Ryan and Weber 2007	Chicago	Residential assessed values	N/A	1993–2001	1,227	In economically distressed neighborhoods, houses located in traditional neighborhood developments (TND) received a 21 percent −27 percent price discount compared to other infill projects.
Song and Knaap 2003	Portland, OR	Single-family residential sales	N/A	1999–2000	48,070	Houses in New Urbanist neighborhoods receive a $24,255 premium compared to houses in convential suburban neighborhoods.
Tu and Eppli 1999	Kentlands, MD	Single-family residential sales	N/A	1994–1996	2,155	Houses in the Kentlands receive a 12 percent price premium over houses in conventional surburban neighborhoods.

comparable large-lot developments in the same zip code (Tu and Eppli 1999). Song and Knaap (2003) show a $24,255 premium for Portland-area homes in New Urbanist areas compared to those in conventional suburban neighborhoods. Ryan and Weber (2007), on the other hand, find a 21 percent to 27 percent discount for housing located in traditional neighborhood developments (TNDs) compared to infill projects. Critics of this latter analysis, however, suggest a series of possible confounding variables that may have influenced the analysis, including variations in design quality, the inclusion of public housing in the TND projects, and the use of assessed values instead of sales prices (New Urban News 2007).

Of course, key to the TOD concept is integrating these design features with high-quality transit. Returning to Duncan's analysis of the San Diego Trolley (in press), the author shows that a good pedestrian environment—which he defines as people serving jobs, connected streets, and flat (i.e., walkable) terrain—located in a transit station area can result in a condo price premium as high as $20,000 or 15 percent. More importantly, he demonstrates a degree of mutual dependence between pedestrian design and of transit proximity. As already outlined, the author shows that transit station proximity provides no statistically significant price premium in the absence of a good pedestrian environment. He also shows that the reverse appears to be true—that a good pedestrian environment provides no price premium in the absence of station proximity. For example, at 0.1 km distance to a transit station, the presence of people serving jobs provides a significant and strong price premium; the premium declines with distance from the station and at 0.9 km becomes insignificant. This reciprocity between design and transit leads Duncan to conclude that "TOD does seem to have a synergistic value greater than the sum of its parts, at least in the San Diego condo market" (p. 21).

Atkinson-Palombo (2010) shows similar effects in Phoenix, with single-family houses in mixed-use neighborhoods enjoying a 6 percent premium because of proximity to light rail, while the effect of station proximity is insignificant for houses in residential-only neighborhoods. Condos in mixed-use neighborhoods enjoy a 16 percent premium if they are walking distance to transit plus an additional 37 percent if the area is zoned for TOD. In the residential-only neighborhoods, however, condos within walking distance achieve only a 3 percent premium and that small advantage is overwhelmed if the area is zoned for TOD, which depresses prices by 11 percent.

Conclusion

In summary, the hedonic price literature confirms that the market shifts in favor of pedestrian- and transit-designed development indicated by survey data and demographic analyses are, indeed, being capitalized into real estate prices. As such, this literature provides a third, independent method of confirming and observing those market shifts. The literature also demonstrates that the amenity-based elements of transit-designed development play an important positive role in urban land markets, in addition to the accessibility benefits provided by transit. In fact, the newest literature suggests that the benefits of transit accessibility and TOD-based design are linked synergistically and may be, to a degree, mutually dependent. This tends to validate the distinctions others have made between transit-oriented and transit-adjacent development and suggests that planners, elected officials, transit agencies, and developers pay closer attention to the nontransit, amenity-based elements of land developments proximate to transit facilities.

Paradoxically, the literature of transit-related effects on real estate prices is both mature and yet still in its infancy. With more than 50 empirical studies in the last 35 years, there is a great deal of published research on the connections between transit and real estate. However, because much of that literature ignores the roles that urban form and development design play in real estate values (and transit ridership), its explanatory power is severely limited. Given that much of this literature was written during a period of burgeoning interest in land use−transportation interactions, in general, and in TOD, in particular, it is curious that hedonic research did not better reflect land use−transportation interactions. Only now are we beginning to see research that is beginning to unpack the market impacts of these interactions.

Perhaps the lag in the literature is the natural result of a limitation inherent to all RP methods, including hedonic price analysis: the need for transactional data. One cannot test market acceptance of pedestrian-/transit-oriented development using hedonic methods until there is enough of it actually constructed and on the market to provide statistically reliable samples. Now that these product types are becoming more available, one would hope that hedonic research would take advantage of the data to further explore what pedestrian- and transit-based design features mean for real estate markets. The studies outlined in table 3 are a good start in this direction.

Another possible direction for future research is to overcome the bounds of RP approaches by incorporating SP techniques. For several decades, researchers have explored the development of models that combine SP and RP methods to create tools that take advantage of each approach's strengths while mitigating their respective weaknesses (e.g., Ben-Akiva and Morikawa 1990; Brownstone, Bunch, and Train 2000; Clark and Kahn 1989; Hensher and Bradley 1993; Nestor 1998; Whitehead et al. 2008). By employing a mixed method approach, researchers could use SP data to test the depth of the market for pedestrian- and transit-oriented development and to explore more nuanced factors influencing buyers and sellers in that market, while bounding the data with empirical observations of actual transactions.

When pedestrian- and transit-oriented development was first discussed as a response to contemporary transportation and urban development challenges, skeptics asked, "Will anyone buy it?" The hedonic literature presented here shows that many people will, indeed, buy these types of development. A research method that mixes SP and RP approaches could go beyond that to help us better understand how many will buy it, who they are, and what conditions and circumstances are optimal to make the sale.

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