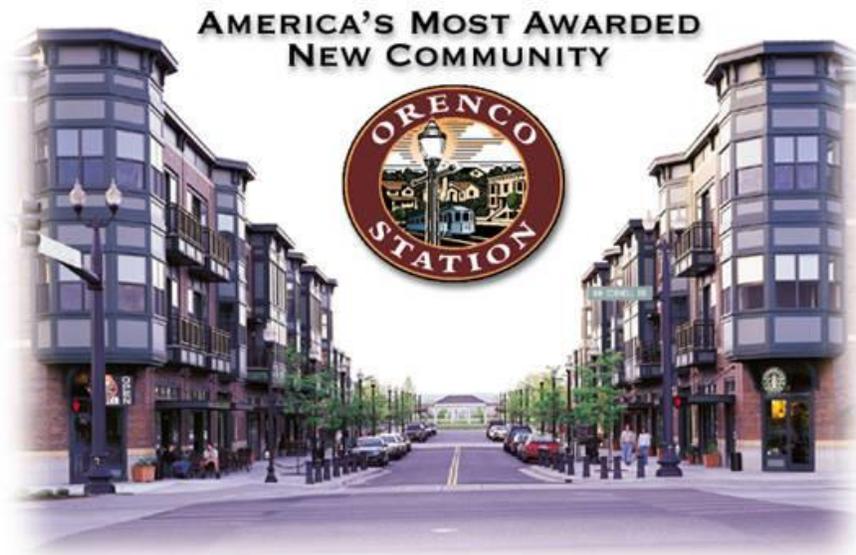

Financing Transit Systems Through Value Capture

An Annotated Bibliography

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Orenco Station in Portland, Oregon is a successful Transit Oriented Development. Property values tend to increase in such areas reflecting their improved accessibility and transportation cost savings.

Abstract

This paper summarizes the findings of more than 100 studies concerning the impacts transit service has on nearby property values, and the feasibility of capturing a portion of the incremental value to finance transit improvements. The results indicate that proximity to transit often increases property values enough to offset some or all of transit system capital costs.

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Introduction

When people are shopping for property for a home or business, experts generally offer three bits of advice: *location, location, location*. Why is location so important? Various factors come into play. People generally don't want to live near a noisy factory, hazardous waste site or other locally undesirable land use (LULU). Some neighborhoods are considered safer or more prestigious.

Another important factor is *accessibility*, that is, the ease with which people can reach services, employment, and other important destinations. Home buyers want to know that the house they purchase is located within reasonable travel time to shops, services and worksites. Similarly, business managers want a location easy for customers and employees to reach. A location's accessibility is also affected by the quality of transportation serving it. Rural and suburban areas are dependent primarily on automobile travel, so locations along a major roadway or at the intersection of major highways, is considered optimal. This is why businesses tend to form commercial strips along highways.

In urban areas, transit access is also important. By its nature, transit accessibility is more concentrated. Transit users generally want to walk no more than five or ten minutes from their trip origin to a stop or station, and similar distances to their destinations. As a result, locations within a quarter mile radius of a transit stop or station have better access, which reduces their transportation costs and increases their economic opportunities and productivity.

Transit-oriented communities tend to have better walking conditions and more clustered commercial activities than communities that are more automobile-dependent, and they often have lower parking requirements that provide additional consumer savings. Several studies indicate that residents of multi-modal neighborhoods spend significantly less in total on transportation than residents of automobile dependent communities (McCann, 2000; Litman, 2004; Ricciulli, 2020).

The value of accessibility has been well studied within the disciplines of urban economics, land economics and urban planning. In general, the more accessible a location, the higher its property value (Vadali 2014). Many experts assumed that transit accessibility was displaced in importance by automobile accessibility, but in recent years there has been increased recognition of the demand for high quality public transit; therefore the potential increase in value of properties located near high quality public transit services (Litman 2002). Proximity to transit can affect property values in three somewhat different ways, one negative and two positive (Higgins and Kanaroglou 2016).

1. Being located very close to a transit station or along a transit line can have negative impacts, including noise and air pollution from trains, and increased local vehicle traffic from transit passengers with parked cars. These nuisance effects may reduce property values.
2. It gives one location a relative advantage over other locations, attracting residential and commercial development that would otherwise occur elsewhere in the region. This is an economic transfer.
3. Transit can also increase overall productivity by reducing total transportation costs (including costs to consumers, businesses and governments for vehicles, parking and roads), and providing a catalyst for more clustered development patterns that provide economies of agglomeration, which can reduce the costs of providing public services and increase productivity due to improved accessibility and network effects (Coffey and Shearmur, 1997). Although these productivity benefits are difficult to quantify, they can be large. Just a small percentage increase in property values, a small percentage reduction in automobile and parking costs, or a small percentage increase in business productivity in a community can total hundreds of millions of dollars.

Potential benefits to residents and businesses raise intriguing prospects. Is it feasible that public transit systems could be partly funded by capturing a portion of their property value gains? This is consistent with the concept of *land value taxation* promoted by Henry George ([Lincoln Institute](#)). Many planners and economists, including Nobel laureate William Vickrey, suggests that cities could benefit by funding transit system development costs and a major portion of operating costs from *land value capture*, that is, by taxing a portion of the additional value of adjacent properties that result from transit accessibility (Jaffe 2020).

Value capture is based on the proposition that new transportation improvements such as a rail station not only create accessibility benefits to potential transit riders but also create value for the owners of nearby properties in the form of higher site values and new development opportunities. Land-based taxing mechanisms are rooted in the *benefits principle*, whereby the financial benefits of transportation improvements are in effect capitalized into higher land values.

Value capture is commonly conceived as a mechanism by which all or a portion of the financial benefits to property owners generated by geographically targeted public capital investments are appropriated by a local public authority. The term has been loosely used to cover almost every form of special tax or levy on real property. Over the past years, several methods of capturing growth in property values have come into practice. Strategies widely practiced in North America include local improvement districts, tax increment financing, and developer impact fees. Increasingly the term's usage has been focused on transportation corridors, particularly rail transit.

If benefits are understood to accrue in the form of land value uplift attributable to a public asset, we must disregard taxing instruments that include building value. Hence, the 'pure' rendering of the term value capture should be limited to land value premiums (or 'betterment') resulting from specified public capital investments, usually within transit corridors. It is a distinctive application of a special assessment district which unlike the conventional local improvement district excludes building value in the equation. Land value capture is becoming widely recognized as the preferred tool for financing transit-oriented development.

A large number of empirical studies have confirmed the positive impact of transit station improvements on nearby property values. Urban rail transit will significantly raise site values in station areas, especially if the regional economy is growing, and complimentary regulatory and joint development programs are in place. ("Transit Oriented Development," VTPI, 2004). Most of the land use and value impacts occur within a quarter to half mile of stations and are independent of landowners' property investment decisions.

Many published studies have investigated value capture's ability to fund transit (Higgins and Kanaroglou 2016). Most researchers focus on properties within transit corridors (within about 500 meters of a transit stop or station). Tideman (1993) and Borhart (1994) argue that this perspective underestimates full impacts. Considering all regional property gains could justify more transit investments.

There are many examples of potential or successful land value capture to fund transit. R. T. Meakin notes that Hong Kong's rail transit system receives no subsidy; all costs including interest on bond indebtedness are paid from land rents derived from development in station areas. R. Rybeck estimated

added land values sequential to the development of Washington D.C.'s Metro, finding a surplus of incremental value. D. Riley found that the London tube extension also generated surplus value.

In recent years there has been growing support for *Transit Oriented Development* (TOD, a component of *New Urbanism and Smart Growth*), which results when a transit station provides a catalyst for mixed-use, walkable land use patterns, sometimes called a *transit village*. It tends to increase property values, reflecting the direct benefits to residents and businesses of having diverse transportation options, and resulting automobile and parking cost savings.

A substantial portion of the capital costs associated with constructing public transit facilities is land acquisition. This cost could be effectively reduced if ground rents were collected. That is, when the public sector captures incremental land values through the general property tax (particularly a land value tax) and through special levies on land holdings in transit corridors, less value remains for private owners to capitalize into price. This dampening of land prices helps to reduce land acquisition costs, not to mention the cost savings passed on to future occupants.

In the past, private developers often built transit systems extending to urban fringe neighborhoods, recouping the capital costs from the sales of developed sites (still common practice in Japan). Such profits from land residuals are commonplace in the private sector but could reasonably be extended to the public domain – where local government covers the financial risk and the cost of building transit systems. Cervero, et. al. (2004) state that a central element of joint-development amounts to a *quid pro quo*, whereby private developers' benefits from transit accessibility are capitalized into higher rents and occupancy rates. This benefit is then offset through cost sharing mechanisms whereby transit agencies' capital funding is enhanced.

Most older value capture studies focus on developed country cities, but recent studies have begun to emerge from developing countries where transit mode shares are higher (Cervero & Susantono, Gutman, Nakagawa & Matsunaka, Prest, and Tsukada). Applying land value capture may require policy reforms and improved property valuation and tax collection infrastructure.

Below is our summary of numerous studies of transit property value gains, and the feasibility of financing transit improvements through value capture. Previous transit value capture summaries and bibliographies were compiled by the U.S. Subcommittee on the City (1980), Pickett & Perrett (1984), Huang (1994), the Transportation Research Board (1998), Diaz (1999), Lewis & Williams (1999), NEORail II (2001), Jonathan Hack (2002), TRB 2010 and Vadili 2014.

Financing Public Transportation

1. Wayne Boyle (1993), “Eight Ways to Finance Transit: A Policymaker's Guide,” Item # 9362, *National Conference of State Legislatures*.

The Los Angeles Metro Rail Special Benefit Assessment District survived a challenge in court, and contributed \$130 million per year to the cost of retiring LA Metro bonds.

2. M. Buchanan (1988), *Urban Transport and Market Forces In Britain*, Anglo-German Foundation for Study Industrial Society, London. Available from: AGFSIS, 17 Bloomsbury Square, London, England, pp 211-219.

The report features sections on buses, trains, and roads. The application of market forces and competition may decrease the public cost of transport and decrease traffic congestion in the U.K. Thus far, policies addressing market forces have been confined largely to bus service where deregulation has produced little change in service levels. Although public savings have been realized in large urban areas, the tendering process has led to major increases in county council costs and public transport staff. Market forces have not been effectuated in the railway system in the same way; large subsidies are still required. Tighter financial targets, the disposal of surplus land, and the subcontracting of work have all been undertaken, as have improvements in administration. Construction of new railways is being funded in part by the consequent increase in land values, an example being the London docklands railway. Four methods are discussed: allocating the subsidy to specific purposes; paying the subsidy via a third party; separating the operation of railways from the provision and maintenance of infrastructure; and privatization. Methods to commercialize road infrastructure include: urban parking management, the financing of new highway construction from tolls, and road pricing. (From Transport and Road Research Laboratory in TRIS Database under “Taxing Property Values for Transit”)

3. Matthew Doherty (2004), *Funding Public Transport Development Through Land Value Capture Programs*, EcoTransit (www.ecotransit.org.au).

This paper examines the potential to raise capital for funding public transport development through the use of land value capture programs. A literature review of studies that examine examples from Australia and abroad has been undertaken to do this. Among the mechanisms considered are development land taxes, systems of property rating, taxation models and specialised loans. These are considered alongside other funding measures such as statutory charges, CBD parking levies, business rate supplements and recent international methods of congestion charging.

4. Thomas A. Gihring (2001), “Applying Value Capture in the Seattle Region,” *Journal of Planning Practice & Research*, Vol. 16, Nos. 3-4 (Winter): 307-320.

The “geo-bond” financing mechanism features the capture of land rent as distinct from other capture devices that may include the building component of assessed value. Using the Broadway station area of Sound Transit’s proposed LINK light rail line, the author employs a model simulating the tax effects of (i) a general land value property tax and (ii) a land value gains tax within the transit benefit district itself. The LVT produces the desired development incentive effects, as it shifts the burden off buildings in this “main street” setting. The gains tax targets the difference between the annual assessed land value increase and the revenue derived from the general property tax within the half-mile radius benefit district. Given the rapid rises in values in recent years, “a land value gains tax combined with a

hypothecated general LVT can raise as much as \$118 million to support the necessary transit improvements. At a minimum, about \$24 million could be raised from an incremental gains tax alone.” Sound Transit estimates station and street improvements (excluding right-of-way acquisition) construction costs at \$80 million.

5. Donald G. Hagman and Dean J. Misczynski, eds. (1978), *Windfalls for wipeouts: land value capture and compensation*. American Society of Planning Officials. (Funded by U.S. Dept. of HUD).

Special Assessment Districts (SAD) by local governments, once used extensively, fell out of favor during the Great Depression. Yet by the 1970s, the tool was making a comeback. In 1913, Los Angeles, Oakland, Portland, and Kansas City raised 20% of their budgets from SADs. When the Depression wiped out land value, civic bonds became difficult to pay off and lost their ratings. Then, by 1972, the cities over 100,000 population that had SADs in effect (about 5% of all local jurisdictions), funded an aggregate 12% of their budgets through this method. With regard to the use of the Land Value Tax (LVT), the editors questioned the effectiveness of Pittsburgh’s experience in shifting the property tax rate from buildings to locations, citing a 1973 Price Waterhouse study (written before the rate differential was increase to 6:1, land to improvements). Nevertheless, the solid results from using the LVT for developing Waikiki Beach, Hawaii were also noted.

6. Yoshitsugu Hayashi (1989), “Issues in Financing Urban Rail Transit Projects and Value Captures,” *Transportation Research. Part A: General, Vol. 23A, Issue 1 (January)*.

In Japan, urban rail transit projects are suffering from cost burden due to the current financing system’s dependence on borrowed money from loans and bonds that are repaid mainly by fares. The transit fund cannot bear increased expenditures from accelerated construction demand and the rising cost of land acquisition. This paper reexamines the financing system and analyses the possible means of raising revenues. From the viewpoint of the benefits principle, the author examines the imbalance between those who bear the costs and those who receive the benefits, using Japanese examples.

7. Martin Higginson (1999), “Alternative sources of funding,” *Public Transport International, Vol. 48, No. 5 (September)*.

The author cites several transit systems. Copenhagen, Denmark, is funding a line to a new suburb by selling off public land for the development, privatizing development, and collecting more property tax revenue from the higher ensuing land values.

8. Jane A. Howard (1984-85), *Strategies to Implement Benefit-Sharing for Fixed-Transit Facilities*. Series Report from Transportation Research Board, National Research Council, National Cooperative Transit Research & Development Program No. 12.

A Local Improvement District is a special property assessment to pay for capital improvements benefiting a defined area. In Portland, Oregon, it is designed to collect some site rent (attributed increases in land values) to fund transit-related improvements such as street paving, streetscape amenities, and trolleys. In a required-by-law election, affected downtown owners unanimously approved the LID, and are assessed by square footage of land (excluding buildings), with greater weight given to frontage within 100 feet of transitways. The LID is paying off \$1.5 million in bonds over 20 years, comprising over a quarter of the \$5.5 million total project cost.

9. M. Ito (1989), *Establishing New Measures to Construct New Railroad Lines*, JTERC Reports, Vol. 11, Japan Transport Economics Research Centre, Tokyo, Japan.

This study examines the New Joban railway line in the northeastern area of Tokyo. It estimates land values of properties along the corridor, with and without the rail line, and calculates the resulting increment. Methods of ensuring that a region receives an adequate return on its investment are discussed. Included are (i) local taxes for a Railroad Construction Fund; and (ii) reduction of station construction costs, either by setting up a trust company to construct a combination of station retail outlets, or by making the developer or local companies responsible for some of the costs. For rural areas, the author recommends a system of integrated development, ensuring that development of residential, educational and cultural facilities along the line keep pace with rail construction. Also included are suggested methods by which problems of acquiring railway land can be overcome. (See IRRD 857359 in Transport Research Laboratory on TRIS Database, "Taxing Property Values for Transit")

10. Todd Litman (2014a), "Evaluating Public Transportation Local Funding Options," *Journal of Public Transportation*, Vol. 17, No. 1, pp. 43-74 (www.nctr.usf.edu/wp-content/uploads/2014/03/JPT17.1.pdf); more complete version at www.vtppi.org/tranfund.pdf. Also see, *Raise My Taxes, Please! Evaluating Household Savings From High Quality Public Transit Service*, at www.vtppi.org/raisetaxes.pdf.

This report evaluates eighteen potential local funding options suitable to help finance public transit or other transportation projects and services. They are evaluated according to eight criteria, including potential revenue, predictability and sustainability, horizontal and vertical equity, travel impacts, strategic development objectives, public acceptance and ease of implementation. This is a somewhat larger set of options and more detailed and systematic evaluation than most previous studies. This research identified no new options that are particularly cost effective and easy to implement; each has disadvantages and constraints. As a result, its overall conclusion is that a variety of funding options should be used to help finance the local share of transportation improvements to ensure stability and distribute costs broadly.

11. T. M. Ridley and J. Fawkner (1987), *Benefit Sharing: the Funding of Urban Transport through Contributions from External Beneficiaries*, Report from the 47th Congress, International Union of Public Transport, Lausanne.

"Specific improvement assessments" funded the first 35 km of Milan, Italy's Metro. The special levy is assessed on properties within 500 m of stations. This form of LID had raised 36 billion lire, but following its initial success the levy was replaced by a real estate transfer tax that feeds into the local general fund.

12. Rick Rybeck (2004), "Using Value Capture To Finance Infrastructure And Encourage Compact Development," *Public Works Management & Policy* (<http://pwm.sagepub.com>), April, pp. 249-260; at www.mwcog.org/uploads/committee-documents/k15fvl1f20080424150651.pdf.

This article discusses the theory and practice of value capture. It describes how transportation investments often increase nearby land values, including a review of empirical studies of this effect. This increased value can choke off urban development, pushing new growth to cheaper sites remote from these investments. This "leapfrog" development creates a demand for infrastructure extension that

starts the process over again. Transportation infrastructure, intended to facilitate development, thus chases it away. The resulting sprawl strains transportation, fiscal, and environmental systems. Several jurisdictions around the country utilize a value-capture technique embedded in their property tax to help finance infrastructure and motivate affordable compact development. They reduce the tax rate on assessed building values and increase the tax rate on assessed land values. The resulting compact development should facilitate better transportation and accommodate economic growth with reduced fiscal and environmental costs. This technique's ability to foster affordable compact development might help bridge the gap between those who advocate growth boundaries and those who fear the impact of growth boundaries on affordable housing. The author is an attorney with a master's degree in real estate and urban development, has served as the Deputy Administrator for Transportation Policy and Planning within the District of Columbia Department of Transportation since 1997.

13. Philip J. Shinbein and Jeffrey L. Adler (1995), "Land Use and Rail Transit," *Transportation Quarterly*, Vol. 49, No. 3, pp. 83-92.

Using a case study of Orange County, New York, the authors state the case for shifting transit subsidies from the present system of general taxes to land value taxes, arguing that it is realistic to think of self-financing transit improvements from LVT. Joint development programs coupled with permissive zoning to encourage high density "pocket communities" near transit stations would increase land values that can be recaptured to pay for the capital costs of rail infrastructure.

14. James G. Strathman and Kenneth J. Dueker (1987), *Regional economic impacts of local transit financing alternatives: input-output results for Portland*, Portland State University, Center for Urban Studies.

This study ranks several taxing methods for funding transit. The one found to distort economic activity the least is the gasoline tax, followed by the property tax. The least desirable method of raising revenues is a higher onboard fare, followed by a payroll tax. Taxes on income, parking, and sales produce moderate distortion effects.

15. E. Walther, L.A. Hoel, L. J. Pignataro and A.K. Bladikas (1990), *Value Capture Techniques in Transportation: Final Report, Phase One*, Report No. DOT-T-90-11, Office of the Secretary of Transportation.

The authors provide an overview of the potential use of value capture techniques. Included is a general set of criteria for state and local officials to evaluate the applicability of value capture to specific funding situations. A series of techniques in communities of various sizes is provided, along with a decision support methodology based on a set of 63 indicators to evaluate specific value capture proposals. Techniques include: special assessment districts, donations, negotiated investments, public / private partnerships.

Prospects for Cost Recovery

16. Allen, W. Bruce (1987), "Value Capture in Transit," *Journal of the Transportation Research Forum*, Vol. 28, no. 1.

This case study in south metropolitan Philadelphia offers an interdependent set of models of modal choice, station choice, and travel savings using the economic law of market areas. These models (i) spatially separate auto users from transit users, (ii) spatially separate the users of station A from the users of station B, and (iii) spatially connect the locii of all points where the user saves an equal amount of money from using transit over auto. All of these models yield hyperbolas that bend around the stations on the line. The station choice model is tested using auto access data for all suburban stations of the line for a morning rush hour (13,000 observations), and assumes the station chosen most often from any given location is the preferred station. The savings model is tested by postulating that residential sales price is a function of the characteristics of the property, the neighborhood, distance from the CBD, and savings (using over 1,300 real estate transactions from 1980). Each dollar of daily savings is found to add \$443 to the value of the property. If rents fell elsewhere, such loss was not deducted. The benefit to non-transit census tracts (less congestion and shorter travel times) was not added in; if it were added, savings would be 30% higher. Without it, \$4,581 could be captured per single family home. Within the transit census tracts, this adds up to \$279.5 million, or 117.9% of the construction cost of the Lindenwold Line, the right-of-way of which did not need to be purchased. Buying the land and constructing bridges would have raised the cost to \$820 million, of which captured land rent could have paid one-third (unless all rent were captured, which would drop land's price to zero). In order that the costs are borne by the beneficiaries, land value should be captured at the time it is created, that is, between the announcement of a new improvement and its actual opening.

17. Mezyad Alterkawi (1991), "Land Economic Impact of Fixed Guideway Rapid Transit Systems on Urban Development in Selected Metropolitan Areas: The Issue of the Price-Distance Gradients." Ph. D. thesis, Texas A&M University, Stock No: 91-33904 University Microfilms International.

This study concentrated on Washington, DC and Atlanta, GA. It also noted that Toronto, Canada's Yonge Street Subway increased property tax revenue by \$5 million annually, while the annual cost of servicing the subway's bonds was \$4 million.

18. Alex Anas (1983), *The Effects of Transportation on the Tax Base and Development of Cities*, Report for the U.S. Dept. of Transportation.

Transportation improvements and investments change zone-to-zone travel times and costs. This researcher's model forecasts changes in land values. The forecasts are determined annually and by small geographic zones in a metropolitan area. The Chicago application shows that under 1970 conditions, capitalized land value changes are nearly 36-40% of the capital cost of rail rapid transit proposals then proposed for Chicago's southwest side. Similar calculations for bus systems appear more promising. Anas suggests a one-time lump sum property assessment rather than an increase in the land tax rate, since that latter would lower "site values". This would lower selling price, while the value remains the same (what buyers are willing to pay: price plus tax).

19. H. William Batt (2001), “Value Capture as a Policy Tool in Transportation Economics: An Exploration in Public Finance in the Tradition of Henry George”, *The American Journal of Economics and Sociology*, Vol. 60, No. 1, pp. 195-228.

This study shows how value capture could have been used to finance a 9-mile portion of the New York State interstate highway system. The added increment of land value attributed to the Northway sector amounted to 11 times that of the cost of right-of-way acquisition, road and bridge construction. Batt concludes that the windfall gains in land value that fell to private landowners could easily have paid off the bonds issued to build the project. Furthermore, the added taxes from value capture assessments in the highway corridor removes the invitation to land holders to speculate on their sites. Directing some of the gains to mass transit also indirectly compensates for the cost of smog and other pollutants emitted from cars.

20. Jonathan Hack (2002), *Regeneration and Spatial Development: a Review of Research and Current Practice*, IBI Group, Toronto.

This paper provides specific examples of how, and to what degree, transit investment (principally light rail) has stimulated urban regeneration and created private opportunities for private sector investment in transit corridors, notably around transit stations. The case studies provided are derived from a review of research to date that showcases recent examples of LRT investment in Europe and North America.

European cities:

1. Tyne & Wear Metro, Newcastle, U.K.: 55 km./44 stations:
 - House prices increased 2% within 200 meters of metro stations.
 - Retail activity or office developments near stations does not appear to be directly linked to LRT.
2. Manchester Metrolink (LRT completed 1992):
 - Development of 20 500 sq.m of offices and services in City centre.
 - Yet, no evidence of urban development outside City centre.
3. London Docklands Light Railway: open 1987, 13 km./16 stations; Beckton & Lewistan extensions totalled 50 km and cost 424 million pounds:
 - A priori assessment proved correct: 50% of capital cost was recaptured through transport costs reduction, reduction in congestion and in accident, while 50% was recaptured through overall office development and job creation.
4. Croydon Tramlink, South-London (opened May 2000, 28 km. Croydon to Wimbledon/38 stations):
 - Economic impact yet to be felt.
5. LRT in Strasbourg, France (built 1991-94):
 - Between 1994 and 1995, park-and-ride schemes near the city centre resulted in an increase of 100% of transit system users and draw shoppers from outside the metropolitan area.
 - Pedestrianization around Place Kleber helped create larger and more accessible activities.
6. Helsinki Metro, Finland (1982):
 - Property within walking distance of railway or metro station worth 7.5% more than elsewhere.
 - Impact was most significant at 500-750 m., values dropped at adjacent locations.
 - In the best locations, dwelling prices raised by 11%.

7. Vienna S-Bahn, Austria (opened 1962, 14 km.):

- Districts located along S-Bahn corridor have witnessed increases in number of new housing units of 18,7% over 10 yr. period, as opposed to 4% and 10% in more remote locations.

8. Nantes, France:

- Between 1985 and 1995, 25% of new offices, 13% of new commercial premises and 25% of new residential dwellings were built adjacent to LRT.

North American Experience:

9. Baltimore Central Light rail, USA (first segment 1992, 29 miles):

- While useful from a transit standpoint, Baltimore LRT system failed to spur retail activity in downtown area.

10. Portland Metropolitan Express (started in 1986, 15 miles/32 stations, plus plans for 18 miles expansion):

- Since 1986, \$1,9 billion in property development in the immediate vicinity of line.

11. St-Louis, Missouri (opened 1993, 18 miles/18 stations):

- To date, development spurred by transit system totals \$530 millions and includes major projects.
- A \$1,5 billion expansion to LRT is expected to have a \$2,3 billion impact on business sales.

12. San Diego Trolley, a LRT which connects downtown area to Tijuana, Mexico (40 miles/34 stations):

- Since construction, some 4 million sq. feet of Class A office space has been added to downtown area, with population growing from 0 to 20 000 persons.

13. Metro Toronto Subway (built during 1950s & 1960s):

- Between 1959-1964, 90% of all new office spaces and 40% of apartment buildings in Toronto took place along the metro lines.
- Tax assessment values near City centre stations rose by 45% and by 107% around suburban stations, as opposed to 25% elsewhere.
- Office space rents adjacent to the stations average 30% more than average for the City as a whole, while office rents within 500 m. of stations rose by 10% more than average.

14. Chicago LRT:

- Chicago Transit Authority estimates that maintaining a “good repair” scenario in its transit system would yield \$4,6 billion in additional business sales, 41 209 jobs over 20 years and annual tax revenues of \$154 million.
- Chicago authority projected that return on capital investment in LRT was \$6 for every \$1 spent.

15. Dallas Area Rapid Transit (DART):

- Property values near the DART lines are 25% higher than similar real estate elsewhere in the area.

16. Other cities:

- In Atlanta and Washington DC., real estate developments around transit stations command a premium of between \$3 and \$4 per sq. foot.

21.

- 22. Todd Litman (2004), *Rail Transit In America: Comprehensive Evaluation of Benefits*, Victoria Transport Policy Institute (www.vtpi.org); at www.vtpi.org/railben.pdf. Also see, *Evaluating Public Transit Benefits and Costs* (www.vtpi.org/tranben.pdf) which provides additional information on methods for evaluating benefits.**

This study evaluates rail transit benefits based on a comprehensive analysis of transportation system performance in major U.S. cities. It finds that cities with large, well-established rail systems have significantly higher per capita transit ridership, lower average per capita vehicle ownership and annual mileage, less traffic congestion, lower traffic death rates, lower consumer expenditures on transportation, and higher transit service cost recovery than otherwise comparable cities with less or no rail transit service. It finds that monetized benefits exceed rail transit costs several times over. This indicates that rail transit systems provide economic, social and environmental benefits, and these benefits tend to increase as a system expands and matures. This report discusses best practices for evaluating transit benefits. It examines criticisms of rail transit investments, finding that many are based on inaccurate analysis.

- 23. Lewis, David, and Fred L. Williams (1999), *Policy and Planning as Public Choice: Mass Transit in the United States*, Ashgate.**

This book examines various economic benefits from public transit, including improved mobility, reduced congestion and increases in nearby property values. They conclude that, “The public realizes \$5 in cash savings for each tax dollar invested in transit services.” On page 141, they display a chart that clearly correlates transportation mobility with national wealth (and elsewhere with household wealth).

- 24. Shishir Mathur (2019), “Value Capture to Fund Public Transportation: The Impact of Warm Springs BART Station on the Value of Neighboring Residential Properties in Fremont”**

(https://scholarworks.sjsu.edu/cgi/viewcontent.cgi?article=1265&context=mti_publications), and summarized in *The Journal of Planning Education and Research* (<https://journals.sagepub.com/doi/10.1177/0739456X19898737>).

This study finds that, compared to the houses sold in the referent category (2 to 5 miles away and sold during the pre-project-announcement period of 2000-2001), an average-priced single-family house within two miles of the Warm Springs BART Station has 9% to 15% higher prices. The total property value increment for the single-family houses could fund the \$802 million Warm Springs BART Extension Project cost five times over.

- 25. D. Nakagawa and R. Matsunaka (1997), *Funding Transport Systems: A Comparison Among Developed Countries*, Pergamon.**

The authors repeat the findings of Tsukada and Kuranami (below) that in Japan private railroads manage real estate within rail corridors, and thereby enhance profits.

- 26. Phyllis J. Nathanson and Gary Booher (1983), *Survey of Joint Development and Value Capture Activity in Selected Metropolitan Areas*, City of Los Angeles Planning Dept.**

Among several systems noted in this survey, Miami's Metrorail raised enough site rent to cover 25% of its total capital cost (\$116 million).

27. Don Riley (2001), *Taken for a Ride: Trains, Taxpayers, and the Treasury*, Centre for Land Policy Studies, U.K.

London's Jubilee extension cost £3.5 billion, and raised the nearby land's rental value by £1.3 billion. Public collection of 25% of that increase would pay off the Jubilee in 20 years. In the vicinity of Edinburgh, Scotland, developers are co-funding a new line on an old right-of-way.

28. Walter Rybeck (1981), *Transit-Induced Land Values: Development and Revenue Implications*, Report published in *Commentary*, Council on Urban Economic Development, 24 October 1981, pp 23-27.

In his report to Congress, this former staff to Sen. Paul Douglas noted that Washington, DC's Metro in 1981, after some \$3 billion in expenditures, was 40% complete and had generated over \$2 billion in land value. In January 2001, after \$9.5 billion in expenditures, the completed system had generated between \$10 and \$15 billion in new land value.

29. Nicolaus Tideman (1993), "Integrating Rent and Demand Revelation in the Evaluation and Financing of Services," In *Does Economic Space Matter?*, eds. Hiroshi Ohta and Thisse Jacques-Francois (London: Macmillan) 133-150.

Taking into account more than just the property selling price, this researcher considers how a transportation project changes the returns to land, labor and capital, compared to the project's costs: 1) the increase in privately collected rent – i.e., the increase in the selling price (and lease value) of land; 2) the increase in taxes on land; 3) the decrease (more usual than an increase) in its value, because capital can't be moved (as land rose in value but building fell in value); 4) the change in taxes on existing buildings; 5) the taxes on new buildings erected in response to the transportation improvements; 6) the cost of extra public services for the added buildings (unless there are user fees); 7) the extra tax revenue if there's a sales tax or a wage tax which reduces land values; 8) the savings in travel time if low fares reduce congestion; 9) reduced smog; and 10) the loss of human happiness from uncompensated personal adjustment to the change in the built environment. The sum of these 10 items is compared to the transportation system costs.

30. Transportation Research Board, Price Waterhouse & Co. (1998), *Funding Strategies for Public Transportation*. TRB Report 31, Transit Cooperative Research Program, 1998.

Precise location in the transit facility-property value relationship is found to be crucial. In one New York station, moving a concession stand a mere 20 feet doubled the rent the transit system collected from the vendor.

31. United States Congress: House Committee on Banking, Finance, and Urban Affairs, Subcommittee on the City (1998), *New urban rail transit: how can its development and growth-shaping potential be realized?*, U.S. Government Printing Office.

From page 81: Burkhardt and Howard summarize historical evidence. "Major land value increases occurred in many station areas of New York City's expanding transit system in the early 1900s." From page 124: Donald Richmond states, "The (Toronto Transit) Commission ... experience...suggests that the long-term land-leasing program can completely recover land acquisition costs over a reasonable time period."

Effects of Transit Facilities on Property Values

32. A. Anas and Regina Armstrong (1993), *Land Values and Transit Access: Modeling the Relationship in the New York Metropolitan Area: An Implementation Handbook*. Report No. FTA-NY-06-0152-93, U.S. Federal Transit Administration, Office of Technical Assistance and Safety, Springfield VA. (National Technical Information Service).

This article presents findings of a multi-year study of the relationship between land values and transit access in the New York area. Initiated as an element of the Third Regional Plan for the New York/New Jersey/Connecticut Region, the results serve as a research prototype for transit systems throughout the US. Two economic models are presented – NYREG and NYSTA – which predict shifts in land values within the region and at a parcel scale in relation to transit stations. “The total benefits of reducing wait times on transit equal \$3.7 billion (\$1.57/trip). Taxing the producer surplus increases would raise \$100 million/yr, enough to finance a doubling of the number of trains (an unknown cost).”

33) Saad AlQuhtani and Ardeshir Anjomani (2019), “Do Rail Transit Stations Affect Housing Value Changes? The Dallas Fort-Worth Metropolitan Area Case and Implications,” *Journal of Transport Geography*, Vol. 79, (<https://doi.org/10.1016/j.jtrangeo.2019.102463>).

This study investigates housing value changes between 2000 and 2014 in 454 block groups within a one-mile buffer around Dallas-Fort Worth area rail stations. It uses two approaches to analyze the data. First, it tracks housing value changes in the study area during the study period. Second, it uses regression analysis within the study area to understand the relationships between the selected independent variables and the changes in housing value. The findings demonstrate that economic development and commercial activity locations have the highest effect on housing value during the study period, and block groups that were closer to rail stations experienced lower changes in housing value compared to block groups located farther away from stations. An interesting finding contrary to some of the literature is that an increase in the percent of the minority population does not have negative effects on the change in property values. These findings are a useful addition to the existing literature and contribute to the field of urban planning to mitigate the effects on station area housing values.

33. Robert J. Armstrong (1994), “Impacts of Commuter Rail Service as Reflected in Single-Family Residential Property Values”, *Transportation Research Record 1466*, pp. 88-97.

Single-family residential properties in metropolitan Boston, Mass, are examined. Results indicate that there is an increase in single-family residential property values of approximately 6.7% by virtue of being located within a community having a commuter rail station. At the regional level there appears to be a significant impact on single-family residential property values resulting from the accessibility provided by commuter rail service.

34. William G. Barker (1998), “Bus Service and Real Estate Values”, *68th Annual Meeting of the Institute of Transportation Engineers, Toronto, Ontario*, (available from ITE, 1099 14th Street, NW, Washington DC 20005-3438 U.S.A.).

Real estate developers and lending institutions are not willing to base investments on the location of easily changed bus routes. However, the availability of local bus service does increase the value of at least some urban real estate.

- 35. Keith Bartholomew and Reid Ewing (2010), "Hedonic Price Effects of Pedestrian- and Transit-Designed Development," under review by the *Journal of Planning Literature*; at http://faculty.arch.utah.edu/bartholomew/Individual%20Files/12_Hedonic_Price_Effects.pdf.**

This article reviews literature concerning the use of hedonic pricing to evaluate whether consumer demand for pedestrian- and transit-designed development is growing. This analysis indicates that transit accessibility, walkability, and local environmental quality do tend to be capitalized into real estate prices. It demonstrates that amenities of transit-designed development, such as improved walkability and mixed land use tend to increase urban land values independent of transit accessibility.

- 36. Nathaniel Baum-Snow and Matthew E. Kahn (2001), "The Effects of Public Transit Projects to Expand Urban Rail Transit," *Journal of Public Economics*, Vol. 77, pp. 241-63.**

Study of land values in Boston, Atlanta, Chicago, Portland and Washington DC found that a decrease from three to one kilometer distance from transit stations increases rents by \$19 per month, and housing values by \$4,972.

- 37. John D. Benjamin and G. Stacy Sirmin (1996), "Mass Transportation, Apartment Rent and Property Values," *The Journal of Real Estate Research*, Vol. 12, No. 1.**

This study examines the effects of transit access, measured in ground distance to the nearest station, on residential rent levels. From over 250 observations of 81 apartment complexes, the authors find that rents decrease by 2.4% to 2.6% for each one-tenth mile in distance from a Metro station in Washington, DC.

- 38. M. Bernick, R. Cervero and V. Menotti (1994), *Comparison of Rents at Transit-Based Housing Projects in Northern California*, Working Paper 624, University of California at Berkeley, Institute of Urban and Regional Development.**

"Rents at the BART housing projects are higher than those of nearby projects."

- 39. Helena Bohman and Désirée Nilsson (2016), "The Impact of Regional Commuter Trains on Property Values: Price Segments and Income," *Journal of Transport Geography*, Vol. 56, pp. 102-109 (<http://dx.doi.org/10.1016/j.jtrangeo.2016.09.003>); at www.sciencedirect.com/science/article/pii/S0966692316300151.**

Using single-family home transactions and commuter rail data from 2014 in Malmo, Sweden, we estimate hedonic price models using two-stage spatial quantile regression to capture variations across price segments. The results are significant and robust across different model specifications and across the different price segments, but the price effect of proximity to a commuter train station is strongest in lower price segments of the housing market. These price segment effects are also valid for proximity to highways, as well as for several other property attributes. Results also reveal that the largest of the three regional labour markets in our study has a greater effect on prices. Furthermore, the study introduces property-specific neighbourhood data showing that population density has a negative impact on property prices at the neighbourhood level while population size has a positive impact at the municipal level.

40. C. Bollinger, K. Ihlanfeldt, and D. Bowes (1998), “Spatial Variation in Office Rents Within the Atlanta Region”, 1996 TRED Conference, Lincoln Land Institute, Cambridge, Mass., Georgia State University, Policy Research Center.

This is a hedonic rent study of office buildings in the Atlanta area from 1990 to 1996. Part of the rent differences among office buildings is due to differences in wage rates, transportation rates, and proximity to concentrations of office workers. The convenience of face-to-face meetings facilitated by office agglomerations is also reflected in office rents, providing evidence that agglomeration tendencies continue to be important in explaining office concentrations, despite the ability of information technology designed to reduce the need for some such contacts.

41. Robert J. Borhart (1994), *Corridor Reservation: Implications for Recouping a Portion of the ‘Unearned Increment’ Arising from Construction of Transportation Facilities*, Final Report, Virginia Transportation Research Council, Charlottesville, Va., Series title: VTRC; 94-R15.

Increases in land rents show up in higher property taxes, not only in property selling prices. The author quotes President Franklin D. Roosevelt supporting value capture.

42. David R. Bowes and Keith R. Ihlanfeldt (2001), “Identifying the Impacts of Rail Transit Stations on Property Values,” *Journal of Urban Economics*, Vol. 50, pp. 1-25.

Found that properties between one and three miles of a rail transit station in Atlanta, Georgia have a higher value than otherwise comparable properties located more than three miles away, but properties within a quarter mile of a station are worth 19% less than homes beyond three miles.

43. Cambridge Systematics (1998), *Economic Impact Analysis of Transit Investments: Guidebook for Practitioners*, TCRP Report 35, Transportation Research Board (www.trb.org).

This comprehensive guidebook describes various technical methods for measuring the economic impacts of transit investments, including changes in adjacent property values. It also includes a summary of research findings on the increases in property values found around BART stations in the San Francisco Bay area. Results are summarized in the table below. Tables 9.6 – 9.10 list 15 studies dating from 1970 to 1996 that calculate the premium effect of transit investments, measured in unit area of property.

Table 1 Property Value Increases Near BART Stations (1997 U.S. Dollars)

Land Use Type	Distance From BART Station (ft)	CBD/Urban	Suburban
<i>Single Family</i>		<i>Per Unit</i>	<i>Per Unit</i>
	0-500	\$48,960	\$9,140
	500-1,000	\$14,400	\$7,930
	1,000-1,500	\$8,640	\$3,040
	2,000-2,500	\$5,760	\$5,500
<i>Multi-Family</i>		<i>Per Unit/Month</i>	<i>Per Unit/Month</i>
	0-1,300	\$50.00	\$42.30
	1,300-2,500	\$0.00	\$0.00
<i>Offices</i>		<i>Per Sq. Ft./Month</i>	<i>Per Sq. Ft./Month</i>
	0-1,300	\$0.13	\$0.00
	1,300-2,000	\$0.07	\$0.28
	2,000-2,500	\$0.00	\$0.00

<i>Retail</i>		<i>Per Sq. Ft/Month</i>	<i>Per Sq. Ft/Month</i>
	0-500	\$0.07	\$0.24
	500-1,000	\$0.00	\$0.24
	1,000-2,500	\$0.00	\$0.00

This table summarizes how property values change with proximity to BART stations for different types of land uses.

44. Robert Cervero (1994), “Rail Transit and Joint Development: Land Market Impacts in Washington, D.C. and Atlanta,” *Journal of the American Planning Association*, Vol. 60, No. 1, pp. 83-94.

In addition to public-private cost sharing and the lease revenues derived from commercial space in rail stations, joint development projects generate more fare revenues as they stimulate more transit trips. This study examines how transit investments affect office market indicators. Evidence shows that J-D projects create measurable land value increases and other associated benefits. Among five dependent variables studied, office rent levels are most closely correlated with transit factors – especially ridership. Other benefits associated with transit centers are low vacancy rates, higher absorption rates, and larger office building size. In conclusion, urban rail transit will significantly benefit land use and site rents only if a region’s economy is growing and supportive programs such as permissive zoning are in place.

45. Robert Cervero (1996), “Transit-Based Housing in the San Francisco Bay Area: Market Profiles and Rent Premiums,” *Transportation Quarterly* Vol. 50, No.3, pp. 33-49.

Cervero’s study evaluated apartment rents (most studies evaluate housing prices). Around the three BART stations studied, most residents lived in multi-unit complexes of 20-60 units, were young adults, professionals earning incomes comfortably higher than around some other stations, living alone or as couples, but without children (DINKs), most of whom owned just one car, not one car apiece. The housing near two of the stations those residents lived in did lease at building rents that were 10%-15% higher; around the third (Richmond) no rent premium was found. Cervero did not explain if any characteristic of that neighborhood was different: more industrial or surrounded by lower-income residents or what. He concluded that, “In theory, the existence of a rent premium for multi-unit projects suggests value capture mechanisms (e.g., forming benefit assessment districts) could be used to help finance rail systems.”

46. Robert Cervero (2002), “Benefits of Proximity to Rail on Housing Markets: Experiences in Santa Clara County,” *Journal of Public Transportation*, Vol. 5, No. 1.

Hedonic price models show that nearness to light rail and commuter rail stops substantially add value to residential parcels. Large apartments within ¼ mile of LRT stations command land value premiums as high as 45 percent. Such market profits provide a potential source of local revenue from value capture programs.

47. Robert Cervero and Michael Duncan (2002), “Transit’s Value Added: Effects of Light Commercial Rail Services on Commercial Land Values,” *Presented at TRB Annual Meeting* (available at www.apta.com/info/briefings/cervero_duncan.pdf)

This study models the value effects of proximity to light rail and commuter rail stations, as well as freeway intersections, in Santa Clara County, California. Substantial capitalization benefits to

commercial-retail and office properties were found, on the order of 23% for a typical commercial parcel near an LRT stop, and more than 120% for commercial land in a business district within a quarter mile of a commuter rail station.

48. Robert Cervero, Christopher Ferrell and Steven Murphy (2002), "Transit-Oriented Development and Joint Development in the United States: A Literature Review," *Research Results Digest*, No. 52, Transit Cooperative Research Program, TRB (www.trb.org).

This is a comprehensive review of literature on transit oriented development. Topics include: Definition of TOD, agency roles, impacts and benefits on land markets, supportive policies and regulations, the use of value capture financing, and station area design supportive of TOD. The authors suggest that transit boards might share in the land-value benefits derived from proximity to transit by participating in joint development as well as value capture.

49. Hong Chen, Anthony Rufolo, and Kenneth Dueker (1998), "Measuring the Impact of Light Rail Systems on Single Family Home Values: An Hedonic Approach With GIS Application", *Transportation Research Record 1617*, TRB (www.trb.org).

Proximity to transit stations account for a 10.5% home price differential. This confirms the findings of Al-Mosaind et. al. (see Ref. 25). They conclude positive effects outweigh negatives.

50. Helen Chaney (2005), *Evaluating The Capitalization Effects Of METRA Commuter Rail Transit Upon Land Values In The Suburban Chicago Municipality Of Arlington Heights: A Tale Of Two Stations*, Masters Thesis, Chapel Hill (<https://cdr.lib.unc.edu>).

This research indicates that in the transit-oriented development study station of Arlington Heights, housing prices decrease by \$12,776 with each 100 meter distance from the station. The comparison station of Arlington Park, which features conventional development, does not reveal capitalization effects associated with proximity to the station. The research provides decision-makers with localized information on the value-added of proximity to transit-oriented development of commuter rail stations upon residential land values.

51. Terry L. Clower, Bernard Weinstein and Michael Seman, *Assessment of the Potential Fiscal Impacts of Existing and Proposed Transit-Oriented Development in the Dallas Area Rapid Transit Service Area*, by the Center for Economic Development and Research, University of North Texas, for the Dallas Area Rapid Transit, 2007; at <http://reconnectingamerica.org/public/download/dartreport102507>.

This study updates the fiscal impacts of transit oriented development associated with development of the Dallas Area Rapid Transit light rail system. The analysis considers development near existing and planned light rail stations. The findings support the conclusion that the transit-oriented developments associated with DART Rail stations offer substantial fiscal impacts for local taxing entities. These findings include:

- The announced existing and projected values of development projects located near DART Rail stations have increased by almost 50% since 2005.

- While there are many factors contributing to development investment decisions, proximity to an LRT station is often an important site location factor. The total value of projects that are attributable to the presence of a DART Rail station since 1999 is \$4.26 billion.
- Adjusting for tax exemptions and the value of public buildings, the taxable value of real and business personal property associated with the projects reviewed in this analysis along existing DART Rail corridors and the planned Green, Orange, and Blue Line extensions exceed \$2.84 billion.
- In total, once all announced projects are completed, state and local tax revenues associated with development near DART Rail stations will exceed \$127 million per year.

52. CNT (2013), *The New Real Estate Mantra: Location Near Public Transportation*, American Public Transportation Association (www.apta.com) and the National Association of Realtors (www.nar.realtor); at <https://bit.ly/2WiWtzT>.

Investigates how well residential properties located near fixed-guideway transit have maintained their value as compared to residential properties without transit access between 2006 and 2011 in five regions: Boston, Chicago, Minneapolis-St. Paul, Phoenix, and San Francisco. Found that the transit-shed outperformed the region as a whole by 41.6% with higher values for all types of residential properties, single- and multi-family; these benefits increased for transit that was better connected and had higher service frequency; households living in transit sheds had better access to jobs and lower average transportation costs than the region as a whole.

53. CNT (2019), *The New Real Estate Mantra: Location Near Public Transportation*, American Public Transportation Association (www.apta.com) and the National Association of Realtors (www.nar.realtor); at <https://bit.ly/2WlybFL>.

In seven regions analyzed (Boston, Eugene, Hartford, Los Angeles, Minneapolis–St. Paul, Phoenix and Seattle), residential properties in proximity to public transit (defined as within a half-mile radius) performed better than properties farther from public transit. Between 2012 and 2016, median sales price increases near stations were 4 to 24 percentage points higher for residential properties than in areas farther from public transit. More than 43,500 occupied-units were added near transit in this time period across the seven regions. Commercial property values also experienced gains in the studied cities. While data availability limited the office property analysis to five regions, four of them saw median sales price per square foot increase between 5 and 42 percentage points more in transit-proximate areas when compared with areas farther from public transit. An increase in residential rents within transit sheds has encouraged developers and frustrated consumers. Increases in rents were between 2 and 14 percentage points higher in the public transit station area than in neighborhoods away from transit. Cities will need to keep working on housing affordability and land use policies to mitigate displacement from high-value public transit. In the seven regions, one in four households in public transit areas does not own a vehicle, and the cost savings are significant; on average, a household spends between \$2,500 and \$4,400 less per year on transportation.

54. David Damm, Steven Lerman, Eva Lerner-Lam, and Jeffrey Young (1980), “Response of Urban Real Estate Values in Anticipation of the Washington Metro,” *Journal of Transport Economics and Policy*, pp. 315-335.

The authors draw conclusions from reviews of earlier studies of value capture financing, showing that in response to new transit lines, land values are enhanced in centers of concentrated activity and in

predominantly undeveloped areas. Their Metro case study demonstrates that the values of retail properties are highly sensitive to proximity to transit stations. This suggests that retail areas are better suited for value capture policies.

55. Ghebreegziabihir Debrezion, Eric Pels and Piet Rietveld (2006), *The Impact of Rail Transport on Real Estate Prices: Empirical Study of the Dutch Housing Market*, Tinbergen Institute (<http://www.tinbergen.nl/discussionpapers/06031.pdf>).

This study used a hedonic pricing model to analyse railways impacts on house prices. The railway relevant features considered are: 1. distance to railway station, 2. frequency of railway services at the station, and 3. distance to the railway line, reflecting potential noise and other disturbance effects. Correcting for various other house price determinants we find that dwellings very close to a station are on average about 25% more expensive than dwellings 15 kms or more distant. This percentage ranges between 19% for low frequency stations and 33% for high frequency stations. A doubling of frequency leads to an increase of house values of about 2.5%, ranging from 3.5 for houses close to the station to 1.3% for houses far away. We find a negative effect of distance to railways, probably due to noise effects: within the zone up to 250 meters around a railway line prices are about 5% lower compared with locations further away than 500 meters. As a result of the two distance effects, the price gradient starts to increase as one moves away from a station, followed by a gradual decrease after a distance of about 250 meters. Two railway station references were used the nearest and most frequently chosen station in the post code area. Our estimations reveal that this distinction is important. In many cases the traveller does not choose the closest station. This indicates that railway station accessibility is a more complex concept than one might think. It involves competition between railway stations.

56. Roderick B. Diaz (1999), "Impacts of rail transit on property values," *Commuter Rail/Rapid Transit Conference, Toronto, Ont.*, American Public Transit Association.

The author summarizes recent North American studies examining the impact of 12 rail projects, including both heavy rail and light rail. Several variables contributing to positive and negative changes in property values are identified. In Miami, home values near stations increased by up to 5 percent (Gatzlaff, 1993). In Toronto, nearby home value increases averaged \$2,237 (Bajic, 1983). In general, proximity to rail increases accessibility, which is the primary factor in rising property values. (From "Rail transit and property values" in *Information Center Briefing*, No 1 - March 2001, at www.apta.com/info/briefings/briefings_index.htm).

57. Jean Dube, et al (2018), "Exploring Difference in Value Uplift Resulting from New Bus Rapid Transit Routes Within a Medium Size Metropolitan Area," *Journal of Transport Geography*, Vol. 72, pp. 258-269 (doi.org/10.1016/j.jtrangeo.2018.09.011); at www.sciencedirect.com/science/article/pii/S0966692317301394.

This study used information on seven BRT routes and the prices of nearby single-family houses in the Québec metropolitan area (Canada) between 1986 and 2015. It found that the impacts vary between routes; when significant, are spatially concentrated; and the characteristics of the stops along the routes impact housing price effects.

58. Michael Duncan (2010), "The Impact of Transit-oriented Development on Housing Prices in San Diego, CA," Urban Studies

(<http://usj.sagepub.com/content/early/2010/05/18/0042098009359958.abstract>).

This research measures the influence of transit-oriented development (TOD) on the San Diego, CA, condominium market. A hedonic price model is estimated to isolate statistically the effect of TOD. This includes interaction terms between station distance and various measures of pedestrian orientation. The resulting model shows that station proximity has a significantly stronger impact when coupled with a pedestrian-oriented environment. Conversely, station area condominiums in more auto-oriented environments may sell at a discount. This indicates that TOD has a synergistic value greater than the sum of its parts. It also implies a healthy demand for more TOD housing in San Diego.

59. Robert T. Dunphy (1998), *The Cost of Being Close*, ULI Working Paper 660, Urban Land Institute.

In Southern California, real estate consultant Larry Netherton compared examples of comparable housing for sale at different distances from a central business area. Buyers would have to travel another 15 to 30 minutes to trim \$10 to \$15 per square foot off the price of a house. In Orange County, two similar upper-end housing projects were compared, one near major employment, retail, and cultural centers, and the other 20 miles away from employment centers. The closer-in units sold for an average of \$599,400, the distant units sold for \$320,000 – a difference of about \$280,000, or \$14,000 per mile, or \$11,200 per minute of extra commute time. In more distant Riverside County, the closer-in project was priced at \$214,900, while a same-sized, similar house 20 miles farther out sold for \$141,900. The differential here was \$73,000 total, or \$3,600 per mile, or \$2,400 per minute of extra commute time.

60. Fejarang, R. A., "Impact on Property Values: A Study of the Los Angeles Metro Rail," *Transportation Research Board 73rd Annual Meeting, January 1994.*

Did the announcement of Metro Rail impact property values? The announcement involved a consortium of federal, state, and local funding propositions that began in 1983 and legislated in 1988. The period studied was from 1980 to 1990 during which plans became actualized. That is, investments were secured and rail transit was under design and construction, but not yet available for riders or for rider-dependent shopping. Isolating exogenous variables was accomplished at both macro and micro levels. Using a pre-test - post-test control group, property values following the period of actualization were found to be significantly different from prior values. Property values near rail lines were found to be significantly different from property values located a distance. (From Transport Research Laboratory)

61. Alanna Finn (2017), *How Much is One Point of Transit Score Worth?*, Redfin (www.redfin.com); at www.redfin.com/news/how-much-is-one-point-of-transit-score-worth.

To estimate how much transit access is worth when buying or selling a home, Redfin, an on-line real estate broking service analyzed the sale prices and Transit Score ratings of more than one million homes sold between January 2014 and April 2016 across 14 major metro areas. Here are the price premiums of one point of Transit Score on a home, grouped by metro area.

Table 2 **Housing Price Premium from One Transit Score Point** ([Finn 2017](#))

Metro Area	Transit Score	Median Sale Price	\$ Premium of 1 Transit Score Point on Median Home Price	% Premium of 1 Transit Score Point on Median Home Price
Atlanta	44	\$168,000	\$1,901	1.13%
Baltimore	58	\$229,900	\$226	0.10%
Boston	74	\$325,000	\$3,585	1.10%
Chicago	65	\$220,000	\$1,731	0.79%
Denver	47	\$285,000	\$1,366	0.48%
Los Angeles	51	\$475,000	\$3,095	0.65%
Oakland	55	\$523,000	\$2,816	0.54%
Orange County	27	\$580,000	(\$201)	-0.03%
Phoenix	32	\$204,900	\$291	0.14%
Portland	51	\$275,000	\$1,338	0.49%
San Diego	37	\$449,000	\$786	0.18%
San Francisco	80	\$950,000	\$4,845	0.51%
Seattle	57	\$375,000	\$3,360	0.90%
Washington DC	71	\$360,000	\$3,457	0.96%

Improved transit access, indicated by Transit Score (www.walkscore.com/transit-score-methodology.shtml) can significantly increase residential property values.

These estimates compare homes by controlling for differences in property and neighborhood characteristics, including property size, number of bedrooms and bathrooms, age of the building, type of property (single-family, condo or townhouse), neighborhood median income and total employment, and controls for market conditions (appreciation over time) are also built into the model. In all metro areas, a home located in a more transit-friendly neighborhood was more expensive than the same home in a less transit-friendly location, with the exception of Orange County. On average, across the 14 metros analyzed, one Transit Score point can increase the price of a home by \$2,040. But the price premium varies widely from metro to metro. One point of Transit Score in Atlanta bumps up the price of a home over one full percentage point, or \$1,901.

62. Garrett, Thomas A., *Light Rail Transit in America: Policy Issues and Prospects for Economic Development*, Federal Reserve Bank of St. Louis (www.stlouisfed.org), 2004.

Hedonic pricing model applied to residential property values in St. Louis found that average home values increase \$140 for every 10 feet closer they are to a MetroLink rail transit station, beginning at 1,460 feet. A home located 100 feet from the station has a price premium of \$19,029 compared with the same house located 1,460 feet away. This represents a 32% increase in property values. Their analysis also indicated that beyond 1,460 feet, property values increased with distance from MetroLink stations, but this probably location-related reflects other factors not included in their model, such as traffic volumes on nearby streets, rather than proximity to station. Their analysis did not investigate property value impacts on commercial properties, which probably also increase with proximity to stations.

63. Gatzlaff, Dean H., and Mark Smith (1993), "The Impact of the Miami Metrorail on the Value of Residences Near Station Locations", *Land Economics*, Vol. 69 No. 1 (February, 1993).

Miami Metrorail began in the mid-1980s, in a city that is largely new and sprawling. The 20 miles of rail line run thru downtown, half to the poorer north, half to the richer south. Neither are considered prime areas for redevelopment. Ridership is relatively low (some stations are in blighted areas). The researchers looked at only houses that had sold before and after Metrorail was completed. The researchers found that the line perceptibly increased nearby site values in the richer neighborhoods, not in the poor areas where new capital still had not ventured.

64. Debrezion Ghebreegsiabiher, Eric Pels and Piet Reitveld (2007), "The Impact of Railway Stations on Residential and Commercial Property Value: A Meta-Analysis," *Journal of Real Estate Finance and Economics*, Vol. 35, pp. 161-180.

This meta-analysis of previous studies finds attempts to explain the variation in the findings by meta-analytical procedures. Generally the variations are attributed to the nature of data, particular spatial characteristics, temporal effects and methodology. Railway station proximity is addressed from two spatial considerations: a local station effect measuring the effect for properties within 1/4 mile range and a global station effect measuring the effect of coming 250 meters closer to the station. The study finds that the effect of railway stations on commercial property value mainly takes place at short distances. Commercial properties within 1/4 mile range are 12.2% more expensive than residential properties. Where the price gap between the railway station zone and the rest is about 4.2% for the average residence, it is about 16.4% for the average commercial property. At longer distances the effect on residential property values dominate. Finds that for every 250 meters a residence is located closer to a station its price is 2.3% higher than commercial properties. Commuter railway stations have a consistently higher positive impact on the property value compared to lights and heavy railway/Metro stations. The inclusion of other accessibility variables (such as highways) in the models reduces the level of reported railway station impact.

65. Goodwin, Ronald E., and Carol A. Lewis (1997), *Land Value Assessment Near Bus Transit Facilities: A Case Study of Selected Transit Centers in Houston, Texas*, Southwest Region University Transportation Center, Houston, Texas.

Site values in the Houston region were falling due to shrinking incomes and diminished incomes. However, values fell less near bus stops than they did in more distant locations.

66. Aaron Gruen (1997), *The Effect Of CTA and METRA Stations on Residential Property Values: Transit Stations Influence Residential Property Values*, Report to the Regional Transportation Authority.

Observing 96 Chicago-area Chicago Transit Authority (CTA) and METRA stations, this study used a literature review, hedonic modeling, and interviews with real estate market experts. More important than the presence of a transit station is the perception of neighborhood desirability. Still, the proximity of transit does positively affect property values. The price of a single-family house located 1,000 feet from a station is 20% higher than a comparable house located a mile away. Realtors in both the affluent suburban West Hinsdale station area and the gentrifying Logan Square area on Chicago's northwest side point out that prices have been increasing and that these locations increasingly appeal to younger, higher-income professionals, many of whom commute via CTA or METRA to downtown Chicago.

Apartment properties located closer to train stations tend to realize higher rents and occupancy levels than comparable apartments less conveniently located. (www.ggassoc.com from “Rail Transit And Property Values,” *Information Center Briefing*, No. 1, March 2001, at www.apta.com/info/briefings/briefingsindex.htm).

67. Arpit Gupta, Stijn Van Nieuwerburgh and Constantine Kontokosta (2021), Take the Q Train: Value Capture of Public Infrastructure Projects, NBER Working Paper No. 26789 (www.nber.org); at www.nber.org/papers/w26789 and https://conference.nber.org/conf_papers/f189971.pdf.

We measure the benefit of the Second Avenue Subway extension in New York City, the most expensive urban transit infrastructure project in recent memory, by analyzing local real estate prices which capitalize the benefits of transit spillovers. We find 8% price increases, creating \$6 billion in new property value. Using cell phone ping data, we document substantial reductions in commuting time especially among subway users, offering a plausible mechanism for the price gains. The increase in prices reflects both higher rents and lower risk. Infrastructure improvements lower the riskiness of real estate investments. Only 30% of the private value created by the subway is captured through higher property tax revenue, and is insufficient to cover the cost of the subway. Targeted property tax increases may help governments capture more of the value created, and serve as a useful funding tool.

68. Shima Hamidi, Katherine Kittrell and Reid Ewing (2017), “Value of Transit as Reflected in U.S. Single-Family Home Premiums; A Meta-Analysis,” *Transportation Research Record 2543*, Transportation Research Board (www.trb.org); DOI: <http://dx.doi.org/10.3141/2543-12>.

Although transit accessibility premiums have been rigorously studied at the local and regional levels for more than 40 years, drawing conclusions about premiums on a national scale requires a meta-analysis. This study sought to fill gaps in the literature by conducting a regression analysis and a thorough meta-analysis that reviewed 114 studies published from 1976 to 2014. Of 114 U.S. and Canadian single-family studies, a sample of 45 single-family studies was selected for further analysis. Compared with the previous meta-analysis, the current analysis found that, overall, U.S. and Canadian studies reported lower premiums on average for single-family houses. The average single-family home premium of 2.3% was significantly lower than the 4.2% premium calculated by the previous meta-analysis. It was found that reported transit premiums were decreasing over time as more variables, such as walkability of station areas, were statistically controlled. It was also found that compact regions with greater accessibility via transit produced higher transit premiums and transit premiums were neutral with respect to technology (light versus heavy rail) once regional compactness was controlled for. These findings suggest that to get the most out of transit investments, planners and public officials must make an effort to create compact regional development patterns and that single-family housing may not be the best use in areas close to transit.

69. Hass-Klau, Carmen, Graham Crampton and Rabia Benjari (2004), *Economic Impact of Light Rail: Results Of 15 Urban Areas In France, Germany, UK and North America*, Environmental & Transport Planning (<http://etphassklau.co.uk>).

This report investigates tram and light rail impacts on travel patterns and economic activity in various European and North American cities. It evaluates impacts on residential property prices, office rents and retailing; city center shoppers, car ownership; retail structure and competition between city centres and sub-centres; parking requirements and changes in building and development patterns. Many of these impacts are quantified and compared in tables. Concludes that urban rail can provide substantial economic benefits with appropriate policies and support.

Table 3 Property Value Impacts of Rail Proximity (Hass-Klau, Crampton and Benjari, 2004)

City	Factor	Difference
Newcastle upon Tyne	House prices	+20%
Greater Manchester	Not stated	+10%
Portland	House prices	+10%
Portland Gresham	Residential rent	>5%
Strasbourg	Residential rent	+7%
Strasbourg	Office rent	+10-15%
Rouen	Rent and houses	+10%
Hannover	Residential rent	+5%
Freiburg	Residential rent	+3%
Freiburg	Office rent	+15-20%
Montpellier	Property values	Positive, no figure given
Orléans	Apartment rents	None-initially negative due to noise
Nantes	Not stated	Small increase
Nantes	Commercial property	Higher values
Saarbrücken	Not stated	None-initially negative due to noise
Bremen	Office rents	+50% in most cases

This table summarizes how property values are affected by proximity to rail stations in various cities.

70. Hess, Daniel Baldwin and Tangerine Maria Almeida (2007), "Impact of Proximity to Light Rail Rapid Transit on Station-Area Property Values in Buffalo," *Urban Studies*, Volume 44, Issue 5 & 6, May 2007, pages 1041 – 1068.

This study assesses the impact of proximity to light rail transit on residential property values near stations in Buffalo, New York, where light rail has been in service for 20 years, but population is declining and ridership is decreasing. The researchers construct hedonic models of assessed value for residential properties within ½ mile of 14 Metro Rail stations, including independent variables that describe property characteristics, neighborhood characteristics, and locational amenities. The model suggests that every foot closer to a light rail station increases property values by \$2.31 (using geographical straight line distance) and \$0.99 (using network distance). Consequently, a home located within one-quarter mile radius of a light rail station can earn a premium between \$1,300 to \$3,000, or 4% to 11% of the median assessed home value. Model results suggest that three independent variables—the number of bathrooms, size of the parcel, and location on the East side or West side of Buffalo—are more influential than rail proximity in predicting property values. Individual regression models for each of the light rail system’s 14 stations suggest that effects are not felt evenly throughout the system. Proximity effects are positive in high-income station areas and negative in low-income station areas. An analysis of the actual walking distance to stations (along the street network) versus the perceived proximity (measured by straight-line distance) to stations reveals that the results are statistically more significant in the network distance than the straight line distance model, but the effects are greater in the straight line distance model, which suggests that apparent proximity to rail stations is an added locational advantage compared to physical walking distance to the station.

Christopher M. Hewitt, M.A., and W. E. (Ted) Hewitt (2012), “Effects of Proximity to Urban Rail on Housing Prices in Ottawa,” *Journal of Public Transportation*, Vol. 15, No. 4, pp. 43-66; at www.nctr.usf.edu/wp-content/uploads/2012/12/jpt_15.4.pdf.

The conventional wisdom suggests that construction of urban rail transit (URT) lines serves as a magnet for new housing development which increases property values near urban rail transit stations. Existing studies have confirmed this belief, but largely on the basis of global area studies that can often mask locally differentiating factors affecting housing prices. Using data from the City of Ottawa, this study used geographically weighted multiple regression (GWMR) and mapping techniques that reveal that the relationship between URT stations and housing prices is far more complex than is commonly believed. This analysis found a statistically significant positive relationship between house prices and proximity to the O-Train stations, but that this is a relationship that the strength and direction of the relationship is locationally dependent, with housing prices in some areas affected positively and in other areas negatively, probably due to the combination of rail station’s undesirable local impacts (noise and traffic) and low levels of rail transit demand among some household types.

Christopher D. Higgins and Pavlos S. Kanaroglou (2016), “Forty Years Of Modelling Rapid Transit’s Land Value Uplift In North America: Moving Beyond The Tip Of The Iceberg,” *Transport Reviews*, (DOI: 10.1080/01441647.2016.1174748); summary at www.tandfonline.com/doi/abs/10.1080/01441647.2016.1174748?journalCode=ttrv20.

Identifying and measuring the land value uplift (LVU) impacts of rapid transit is important for a number of reasons. However, despite the general notion that rapid transit does confer positive LVU benefits, our comprehensive and critical review of more than 130 analyses across 60 studies completed in North America over the past 40 years finds significant heterogeneity in research outcomes, leaving many significant questions unanswered. Beyond high-level differences in study inputs, we argue that a fundamental source of variability is a lack of empirical specificity from the use of proximity as the dominant way in which LVU benefits are captured. This use of a proxy leads to the potential for omitted variables and unobserved relationships, and exposes previous work to the potential for misvalued results. To overcome this issue, we outline recommendations for future research, namely a recognition of relative accessibility and the possibility of LVU impacts from transit-oriented development. Incorporating measures related to these factors into LVU models can reveal their implicit prices, resulting in research that is more theoretically inclusive, empirically comprehensive, comparable, and able to provide important information to inform policy analysis and prescription.

71. W. Huang (1994), *The Effects of Transportation Infrastructure on Nearby Property Values: A Review of the Literature*, Working Paper 620, Institute of Urban and Regional Development, Berkeley, California.

The effect of the presence of transportation infrastructure on distant lot values is small, but there are many distant lots, therefore the hedonic method may underestimate incremental site rents. Furthermore, it may be a mistake to regard as exogenous the values attributed to other amenities that developers add in response to accessibility-induced value.

72. Michael Iacono and David Levinson (2012), *Accessibility Dynamics and Location Premia: Do Land Values Follow Accessibility Changes?*, University of Minnesota, presented at the Transportation Research Board Annual Meeting (www.trb.org); at <http://nexus.umn.edu/Papers/AccessDynamics.pdf>.

The structure of transportation networks and the patterns of accessibility they give rise to are an important determinant of land prices, and hence urban spatial structure. This paper provides evidence of this dynamic relationship using data on home sales in the Minneapolis-St. Paul (MN) metropolitan area, coupled with disaggregate measures of urban accessibility for multiple modes, from 2000 to 2005. It tracks the effects of marginal changes in accessibility over time, as opposed to static, cross-sectional relationships, by using an unconventional approach in which the unit of observation is a *representative house* for each transportation analysis zone in the region. This approach allows us to control for changes in structural attributes of houses over time, while also isolating the effect of changes in accessibility levels. Finds that automobile access to employment has a significant impact on housing prices, and although walking and public transit employment access also had a positive impact the results are not considered statistically significant. Results of this approach are compared to a cross-sectional model using the same variables for a single year to illustrate important differences. These differences are discussed in terms of their implications for practitioners and for further investigations of the relationship between transportation, location and land value.

73. J. H. Kay and G. Haikalis (2000), "All Aboard", *Planning*, Vol. 66, No. 10, pp. 14-19.

Property values around Dallas, Texas DART transit stations increased approximately 25% since operation began in 1996. However, the region's sprawled development complicates transit's contribution to regional transport. A sidebar describes New Jersey's new Hudson-Bergen line.

74. Katherine Kittrell (2012), *Vacant Land Values: Reviewing The Success Of Phoenix Metro Light Rail Stations*, Arizona State University, presented at the Transportation Research Board Annual Meeting (www.trb.org); at www.lai.org/newsletter/september2011/VacantLandValues.pdf.

This article investigates the land market response to the 1997 announcement of the Phoenix METRO light rail line station locations as a time series case study. It compares sales prices per square foot before and after light rail was announced, and commercial vacant land within a ½ mile of transit stations to vacant land at Phoenix's most prominent, centrally located, mixed-use intersections not serviced by high capacity transit to further evaluate light rail development potential. The results indicate that most rail station areas experienced increased property values and increased development activity, particularly if supported by effective station-area plans that support development.

75. Gerrit Knaap, Lewis Hopkins, and Arun Pant (1996), *Does Transportation Planning Matter? Explorations into the Effects of Planned Transportation Infrastructure on Real Estate Sales, Land Values, Building Permits, and Development Sequence*, Lincoln Institute of Land Policy, Research Paper.

This study observed property values in the Westside LRT corridor in Washington County, suburban Portland, Oregon. The study compared values prior to construction with values at the beginning of LRT operations. Values of parcels located within ½-mile of the line were found to decrease with distance from the stations, but rise with distance from the rail line between stations. Thus, the opposite affects of accessibility and nuisance were deduced.

76. Kate Ko and Xinyu (Jason) Cao (2013), "The Impact of Hiawatha Light Rail on Commercial and Industrial Property Values in Minneapolis," *Journal of Public Transportation*, Vol. 16, No. 1, pp. 47-66; at www.nctr.usf.edu/wp-content/uploads/2013/03/jpt_16.1.pdf.

Develops hedonic pricing models to assess the value-added of the Hiawatha LRT on commercial and industrial properties, using data on properties sold before and after its completion. The results show that the LRT has induced a significant price premium for properties nearby and that the impact extends to almost 0.9 miles away from LRT stations, significantly more than the 0.3-0.5 mile distance usually assumed. For example, the price gradient is approximately \$6,000 per meter for a typical property located 400 meters (1/4 mile) away from LRT station, while it drops to about \$4,000 for a property 800 meters (1/2-mile) away.

77. John Landis, Robert Cervero, Subhrajit Guhathukurta, David Loutzenheiser, and Ming Zhang (1005), Rail Transit Investments, *Real Estate Values, and Land Use Change: A Comparative Analysis of Five California Rail Transit Systems*, Monograph 48, Institute of Urban and Regional Studies, University of California at Berkeley.

This study measured ground distance to BART stations in Alameda and Contra Costa Counties, California. The authors found that 1990 single family home prices declined by \$1 to \$2 per meter distance from a BART station. They did not find a significant impact on home values based on proximity to CalTrain commuter rail stations, although houses within 300 meters of the CalTrain right-of-way sold at a \$51,000 discount. No increase in value around commercial / industrial stops was found, but the authors note that commercial property observations encounter significant data measurement problems.

78. Steven Lewis-Workman and Daniel Brod (1997), "Measuring the Neighborhood Benefits of Rail Transit Accessibility," *Transportation Research Record 1576: 147-153*. (www.trb.org)

The authors found that within a one-mile radius from the Pleasant Hill rail station in the Bay Area, average home prices decline by about \$1,578 for every 100 feet distance from the station. In the area within a one-mile radius from the Forest Hills, 67th Avenue, and Rego Park rail stations, average home prices decline about \$2,300 for every 100 feet distance from the station.

79. Carol Abel Lewis and Gwendolyn C. Goodwin (2013), *The Impact Of Bus Transit Centers On Nearby Single Family Residential Land Values In Houston, Texas*, Transportation Research Board Annual Meeting (www.trb.org); previous version at <http://swutc.tamu.edu/publications/technicalreports/167372-1.pdf>.

This study assesses the effect of bus transit centers in Houston, Texas, on nearby single family residential property values. It indicates that the transit centers in low to moderate income neighborhoods have a positive influence on property values. In the single affluent neighborhood in the study, results indicate the transit center negatively affects property value, but the influence is less than other variables.

80. Shishir Mathur (2020), "Impact of Heavy-rail-based Rapid Transit on House Prices: Evidence from the Fremont, CA, Warm Springs BART Extension Project," *Journal of Planning Education and Research* (doi:10.1177/0739456X19898737); at <https://journals.sagepub.com/doi/full/10.1177/0739456X19898737>

This study estimates households' willingness to pay for single-family houses and condominiums or townhouses located within 2 miles of Warm Springs (WS) BART Station in Fremont, CA. The study finds that, compared to the houses sold in the control distance band (2–5 miles away), an average-priced

single-family house within 2 miles of the WS BART Station was higher in price by 9 to 15 percent. The total property value increment for the single-family houses is large enough to fund the \$802 million Warm Springs BART Extension Project cost five times over.

81. Shishir Mathur and Christopher E. Ferrell (2009), *Effect Of Suburban Transit Oriented Developments On Residential Property Values*, Mineta Transportation Institute (www.transweb.sjsu.edu); at <https://bit.ly/2FOfBvk>. Also see, “Measuring The Impact Of Sub-Urban Transit-Oriented Developments On Single-Family Home Values” in *Transportation Research A*, Vol. 47, pp. 42-55, <http://dx.doi.org/10.1016/j.trra.2012.10.014>.

This study estimated the impact of *Transit Oriented Developments* (TODs) on surrounding single-family residential housing values in four suburban San Francisco Bay area neighborhoods: Ohlone Chynoweth TOD in San Jose, Pleasant Hill TOD in Contra Costa County, Downtown Hayward TOD in the City of Hayward in Alameda County, and Bay Meadows TOD in the City of San Mateo in San Mateo County. Finds that every 100 feet decrease in distance for single-family homes to the Ohlone Chynoweth TOD the home sale price increased an average of \$10,150 or 1.5%. However, the remaining three TODs do not have any effect – positive or negative – on the prices of surrounding single-family homes.

82. Musaad A. Al-Mosaind, Kenneth J. Duecker, and James G. Strathman (1992), “Light Rail Transit Stations And Property Values: A Hedonic Price Approach,” *Discussion paper 92-04, Presented at Transportation Research Board 72nd Annual Meeting, Center for Urban Studies, School of Urban and Public Affairs, Portland State University*.

Proximity to LRT stations may improve residents’ accessibility to the urban area, and may provide transportation cost savings which result in higher property values. However, LRT stations may also impose negative externalities, depreciating nearby home values. Which of these effects predominates? In metropolitan Portland, Oregon, two distance models to LRT stations were compared. The first showed a positive capitalization in sale prices for homes within 500 m (1/4 mi) walking distance. This effect was equally felt for all homes within that distance zone. The second model found a statistically weak negative price gradient for homes within the 500-m zone. This implies a positive influence of proximity, where homes are priced about 10% higher. Higher density zoning around stations also raised site values.

83. Arthur C. Nelson and Robert Hibberd (2021), “(Overlooked) Association between Express Bus Station/Stop Proximity and Multifamily Rents with a Surprise about Transit Mode Synergism and Implications for Transit and Land Use Planning,” *Transportation Research Record* (doi.org/10.1177/03611981211005457); at <https://nitc.trec.pdx.edu/research/project/1253>.

Evaluates the impacts of both fixed-route transit (FRT) and express bus transit (XBT) stations/stops on multifamily housing rents. Using a static, cross-section quasi-experimental research design, we evaluate CoStar multifamily (MF) rent per square foot to estimate the difference in rent with respect to proximity to XBT stations/stops. However, we are also interested in knowing whether there are synergistic price effects at the intersection of XBT and other FRT systems such as light rail transit (LRT). In this article, we estimate the MF rent premium with respect to XBT and LRT (XBT+LRT) station/stop proximity separately, rent premiums for combined XBT and LRT stations/stops and for those MF cases that are more than 1.0 mi beyond the nearest LRT station. In all cases, whether separately or combined with LRT stations or away from LRT stations, we find positive associations between MF rent and proximity to XBT

stations/stops. However, we also find evidence of negative externalities at or near XBT, LRT, and XBT+LRT stations/stops. Express bus transit and land-use planning implications are offered.

84. Arthur C. Nelson (1992), "Effects Of Elevated Heavy-Rail Transit Stations On House Prices With Respect To Neighborhood Income," *Transportation Research Record 1359: 127-132.*

In Atlanta's low value neighborhoods, a transit stop raises value, and in high value communities installing a transit stop lowers site value – by nearly the same amount.

85. Arthur C. Nelson (1999), "Transit Stations And Commercial Property Values: A Case Study With Policy And Land-Use Implications," *Journal of Public Transportation, Vol. 2, No. 3.*

Develops a model of commercial property value with respect to transit station proximity and the role of policies that encourage station area commercial development without discouraging such development elsewhere. Applies this model in Atlanta's *Midtown*, located 1 km north of the downtown edge, served by three heavy rail transit stations operated by the Metropolitan Atlanta Transit Authority (MARTA). To encourage transit-oriented development near MARTA stations the city waives parking requirements and floor area ratio restrictions. Commercial property values are affected positively by both access to rail stations and policies that encourage more intensive development around those stations. Citywide analysis, measuring access as ground distance to a MARTA station, finds that price per square meter falls by \$75 for each meter away from transit stations. Prices rise by \$443 for location within special public interest districts (SPIDs). At the time of his study, Atlanta was the most sprawled metro region in the nation, and that the size of the SPIDs was identical to comfortable walking distance from stations, about a 1/4 mile radius. Theoretical and policy implications are explored.

86. Robert B. Noland, Stephanie DiPetrillo and Michael L. Lahr (2012), *Residential Property Values and the New Jersey Transit Village Program*, Voorhees Transportation Center, Rutgers University (www.policy.rutgers.edu/vtc); at

http://policy.rutgers.edu/vtc/tod/documents/2011_PropertyValuesinNJTransitVillages.pdf.

Since 1999 New Jersey has designated 23 Transit Villages in municipalities around the state with the intention of intensifying development around rail stations and bus hubs. This study measures the appreciation in residential property values compared to other municipalities within the state. Some limited positive evidence of being designated a New Jersey Transit Village is found. Econometric analysis of the change in average residential sales price over nine years finds an association, but cannot establish a causal effect. Case study analysis of selected transit villages suggests that the forethought, commitment, and political will required to apply for Transit Village status may be what sparks municipal development rather than the designation itself.

87. Parsons Brinkerhoff (2001), *The Effects of Rail Transit on Property Values: A Summary of Studies*, Project 21439S, Task 7, NEORail II, Cleveland, Ohio, 27 February 2001; at www.reconnectingamerica.org/public/download/bestpractice162.

This paper summarizes the results of several previous studies in tabular form. The authors note that varying methodologies make it difficult to compare results. Nevertheless, it is clear that in most cases access to transit systems is valued by property owners. Rail's influence on residential values is demonstrated more clearly than on commercial uses; however, influence on commercial values appears

to vary by: (i) how much accessibility is improved, (ii) the relative attractiveness of locations near stations, and (iii) the strength of the regional real estate market.

88. Susan J. Petheram, Arthur C. Nelson, Matt Miller and Reid Ewing (2013), “Use of the Real Estate Market to Establish Light Rail Station Catchment Areas: Case Study of Attached Residential Property Values in Salt Lake County, Utah, by Light Rail Station Distance,” *Transportation Research Record 2357*, Transportation Research Board (www.trb.org); summary at <http://trid.trb.org/view/2013/C/1242804>.

This study measured the value of rental apartment buildings located in 0.25 mile to 1.5 mile distance bands from TRAX light rail stations in Salt Lake County, Utah. Controlling for structural, neighborhood, and location characteristics, a positive relationship between TRAX station proximity and rental apartment building values was found to 1.25 mi but not beyond.

89. Victoria A. Perk and Martin Catalá (2009), *Land Use Impacts of Bus Rapid Transit: Effects of BRT Station Proximity on Property Values along the Pittsburgh Martin Luther King, Jr. East Busway*, National Bus Rapid Transit Institute, Center for Urban Transportation Research, University of South Florida, for the Federal Transit Administration (www.fta.dot.gov); at www.nbrti.org/docs/pdf/Property%20Value%20Impacts%20of%20BRT_NBRTI.pdf.

This study used a hedonic regression model to estimate the impact of distance to a BRT station on the fair market value of single-family homes. Because many BRT systems operating in the United States may be too new to find evidence of capitalization into property values, data from Pittsburgh’s East Busway, one of the oldest operating BRT systems in the country, was used. Decreasing marginal effects were found: moving from 101 to 100 feet from a station increases property value approximately \$19.00, while moving from 1001 to 1000 feet increases property value approximately \$2.75. Another way to interpret this result is to say that a property 1,000 feet away from a station is valued approximately \$9,745 less than a property 100 feet away, all else constant (this figure is determined by summing the marginal effects for each foot of distance). The results shown in this report are only valid for the data used in Pittsburgh’s case. As more BRT systems continue operating in the United States for more years, this method should be applied to other cities and other types of properties to gain a better understanding of the general property value and land use impacts of proximity to BRT.

90. Victoria A. Perk, Martin Catalá and Steven Reader (2012), *Land Use Impacts of Bus Rapid Transit: Phase II—Effects of BRT Station Proximity on Property Values along the Boston Silver Line Washington Street Corridor*, National Bus Rapid Transit Institute, Center for Urban Transportation Research, University of South Florida, for the Federal Transit Administration (www.fta.dot.gov); at www.fta.dot.gov/documents/FTA_Report_No._0022.pdf.

Describes an effort to quantify the impacts of access to BRT stations on the sale prices of surrounding condominiums located along Boston’s Washington Street where Phase I of the Silver Line BRT began in 2002. To test the hypothesis that the BRT stations impact property values similar to rail transit projects (considering the level and permanence of services and facilities), a hedonic regression methodology was used to estimate the impact of access to BRT station on sale prices of condo units. A key result is that for condo sales between 2007 or 2009, the BRT premium was approximately 7.6%. For condo sales in 2000 and 2001, prior to the opening of the Silver Line, no sales premium existed for proximity to the corridor. Further, changes in land uses along the corridor were examined over the period from 2003 to 2009.

91. Pickett, M.W., and K.E. Perrett (1084), *The effect of the Tyne and Wear Metro on Residential Property Values*, Supplementary Report 825, Transport and Road Research Laboratory, Crowthorne, Berkshire, U.K.

Applies three analysis methods. Results show an average increase of £360 (1.7%) in the value of properties near Metro stations during the four-month period surrounding the date on which each section of line opened. In reference to related studies, Dvett et. al. found a small but significant positive effect on the value of single-family dwellings at three of the six BART station areas studied. Lerman et. al. found that distance from Washington Metro stations influences property values, the value rising as the opening date nears, and falling if the opening is delayed. The Regional Commission in Atlanta found an associated increase in industrial property values.

92. Price Waterhouse Coopers (2001), *Review of Property Value Impacts at Rapid Transit Stations and Lines*, Technical Memorandum 6, Richmond/Airport – Vancouver Rapid Transit Project, April 3, 2001.

The authors review transit impact studies from selected cities across North America. The reviewers find a positive relationship between property values and station location, but also a possible negative impact on single-family homes along the line due to nuisance impacts. Four research reports are summarized: (1) Transit Case Studies for the City of Hillsboro, Oregon, (2) Transit Benefits 2000 Working Papers, (3) Light Rail Transit Impacts in Portland, Oregon, and (4) Impact of the Vancouver, BC Skytrain on Surrounding Real Estate Value.

93. Hema S. Rayaprolu and David M. Levinson (2020), *What's Access Worth? A Hedonic Pricing Approach to Valuing Cities*, presented at the 2020 Transportation Research Board Annual Meeting; at <https://ses.library.usyd.edu.au/handle/2123/21352>.

This study developed a hedonic pricing model for house sales in the Sydney, Australia region, which measured access as the cumulative number of jobs (opportunities) reachable within a determined time threshold, by auto and transit. The model also accounts for structural and neighborhood attributes, and resulted in a statistically significant fit. The results indicate a greater influence of transit access on house prices compared with auto access: a unit increase in jobs reachable within 45 minutes by transit was estimated to increase sale price by more than six times than auto.

94. Thomas M. Richert (1999), *Economic Impacts of Automated People Mover Development in Commercial Centers*, Advanced Transit Association.

After one year of Automated People Mover (APM) operation, downtown retail sales grew 8% in Denver, 4% in St. Louis, and 1% in Miami (where patronage of downtown commercial space had historically lagged). Higher retail sales translate into higher site values.

95. Rice Center for Urban Mobility Research (1987), *Assessment of Changes in Property Values in Transit Areas*, Urban Mass Transit Administration, Houston, Texas.

This is a summary of earlier findings from Toronto, Baltimore, Denver, San Diego, and San Francisco. Some transit centers showed a 100% to 300% increase in commercial site values. In Atlanta, 61% of the businesses within 500 feet of a transit stop reported increased sales.

96. Martin E. Robins and Jan S. Wells (2008), *Land Development at Selected Hudson-Bergen Light Rail Stations*, Alan M. Voorhees Transportation Center at Rutgers University; at <http://policy.rutgers.edu/vtc/reports/REPORTS/HBLR%20Final%20Report.pdf>.

The Hudson Bergen Light Rail (HBLR) line is a 20.6-mile, 23-station commuter rail route. Since it opened in 2000, ridership has grown and land development has increased around stations at a scale beyond that which road network alone could have borne. Acres of old, abandoned industrial sites along the route have been transformed into compact residential, office and retail developments in pedestrian, transit-friendly environments reflecting “smart growth” principles. This study identified more than 10,000 new units conservatively estimated to be worth \$5.3 billion were completed by 2005.

97. Daniel A. Rodríguez and Felipe Targa (2004), “The Value Of Accessibility To Bogotá’s Bus Rapid Transit System,” *Transport Reviews*, Vol. 24, No. 5 (www.tandf.co.uk/journals/tf/01441647.html), pp. 587 – 610. Daniel A. Rodríguez and Carlos H. Mojica (2008), “Land Value Impacts of Bus Rapid Transit: The Case of Bogotá’s TransMilenio,” *LandLines*, April, Lincoln Institute for Land Policy (www.lincolninst.edu).

By estimating spatial hedonic price functions, this paper determines the extent to which access to BRT stations in Bogotá, Colombia currently are capitalized into land values. Results suggest that every additional 5 minutes of walking time to a BRT station reduced rental price 6.8% to 9.3%, after controlling for structural characteristics, neighborhood attributes, and proximity to the BRT corridor. Evaluated at the average walking time to a BRT station, this effect translates into an elasticity of -0.16 to -0.22. Although these estimates cannot be attributable directly to the presence of the BRT system due to the study’s cross-sectional design, they suggest that the land market in Bogotá values access to BRT station locations.

98. S. Ryan (1999), “Property Values and Transportation Facilities: Finding the Transportation-Land Use Connection,” *Journal of Planning Literature*, Vol. 13, Issue 4 (May): 412-427.

Ryan reviews empirical studies of the relationship between the presence of transport facilities – highways, heavy rail, and light rail transit systems – and property values. Inconsistencies in findings from this literature over the past several decades are explained. For example, results vary based on whether researchers measure accessibility in terms of travel time or travel distance. Measuring distance yields mixed results in property value effects. Measuring time yields the expected inverse relationship between access to transportation facilities and property values. The delineation of study areas also influences the direction of effects. This study offers a new interpretation of the transportation facility-property value literature, improving the ability to measure relationships and anticipate land-market responses to transport facilities.

99. Sedway Group, *Regional Impact Study*, Report commissioned by Bay Area Rapid Transit District (BART), July 1999.

This is a review of studies of the benefits associated with BART service, measured in positive residential and office property impacts. Reported single family home values fell by \$3,200 to \$3,700 for each mile

distance from a BART station in Alameda and Contra Costa counties. Apartments near BART stations were found to rent for 15% to 26% more than apartments distant from BART stations. The average unit land price for office properties also decreased as distance from a BART station increased, from \$74 per square foot within ¼ mile of a station to \$30 per square foot at locations exceeding ½ mile. Sedway Group, San Francisco, CA at www.sedway.com (From "Rail transit and property values," Information Center Briefing, No. 1 - March 2001, at www.apta.com/info/briefings/briefings_index.htm).

100. Richard Voith, "Changing Capitalization of CBD-Oriented Transportation Systems: Evidence from Philadelphia, 1970-1988," Federal Reserve Bank of Philadelphia, Working Paper No. 31-19 (1991); *Journal of Urban Economics*, Vol. 33 (1993): 361-376.

Voith estimates house value premiums associated with CBD-oriented train service provided by the Southeastern Pennsylvania Transportation Authority (SEPTA). Unlike most previous studies, he documents changes over an extended period, for each year in his 19-year sample. His data include over 59,000 home sales. In 1980 the average sales price was nearly \$120,000. Prices declined from 1974 through 1982, bottomed out during 1983 and 1984, and rose steeply from 1985 through 1988. Using hedonic house value regressions, he finds strong evidence that accessibility to the CBD is capitalized into suburban house values. The premium began in 1970 at well over \$12,000, declined until 1976, bottoming out at a bit over \$5,000, then from 1978 to 1984 averaged nearly \$9,000, and at the end of his sample, 1988, reached \$20,000 plus. The value of such accessibility fluctuates with the economic health of the city (which is impacted by the City's tax on wages). Between 1981-1988 while employment in the suburbs grew rapidly, so did the premium associated with train service (to the CBD) increase dramatically, indicating that the central city economy still contributes significantly to the overall wealth of communities. Hence, suburban communities may not be able to isolate themselves from central decline.

101. Gary Wagner, Timothy Komarek and Julia Martin, "Is the Light Rail "Tide" Lifting Property Values? Evidence from Hampton Roads, Virginia," Federal Reserve Bank of Cleveland, Working Paper no. 16-26; at www.clevelandfed.org/en/newsroom-and-events/publications/working-papers/2016-working-papers/wp-1626-is-the-light-rail-tide-lifting-property-values.aspx.

This paper examines the effect of light rail transit on the residential real estate market in Hampton Roads, Virginia. The Norfolk Tide light rail began operations in August 2011 and has experienced disappointing levels of ridership over its first four years of operations. We estimate the effect of the Tide using a difference-in-differences model and consider several outcome variables for the residential housing market, including sales price, sales-list price spread and the time-on-market. Our identification strategy exploits a proposed rail line in neighboring Virginia Beach, Virginia, that was rejected by a referendum in 1999. Overall, the results show negative consequences from the constructed light rail line. Properties within 1,500 meters experienced a decline in sales price of nearly 8 percent, while the sale-list price spread declined by approximately 2 percent. Our results highlight the potential negative effects of light rail, when potential accessibility benefits do not outweigh apparent local costs.

102. Weinberger, Rachel R., *Commercial Rents and Transportation Improvements: Case of Santa Clara County's Light Rail*, WP00RW2, Lincoln Institute of Land Policy, 2001.

In Santa Clara County, California, property owners sued the County claiming losses in value from the nearby light rail. To determine the actual effect of the light rail facility on property values, Weinberger

examined commercial property rents comparing accessibility to transit and to highway as determinants of rent, and analyzed the effects over time. Controlling for other factors, properties within a half-mile of light rail stations were found to command almost 15% more rent. Highway access, being ubiquitous, offers no particular locational advantage. As the transit system matured, nearby properties accrued greater benefits. But, in times of high demand, so did all other locations command higher rents.

103. Weinstein, Bernard L., and Terry L. Clower, *The Initial Economic Impacts of the DART LRT System*, Center for Economic Development and Research, University of North Texas, July 1999.

Values of properties adjoining Dallas's DART (www.dart.org) light rail stations grew 25% more than similar properties not served by rail. Proximity to stations appears to be an economic advantage for most classes of real estate, especially Class A and C office buildings, and commercial strip retail outlets. Average occupancy rates for Class A buildings near rail stations increased from 80% in 1994 to 88.5% in 1998, while rents increased from an average \$15.60/sf to \$23/sf. Commercial strip retailers near the stations experienced a 49.5% gain in occupancy and a 64.8% improvement in rental rates. (from "Rail transit and property values" in *Information Center Briefing*, No. 1, March 2001, at www.apta.com/info/briefings/briefings_index.htm.)

104. Sisi Yan, Eric Delmelle and Michael Duncan (2011), *The Impact of a New Light Rail System on Single Family Property Values in Charlotte, North Carolina*, World Symposium on Transport and Land Use Research (<http://wstlur.org>).

This paper applies hedonic analysis to evaluate the impact of a new light rail system on single-family housing values in Charlotte, North Carolina. Results indicate that before the rail system began operation, proximity to the future rail corridor had a negative influence on home prices, likely due to the presence of industrial land use zones around existing stations. However, area housing prices started to increase 10-15% during the operational phase. This appears to reflect improved accessibility and other features of transit-oriented development.

Lessons From Developing Countries

105. Christina M. Calvo, *Options for Managing and Financing Rural Transport Infrastructure*, Technical Paper No. 411, World Bank, Washington, DC, 1998.

Berkshire, England successfully privatized the maintenance of roads. Calvo suggests applying this model to developing countries, where central governments are often hierarchical and indifferent to rural areas. "If increases in land value are captured mainly by the local elite or by outsiders, however, there will be little motivation for mass participation in the project."

106. Robert Cervero, and Bambang Susantono, *Rent Capitalization and Transportation Infrastructure Development in Jakarta*, Review of Urban and Regional Development Studies Vol. 11, No. 1, Department of City and Regional Planning, University of California, Berkeley, Calif., 1999.

Freeway off-ramps raised the rents of nearby offices in Jakarta, Indonesia. Thus, value capture would be fair, but the method is not feasible because land ownership and values are not registered; furthermore, owners can buy off tax collectors.

107. M.Q. Dalvi (1996), "Value Capturing as a Method of Financing Rail Projects: Theory and Practice," *From the 7th CADATU Conference: Urban Transport in Developing Countries*, New Delhi, India.

Hong Kong's Mass Transit Railway Corp chooses to not sell land but co-develop it. Property rental income financed about 22% of MTRC's operating cost in 1993.

108. Ü. Özlem Ünver Göçer (2023), "The Value-Creation Role Of Accessibility Through the Critical Realism Method: Istanbul Bus Rapid Transit System Erişilebilirliğin Değer Yaratmadaki Rolünün Eleştirel Gerçekçilik Yöntemi ile İrdelenmesi: İstanbul Metrobüs Sistemi," , Kent Akademisi ([DOI: 10.35674/kent.1378474](https://doi.org/10.35674/kent.1378474))

Public investments in mass transit systems provide an equal right of accessibility economic and social opportunities for everyone. Concurrently, they generate an increase in land value both along the mass transit line and within the accessible area of the stations. This article focuses on the socio-economic and spatial effects of the increased land value resulting from the accessibility created by the mass transit system. By reviewing world wide case studies and practices, it examines these causal processes within the framework of the Critical Realism Method using the example of the Istanbul Bus Rapid Transit (BRT) System. As a result of the Extensive Analysis, an analytical method of the Critical Realism Method, it was observed that the rate of land value increase in the Istanbul BRT System was 28% and the rate of land value increase at all stations along the line varied between 20% and 280%. In the Intensive Analysis, it was observed that the increase in land value at selected stations varied depending on the proximity of the station to Istanbul's Central Business District, new incoming land use types, plan changes made by the public, the presence of vacant lands that would enable land speculation, and the presence of large projects around the station. This article provides insights which explain that "the change in land value resulting from accessibility" does not cause the same magnitude of value increase at every station along the line and does not create the same socio-economic and spatial impact at every station. It presents an empirically tested study by comparing the accessibility created by the Istanbul BRT System before and after its implementation.

109. Deborah Salon and Sharon Shewmake (2012), *Opportunities For Value Capture To Fund Public Transport: A Comprehensive Review Of The Literature With Examples From East Asia*, Asian Development Bank and ITDP, presented at the Transportation Research Board Annual Meeting (www.trb.org); at www.itdp.org/uploads/Salon_and_Shewmake_Opportunities_for_Value_Capture_to_Fund_Public_Transport.pdf.

Successful public transport systems increase the value of surrounding land. Value capture is the concept that government may be able to capture at least part of this increase in land value along public transport corridors, and use these funds to subsidize the system. We shed light on when and how value capture could be used to finance public transit by surveying three strands of literature related to value capture: evidence of the land development impacts of public transport, estimates of land value increases attributable to public transport, and case studies of the use of value capture mechanisms to finance public transport. We find that the best strategies for implementing value capture policies are not the same everywhere. They depend on the particulars of the city's institutional capabilities, as well as the general health of the local economy and the local land development industry. The value capture mechanism that works best for each city will depend on the capacity of the government to track the value of land and to levy land taxes, the government's ability to assemble and acquire land at a favorable price, and its capacity to act as a savvy business partner in land development.

110. Taotao Deng and John D. Nelso (2010), "The Impact of Bus Rapid Transit on Land Development: A Case Study of Beijing, China," *World Academy of Science, Engineering and Technology*, Vol. 66; at www.waset.org/journals/waset/v66/v66-189.pdf.

This study uses qualitative (interviews) and quantitative analysis (questionnaire survey and longitudinal analysis of property data) to investigate land development impact resulting from BRT in Beijing, China. The empirical analysis suggests that BRT has a positive impact on the residential and commercial property attractiveness along the busway corridor. The statistical analysis suggests that accessibility advantage conferred by BRT is capitalized into higher property price. The average price of apartments adjacent to a BRT station has gained a relatively faster increase than those not served by the BRT system. The capitalization effect mostly occurs after the full operation of BRT, and is more evident over time and particularly observed in areas which previously lack alternative mobility opportunity.

111. Ian G. Heggie (1989), "Financing Public Transport Infrastructure: An Agenda for Reform", *Proceedings of Seminar M, PTRC summer annual meeting, Vol. P327, Planning and Transport Research and Computation (International) Co.*

In the developing world, value generated by a transport system can be significant. However, often cadastre records are missing or lack information on registered owners and the value of parcels. Furthermore, better-off owners "are often influential local politicians".

112. Institution of Civil Engineers (1990), *Rail Mass Transit for Developing Countries*, London: Telford.

R. T. Meakin, in "Hong Kong's mass transit railway: vital and viable" notes that in Hong Kong the system receives no subsidy. All of its costs, including interest, are derived from rents from land development. "Discussion" by J. Faulkner notes that the World Bank requires mass transit (but not roads) to be self-financing, and that lenders should minimize environmental impacts.

113. L. R. Leinbach (1995), “Transport and Third World Development: Review, Issues, and Prescription,” *Transportation Research. Part A, Policy and Practice*, Vol. 5, pp. 337-344.

This study finds that even distance sites benefit from the presence of roads. It concludes that the first step is to develop self-governing transit institutions (to evade corruption). [Author’s suggestion: transportation vouchers, or even a general citizens dividend, might be more equitable and effective than subsidizing a public transit agency with collected site rent.]

114. Shanjun Li, Jun Yang and Ping Qin (2016), “Wheels Of Fortune: Subway Expansion And Property Values In Beijing,” *Journal of Regional Science* (DOI: 10.1111/jors.12284).

China is experiencing rapid urbanization. Its capital city, Beijing, experienced a 53 percent increase in population from 2001 to 2013. To address traffic congestion and air pollution Beijing is investing heavily in transportation infrastructure. In particular, the subway system added 15 new subway lines with a total length of 410 km of over the 12-year period. We quantify the capitalization of large-scale subway construction into property values in a first-differenced hedonic price framework while controlling for confounding factors and reverse causality. Our analysis finds positive and significant impacts of subway proximity on property values: a 1 km reduction in the distance to a subway station increases property values within 3 km of the station by 15 percent, and by 3.4 percent for properties within 3–5 km. Our analysis shows that the increase in property values can more than cover the capital cost of subway construction.

115. Ramon Munoz-Raskin (2007), *Walking Accessibility to Bus Rapid Transit in Latin America: Does it Affect Property Values? The case of Bogota, Colombia*, TRB (www.trb.org).

This study investigated how proximity to Bogotá, Colombia’s Transmilenio Bus Rapid Transit (BRT) affects residential property values. This research indicates that results vary by socio-economic strata. Low-income housing showed average 4.3% value discounts for new properties in the immediate walking proximity to trunk stations and 7.3% for the feeder lines, compared to the properties in the five-to-ten minute walking distance, reflecting the negative impacts of BRT air and noise pollution, and the tendency of low-income people to use cheaper paratransit instead of BRT. Middle income housing value premiums of 2.3% and 14.4% for new properties located in the immediate walking distance to trunk stations and to feeder lines, compared to five-to-ten minute walking distance. High-income housing revealed discounts averaging 19.9% for new properties in the immediate walking proximity of the trunk lines, compared with the average value of high-income housing in the five-to-ten minute walk to the BRT system, reflecting high-income household’s preference for private vehicle transport.

116. Alexandra Ortiz (1996), “Economic Analysis of a Land Value Capture System Used to Finance Road Infrastructure: The Case of Bogota, Colombia.” Ph.D. thesis, University of Illinois at Champaign-Urbana.

Starting in 1926, the City of Bogota charged property owners the anticipated rise in site value (“valorization”) before road construction began. Revenue from these charges declined in the late 1980s as assessments fell behind and as poor landholders could not afford even the lagging assessments. A 1992 valorization had collected 80% of its target by mid 1995. Presumably the city made up the difference with other taxes, since new roads were built. What worked for roads could work for transit as well. Ortiz concludes that pre-emptive betterment charges for infrastructure would not be needed if a general land tax were working well. Columbia has a municipal land tax rate of 1% and a national rate of 2%, plus a land gains tax of up to 50%, yet land is registered at only 20% of its value.

117. A. P. Prest (1996), *Transport Economics in Developing Countries*. Praeger.

Prest relates how Uruguay has historically funded roads from land rent. In 1928 the country set up its Permanent Fund for Development and Farm-to-Market Roads, financed by taxes on gasoline, tires, and land value – prorated by distance from the road. Even at a very low rate, 0.125% to 0.65%, the land value tax funded 1/3 of the road construction budget. However, assessments did not keep pace with rising land values, and confusion arose when proximity to more than one road entered into the reckoning. Hence, the LVT fell into disuse.

118. Deborah Salon, Jingyan Wu and Sharon Shewmake (2015), “Impact of Bus Rapid Transit and Metro Rail on Property Values in Guangzhou, China,” *Transportation Research Record 2452*, Transportation Research Board (www.trb.org), pp. 36-45; <http://trid.trb.org/view.aspx?id=1290068>.

Study examines the effects of these two public transport systems on the prices of apartments in the city by using a unique set of data collected from a mainstream Chinese real estate website. Ordinary least squares, spatial regression models, and quantile hedonic regression were used to estimate the price premium for transit access. The findings suggest that proximity to the metro and the bus rapid transit line has a substantial and statistically significant effect on apartment prices that varies by district and the amenities provided.

119. Shunso Tsukada and Chiaki Kuranami (1990), “Value Capture with Integrated Urban Rail and Land Development: The Japanese Experience and Its Applicability to Developing Countries,” *Proceedings of Seminar M, PTRC Transport and Planning Annual Meeting, University of Sussex, England*, PTRC Education and Research Services.

To win matching funds from the Japanese central government for planned urban rail systems, local governments must raise 35% of construction costs. Some jurisdictions increase the property tax rate to raise this revenue. Taxable value is determined by distance from the rail station and the city center. Another strategy is to develop fallow land along rail corridors. One private rail line earns 18% of its total revenue from real estate (plus 54% from the railway and 28% from other businesses). The authors recommend that transit agencies serve extant demand from riders, coincide construction with an economic upswing, cooperate with the private sector, commit themselves then deliver on their promises, and become competitive with other transport modes.

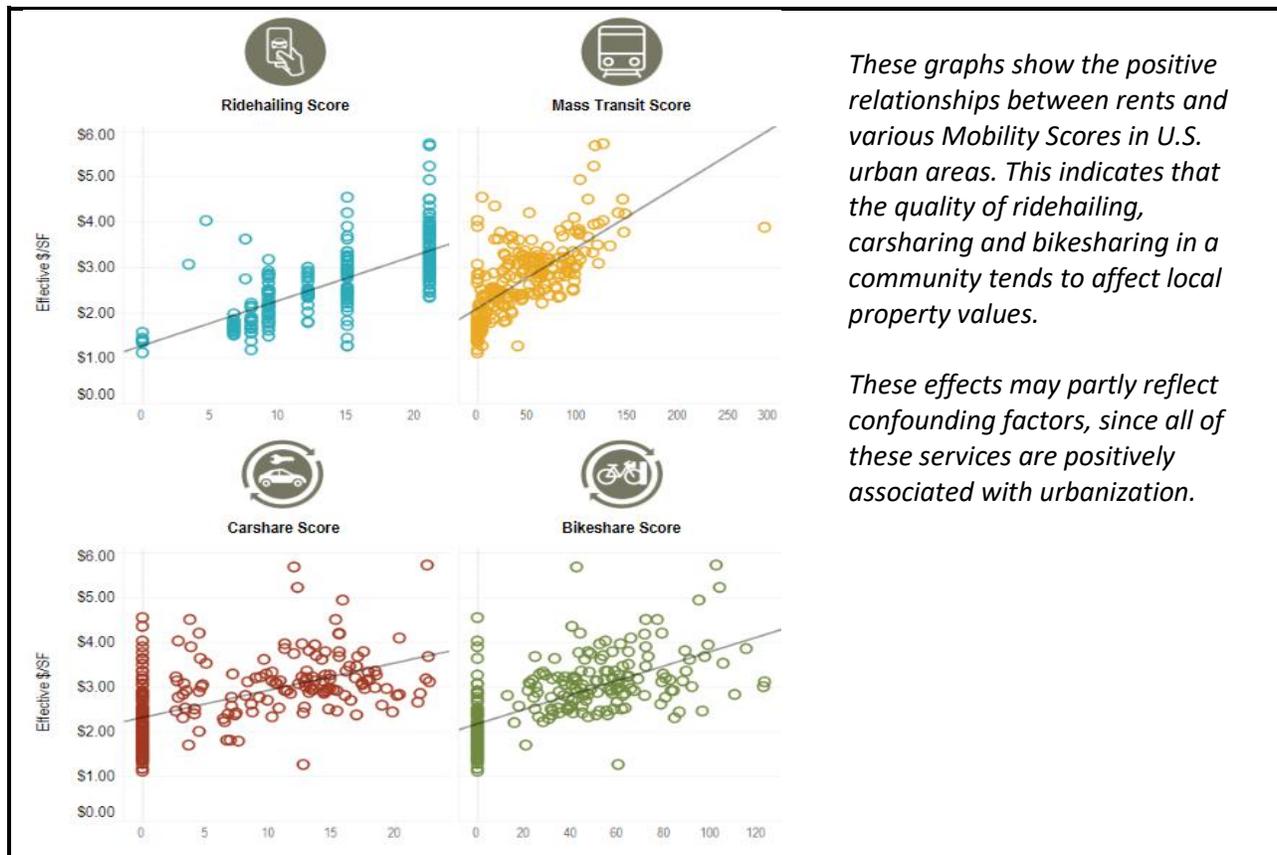
120. D. Walmsley, and G. Gardner (1993), *The Economic Effects of Public Transport*, Transport Research Laboratory in TRIS Database: “Taxing Property Values for Transit.”

Studies from Western Europe, North America, and various developing countries show how changes in the organization and financing of public transport affect patronage and urban development. Its general findings could apply, perhaps on a smaller scale, to other improvements in public transport such as busways. It considers funding from: (1) revenues, (2) taxation, (3) land value capture, (4) advantages and disadvantages of assured funding, and (5) the involvement of private capital. Besides improving public conveyance, rapid transit systems can also improve the environment and the 'image' of a city, as well as encourage new urban development and enhance safety. Bus transit deregulation in the UK illustrates how market disciplines can be applied to bus operation, and how privatization might affect public transport. The report offers recommendations for transport planners in Eastern European countries.

Impacts of Walkability and Mobility Services (Ridehailing, Car- and Bike-sharing)

121. Derek Wyatt and Daniel Warwick (2018), *The Impact of Mobility on Apartment Rents*, RCLCO (www.rclco.com); at www.rclco.com/advisory-mobilityscore-apartment-rents-interactive.

This study used TransitScreen's *MobilityScore* to quantify the impacts of public transit, ridehailing (such as Uber and Lyft), car- and bikesharing services on apartment rents in U.S. urban areas. It found that rents tend to increase with access to these services. Among communities built since 2010 across the country, those with Excellent Mobility scores achieve rents that are 59% higher than average and communities with Good Mobility scores achieve rents 22% higher than average. Nationally, among apartment communities built since 2010, a 10% increase in MobilityScore is correlated with an increase of \$0.12 per square foot, and the difference in MobilityScore accounts for 28% of the variation in rent per square foot. Among the four components of mobility quantified by MobilityScore (transit, carshare, bikeshare, ridehailing), the study found a 10% increase in each score can have dramatically different results. These differences may partly reflect confounding factors, since all of these services are associated with urbanization, and the higher average incomes and rents in cities, but the relationship is not just a New York or Boston phenomenon.



122. Joe Cortright (2009), *Walking the Walk: How Walkability Raises Home Values in U.S. Cities*, CEOs for Cities (www.ceosforcities.org); at www.ceosforcities.org/files/WalkingTheWalk_CEOsforCities1.pdf.

Cortright (2009) evaluated the effects of walkability on housing prices using the used Walkscore (www.walkscore.com) and 95,000 real estate transactions, controlling for house (size, number of bedrooms and baths, age) and neighborhood characteristics (proximity to the CBD, income, and accessibility to jobs). He found that walkability had a statistically significant, positive impact on housing values in 13 of the 15 markets examined. In a typical metropolitan area, each walkscore point increase was associated with a \$700 to \$3000 increase in home values, after controlling for other observable factors, so for example, that all else held constant, shifting from a 50th to a 75th percentile walkscore increases a house's value between \$4,000 and about \$34,000, depending on the market. The biggest gains were in the large cities with the highest densities and best transit systems, such as San Francisco and Chicago. The researchers conclude that these results reflect the value consumers attach to walkable neighborhoods, which tend to be denser, mixed use neighborhoods with good accessibility, including transit service.

123. Gary Pivo And Jeffrey D. Fisher (2010), "The Walkability Premium In Commercial Real Estate Investments," forthcoming *Real Estate Economics* (www.wiley.com/bw/journal.asp?ref=1080-8620); www.u.arizona.edu/~gpivo/Walkability%20Paper%20February%202010.pdf.

This paper examines the effects of walkability on property values and investment returns. Walkability is the degree to which an area within walking distance of a property encourages walking for recreational or functional purposes. We used data from the National Council of Real Estate Investment Fiduciaries (NCREIF) and Walk Score to examine the effects of walkability on the market value and investment returns of more than 4,200 office, apartment, retail and industrial properties from 2001-2008 in the USA. We found that, all else being equal, the benefits of greater walkability were capitalized into higher office, retail and apartment values. We found no effect on industrial properties. On a 100 point scale, a 10 point increase in walkability increased values by 1 to 9 percent, depending on property type. We also found that walkability was associated with lower cap rates and higher incomes, suggesting it has been favored in both the capital asset and building space markets. Walkability had no significant effect on historical total investment returns. All walkable property types have the potential to generate returns as good as or better than less walkable properties, as long as they are priced correctly. Developers should be willing to develop more walkable properties as long as any additional cost for more walkable locations and related development expenses do not exhaust the walkability premium.

Additional Titles Not Annotated

- 124.** Gabriel Ahlfeld and Arne Feddersen (2010), *From Periphery To Core: Economic Adjustments To High-Speed Rail*, Working Paper, London School of Economics, presented at the German Economic Association; at www2.lse.ac.uk/newsAndMedia/news/archives/2010/09/highspeedrail.aspx.
- 125.** R. Armstrong and D. Rodríguez (2006), "An Evaluation of the Accessibility Benefits of Commuter Rail in Eastern Massachusetts using Spatial Hedonic Price Functions," *Transportation*, Vol. 33, No. 1, pp. 21-43.
- 126.** DAG (2011), *Land Value Capture/ Taxation (LVC/T) Scoping Study*, Development Action Group (www.dag.org.za) for the UN-HABITAT and Global Land Tool Network; at www.dag.org.za/docs/2010/GTNScopingStudyOct10.pdf.
- 127.** Philip Day (1992), *Land Value Capture*, Report to the Local Government Association of Queensland.
- 128.** Eleanor F. Dolan (1970), *The Effect of Rapid Transit on Land Value and Building Construction in Boston, Cambridge and Arlington, 1900-1930*, Cambridge, Mass.
- 129.** Matthew Doherty (2008), *Funding Public Transport Development Through Land Value Capture Programs*, Institute for Sustainable Future (www.cooperativeindividualism.org); at www.cooperativeindividualism.org/doherty-matthew_land-value-capture.pdf.
- 130.** Marcus Enoch (2002), "Recouping Public Transport Costs From Gains In Land Values," *Traffic Engineering and Control*, Vo. 43, No 9, pp. 336-340 (<https://dspace.lboro.ac.uk/dspace-jspui/handle/2134/3418>).
- 131.** Mark J. Freeman and F.G. Price (1989), "Value Capture: A Neglected Factor in the Funding of Transport Facilities," *Reprint of paper prepared for the Annual Transportation Convention, Paper 5D-10, Roads and Transport Technology, No. 687. Pretoria*, South African Council for Scientific and Industrial Research, Division for Roads and Transport Technology.
- 132.** Hsu, Kuo-Wei (1996), *The Impact of Mass Rapid Transit Systems on Land Values: Case Study, Taipei*, Chaoyang University, Taiwan. (Available from: secret@mail.cyut.edu.tw)
- 133.** IEDC (2006), *Economic Development and Smart Growth: Case Studies on the Connections Between Smart Growth Development and Jobs, Wealth, and Quality of Life in Communities*, International Economic Development Council (www.iedconline.org); available at www.iedconline.org/Downloads/Smart_Growth.pdf. Evaluates the economic benefits of eight smart growth project case studies, including transit oriented development.
- 134.** G. John and S. Sirmans (1996), "Mass Transportation, Apartment Rent and Property Values," *Journal of Real Estate Research*, Vol. 12, No. 1, pp. 1-8.

- 135.** J. Landis, S. Guhathakurta and M. Zhang (1994), Capitalization of Transportation Investments into Single-Family Home Prices: A Comparative Analysis of Five California Rail Transit Systems, University of California Transportation Center, Berkeley, CA.
- 136.** Lawrence, Wai-chung Lai, "The Effect of MRT [Mass Rapid Transit] on Land Values Rekindled," *Journal of Property Valuation & Investment*, Vol. 9, No. 2 (1991). MCB University Press Limited.
- 137.** J. McDonald and C. Osuji (1995), "The Effect of Anticipated Transportation Improvement on Residential Land Values," *Regional Science and Urban Economics*, Vol. 25, No. 3, pp. 261-278.
- 138.** A. Nelson (1992), "Effects of Elevated Heavy Rail Transit Stations on House Prices with Respect to Neighborhood Income," *Transportation Research Record*, 1359, TRB (www.trb.org), pp. 127-132.
- 139.** Gloria Ohland (2008), *Value Capture: How To Get A Return On The Investment In Transit And TOD*, Reconnecting America (www.reconnectingamerica.org); at www.reconnectingamerica.org/public/display_asset/valuecap.
- 140.** Parsons Brinkerhoff (2001), "The Effect of Rail Transit on Property Values: A Summary of Studies," Reconnecting America (www.reconnectingamerica.org); at www.reconnectingamerica.org/public/download/bestpractice162
- 141.** Reconnecting America, *Hidden In Plain Sight: Capturing The Demand For Housing Near Transit*, Reconnecting America for the Federal Transit Administration (www.fta.dot.gov), 2004; at www.reconnectingamerica.org/html/TOD/newReport.htm. Market analysis finds a significant and growing portion of households value living near transit stations. Concludes that the market for TOD will exceed supply, resulting in price premiums near transit stations that provide appropriate amenities.
- 142.** Scheurer, Jan, Peter Newman, Jeff Kenworthy, and Thomas Gallagher (2000), *Can Rail Pay? Light Rail Transit and Urban Redevelopment with Value Capture Funding and Joint Development Mechanisms*, Institute for Science and Technology Policy (Australia).
- 143.** J. Strand and M. Vågnes (2001), "The Relationship Between Property Values And Railroad Proximity: A Study Based On Hedonic Prices And Real Estate Brokers' Appraisals," *Transportation*, Vol. 28, No. 2, pp. 137-156.
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- 146.** United Nations Centre for Human Settlements, *Comparative Modal Efficiencies in Urban Transport, With Reference to Developing Countries, Volume I*, Report No. HS/236/91E, Mass Public-Transport Modes and Sustainable Development, 1991.

- 147.** B. Vladimir (1983), "The Effects of a New Subway Line on Housing Prices in Metropolitan Toronto," *Urban Studies*, Vol. 20, No. 2, pp. 147-158.
- 148.** Richard Voith (1993), "Changing Capitalization of CBD-Oriented Transportation Systems: Evidence from Philadelphia, 1970-1988", *Journal of Urban Economics*, Vol. 33, pp 361-376.
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