Analysis of Current Empirical Studies on Transport Value-Added Effect and Proximate Housing Price Capture

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Abstract. Transport infrastructure is paraphernalia that helps in curtailing urban sprawl in municipal cities and it also lessens traffic overcrowding and air effluence. It equally promotes high-density development in addition to more affordable accommodation all over developed countries. This article reviews and evaluates the range of study outcomes established by the emerging frontier of knowledge delving on the capitalization effects of transport-oriented development on real estate prices. The effect of transport system services on accommodation price has been investigated from numerous viewpoints employing several rigorous statistical tools. Based on the findings of the existing literature, there are two broad kinds of impacts that closeness to a transport system can have on the value of housing accommodations: accessibility benefits (experienced in close proximity to transit services) might increase housing values, while nuisance qualities (experienced in transit-oriented facilities) could equally have a negative outcome on apartment prices. Owing to the contradictory nature of these simultaneous effects, findings from numerous empirical investigations have been opposing or open to debate. The reviewed empirical studies provide policymakers with new-fangled empirical evidence as well as analytical tools to re-examine value capture as a financing option and to transform, modify, improve, reorganize and restructure investment strategies or opportunities for rail transit services. Property development and construction companies may perhaps be able to make a decision on where to erect real estate for profit maximization and sales. Transportation planning and urban development authorities, conversely, might be able to obtain and distribute tax income based on the ease of access benefit and nuisance effects.

Keywords: housing price; residential property; transit-oriented development; transportation and value-added effect.

INTRODUCTION

It is an undisputed fact that transportation is among the most leading factors on the development, evolution, and growth of urban form. Linking different modes located all the way through the metropolitan environment, transportation offers, gives and affords people with ease of access to various markets, downtown, central business districts, inner-city as well as other vital locations; such ease of access, sequentially, is a significant indicator of real estate value [28]. Moreover, transportation helps create and produce the devolution of urban places following the growth of personal vehicle as the dominant type of transportation and commuting in many developed cities of the world. This has contributed immensely to the declining impact of both heavy and light rail transportation systems on urban real estate prices because people have been virtually less dependent on public transit to convey them to where they intend to go. Even though, just recently, passengers' and commuters' desire for transit rail systems has witnessed growth [15].

Proximity to major highways and arterial roads offers relative or virtual advantages as a result of which commercial users tend to enjoy the advantages. Present day business dealings, commercial industries, trades as well as wide-ranging activities solely rely on transportation along with transport facility, with the movement of people goods, as well as services from location to loca-

tion, becoming fundamental and indivisible aspects of worldwide and urban economic sustenance. Growth, developments, and expansion of different transportation modes have to turn out to be essential to physical as well as economic developments. Such modes of transport include railways, roads human porterage, pipelines, ropeways and cableways, sea, inland waterways and air [69].

Previous urban economic theorists such as [2, 14, 32, 42], by and large, were of the opinion that locations neighboring major transport routes have virtual and relative benefits greater than those situated a few distances away and other locations situated at route intersections have relative advantage through better advantages belonging to locations placed at focus of transport-oriented development. These benefits are analyzed in connection to convenience and ease of access, which have dissimilar distinctiveness in connection to individual sites, therefore distinguishing between locations with regards to accessibility advantages [55].

Historically, in the early part of 1970, light rail transit facilities surfaced as a new-fangled, non-exclusive permanent rail system with the sole aim of attaining some of the advantages of a rapid transit-oriented facility, such as heavy rail, but at a small cost [8]. Throughout 1970 as well as 1980, twelve cities, comprising major urban centers such as Buffalo NY, Portland OR, and San Diego CA, built and erected light rail facilities [60]. Just of recent indeed, light rail facilities have been gaining recognition and increasing in numbers. According to [15], there are sandwiched between thirty-five to forty light rail facilities functioning in the United States as of 2011. Just from one hundred and seventy-five million in 1990, the entire number of traveler journey on light rail transit facilities in the United States increased to three hundred and thirty-seven million in 2002 [68].

Therefore, light rail transit facilities are an exceptional type of rail transit. They facilitate, allow and permit street-level operation or function with no exclusive, restricted and limited rights of way (even though a few transit systems do have exclusive or special rights of way). They are equally unique and distinctive as they characteristically get power essentially from overhead wires. They are generally adaptable and adjustable to short or else long distances. In busy municipal and urban centers, light rail transit facili-

ties have a tendency of operating similar to bus systems, with stops situated every few blocks. Outside overcrowded and busy urban centers, light rail transit systems are capable of traveling more speedily, rapidly and faster with fewer recurrent stops [8]. Based on this background, the study is aimed at analyzing recent empirical studies on transport value-added effect and proximate housing price capture.

Urban Economic Theory and Transport Value-Added Effect

In the words of G. Debrezion, E. Pels and P. Rietveld [19] the model based on agricultural land empirical study originated by Von Thunen [70] is the prominent first effort in this regard. The theory emphasizes the dominance of transportation or traveling cost in ascertaining the pattern of land value as well as land use. As established by Von Thunen, for a particular land of certain fertility, land value variations are traced from the transport savings given by the location of the land [29]. In later and following studies, urban land economists enhanced and modified the theory in bid-rent terms [5, 52].

The fundamental thought behind the bid-rent theory is that each household is ready to give a certain sum of money with particular emphasis to the location of the land in question. This eventually culminates into equilibrium to a rent gradient that decreases as one move further away from the central business district for sites that produce the same usefulness and satisfaction. Going by this contention, the principal indicator elucidating the variation amidst land and landed property values was the ease of access as measured by the distance to the city center or Central Business District (CBD) and the related transport and commuting costs. It is worthy to note that the physical attributes of the land (fertility as explained by Von Thunen in his model) were assumed to be the major determinants of real estate value in the subsequent empirical studies [19].

Nevertheless, as the hedonic price model turns out to be well-liked, the physical attributes of the real property were incorporated as significant elements in analyzing and evaluating the variation in housing values. In conjunction with convenience, ease of access and location issue, the building structural attributes are as well exam-

ined in connection to the distance from the city center or downtown. The Alonso's bid-rent theory hypothesizes and postulates that the dimension, degree, extent, and volume of land and landed property increases upwardly in as much as the distance to the city center increases [74]. Nevertheless, for built-up, municipal and inner-city properties, the commuting cost perception and viewpoint (as an indicator or determinant of accessibility variable) appears narrow and shallow.

Moreover, in subsequent academic investigations, a further refined and broad-spectrum notion, idea, concept and perception of accessibility and location was brought to light. The theory of accessibility or location, hence, includes entire variables that add to the "would be" of opportunities of a location for interface and relations [31, 45]. Despite the fact that an all-inclusive explanation of the notion of accessibility is obtainable, the insufficiency of available data and suitable evaluating and appraising technique entails that straightforward and uncomplicated calculations are incorporated [19].

Consequently, in the previous studies, it could be established that there was an emphasis on a number of determinants only, particularly an inner-city or downtown leaning interface associated with employment along with shopping. In the majority of housing price academic papers, the social interaction (interface) variables were completely omitted and absent from the bid-rent theory. Therefore, the fundamental theory in real property price researches can be suggested and proposed this.

An apartment or residential building proximate to a transport infrastructure enhances the convenience and ease of access to that property. Consequently, the value or worth of the transport facility is integrated and capitalized in the real property price. It might perhaps be anticipated that a price curve will eventually have a negative slope; as one moves further away from the transport facility (rail station, road network, airport, seaport, and the likes), prices drop off and diminish.

Conversely, for the reason that neighborhoods adjacent to a transport facility are admirable and attractive, naturally, transportation stations pave the way to polycentric structures; a linear polycentric urban metropolis is expected to have a price curve (that is, rent gradient) by means of a sinusoidal pattern. The local climax takes place at the transport station areas, and the global peak will be realized around the central business district [19].

Furthermore, the transport accessibility evaluation predicament equally seems to be a key obstacle. In Alonso's bid-rent theory, accessibility or convenience variables had to be analyzed as the distance (that is, transport cost) to the final destination. This method is employed in the majority of transport accessibility empirical studies. Nevertheless, it is perhaps imperative to understand that this approach emanates from the explanation of the concept or notion of accessibility or location: the convenience by which the city center or central business district may perhaps be arrived at. On the other hand, in the previous empirical studies, it has been observed that that are various meanings of location or accessibility largely owing to the goal or aim of the study in question [59].

It is worthy to mention that in some cases, additional parameters might be needed (apart from cost, travel distance/time, fare and the likes), such as interaction patterns. Nonetheless, despite the fact that the concept appears to have a discrepancy in description and analysis, its fundamental theoretical connection to the real property worth remains very similar. A higher accessibility or convenience index for the real property in question indicates a higher property price [19].

It is sufficed to mention that in the previous real property value studies, neighborhood amenities were not incorporated in their analysis. Conversely, the hedonic price model suggests for their inclusion and capture. The notion of neighborhood amenities is having more explanation and evaluation problems compare the concept of accessibility. Having succeeded in explaining and analyzing the concept of neighborhood amenities, the connection to property value is examined in a similar approach: the higher the quality and the availability of the environmental amenity index equivalent to the property, the higher its value or worth [19]. The governing theoretical framework for nearly all empirical studies remains the same as they include physical or structural attributes, accessibility or location attributes and environmental amenity factors in their analyses.

REVIEW AND ANALYSIS OF RELATED EMPIRICAL LITERATURE

This section highlights on related empirical and previous studies that explored the relationship as well as the association between transportation infrastructure, railway station, subway lines, metro station, light, and heavy rail station and abutting, surrounding as well as adjoining real estate prices. The extensive review will go a long way in identifying the major contribution of the previous studies on the subject matter. This review would equally recommend research gap worthy of investigation which was not explored by the past literature.

Transport-Oriented Development Attributes

According to [71], urban land economic theory hypothesized that individuals or households are ready, keen willing and eager to give or spend a premium for convenience and ease of access to neighborhood amenities and these public amenities are capitalized into real estate values [48]. A quite sizeable number of preceding and earlier empirical studies, investigating on the effects of transit-oriented development, decompose and putrefy transit-oriented development impacts into separate and disconnected components, which are separated out into two types of transit-oriented development-generated amenities as well as transit-oriented development generated-disamenities. Price effects of transit-oriented development generated amenities have three main components: transit accessibility or convenience effects, pedestrian or walk-friendly network effects, as well as mixed-use effects. Transit-oriented development-generated dis-amenities such as traffic overcrowding or congestion, noise along with air pollution, would probably decrease, lessen and diminish real estate values. Transit convenience and accessibility is one foremost, leading as well as the most important amenity of transit-oriented development.

A huge amount of existing literature in this regard examines the price effects of transit nearness. Monetary and pecuniary impact of accessibility or convenience begins with the empirical work of Johann von Thunen, who in 1863 hypothesized and theorized concerning the value and worth of farmland as a function of the land's relative nearness or proximity and, consequently, its ease of access to the marketplace. Afterward, empirical investigation modified and trans-formed his empirical work further than the farmland perspective to other forms of land use types, revealing and indicating alike associations [10].

Hypothetically, seeing that transit-oriented service improves and enhances land convenience or accessibility level, the transport in addition to convenience costs of reaching to and from the land turns out to be lower, culminating to the high increase in demand for the land, which upwardly increases land and landed property values [41]. Nevertheless, quite a number of empirical studies query and doubt the applicability and practicability of the theory or model under the thought that developed economies like United State regions have before now constructed an auto-based transport and well-connected networks, followed by a spatial spreading or diffusion of both housing as well as commercial dealings, which restricts the efficiency, efficacy and success of non-auto modes [57].

Preceding and earlier empirical studies analyzing and examining on transit capitalization make known and uncovered varying, conflicting, contradictory, incompatible and incoherent findings and outcomes. Researchers [19] carried out a meta-analysis technique to generalize inference and conclusion in the midst of 57 empirical studies. They established that transit price impacts by means of residential property values rising and increasing 2.4 % for each and every 250 m nearer to a rail transit station. Whereas the mainstream or bulks of the analyzed empirical studies' results discovered that transit contains a positive effect on adjoining property values, a few numbers of studies indicated that the effect is relatively or somewhat self-effacing, moderate, unassuming, unpretentious, diffident or even negative in a number of cases. Authors [67] revealed a negative impact of railroad nearness on housing accommodation values owing to environmental concerns or considerations in the case of Oslo [71].

In another study by [37], they disclosed that transit convenience and accessibility do not play a major and significant role in ascribing value to the real property in Buffalo. The presence of light rail transit affects real estate values merely moderately and negatively close to three rail stations. The finding of [7] study indicates that high-speed handrail way line has little or insignificant impacts on adjoining residential accommodation prices in Tainan province. Authors [48] analyzed

single-family house prices in close proximity to 4 uptown San Francisco transit-oriented developments. They discovered no impacts from three of them. Furthermore, the negative price effects were discussed rather in a different way, based on each study's explicit conditions [71].

It is imperative to state that price effects of transit facility proximity differ with the variations in property type, transit mode in addition to measurement methods. In the words of [34], a real estate adjacent commuter rail station has huge premiums compare to light rail or else heavy rail. Real property close to heavy rail commands higher benefits than real property in close proximity to light rail. Impacts are higher in the midst of proximity measured and estimated by straight line distance, whereas results are more statistically momentous and significant with nearness measured through actual walking distance. Comparison, as well as the relationship among real property types, reveals that transit premium or payment for multifamily accommodation is much greater than that for single-family home [24]. Variation in variable measurements paves way too dissimilar and diverse results as well. Nearness to transport nodes was connected considerably as well as positively by means of single-family values, whereas closeness to transport links and networks was negative but rather not quite significant [63].

It is a documented fact that mixed land-use development helps in providing institutional, commercial, recreational as well as other opportunities in addition to services to close by residents. Through the concentration of mixed land-use, transport oriented development promotes and enhances accessibly for day by day activities along with opportunities for job and employment which can be analyzed, estimated and capitalized as home price premiums. Furthermore, the price effects of mixed land-use rely on a large number of factors, such as land use scale, property type, proximity to residents and mixed-use extent. The study carried out by [47] established that the convenience and ease of access to retail jobs increase low-quality home prices whilst concurrently decreases high-quality home prices [71].

In his study, M. Duncan [24] estimated and analyzed density or compactness of population that were being employed in food, service occupations entertainment, retail sales and representing the quantity of non-work activities contained by

a walkable distance of a land parcel. He discovered that this analysis of commercial undertaking has a strong as well as a positive effect within 0.1 km beginning from the transit stations. Authors [43] in their study found that accommodation prices upwardly increase with the size and dimension of the natural vicinity close by. They analyzed the best size of parks as well as natural areas to be alike to that of the golf course. Additionally, preceding and earlier studies revealed that the value or worth of all types of open space might perhaps be higher in municipal areas compare to suburban locations [71]. As density or concentration of people increases in metropolitan areas, greenways parks as well as other natural scenery present and offer increased and bigger economic benefits or advantages [1, 6].

According to [71], pedestrian-friendly road street design results to real property premiums. It is spontaneous and instinctive that homes situated on quieter and calmer streets should be sold at higher prices compared to those positioned on full of activity, noise and high-trafficked streets [36]. The findings of [58] revealed that individuals are eager and keen to pay or give a premium for homes in the area surrounded interrelated, interconnected or unified streets and smaller housing blocks in Portland, Oregon. One good example of Boston's "Big Dig" project, the substitution of the elevated Central Artery expressway by means of an underground and subversive facility as well as the modification of the surface to a linear expressway and boulevard, demonstrated the premiums solely on financial analysis of Tajima, which concluded that the pulling down of the highway should result in $632 million upward increase in real property values or price [10]. Parameters in addition to indicators are developed to analyze the pedestrian-friendly network or system level, such as density of street connections, steepness or gradients of terrain and vicinity dedicated to parking along with ride lots [24].

Whereas a lot of the earlier empirical studies analyzed price impacts of transit closeness, mixed land-use as well as street design separately, a number of empirical studies moved more advanced and investigate the synergistic impacts in the midst of the three most important transport oriented development characteristics and other connected factors. The findings of [49] revealed that price impacts of mixed land-use are connected to neighborhood road or street patterns.

Retail developments contained by walking distance have no considerable effect in automobile-oriented localities with curvilinear as well as cul-de-sac street or road patterns; whereas in pedestrian-oriented neighborhoods with interrelated streets, retail closeness considerably influences property values or price. Author [9] established that the impacts of transport-oriented development zoning are linked with neighborhood mixed land-use extents. In single-use housing neighborhoods, as a matter of fact, the adoption of transport-oriented development zoning has a negative impact on real property values, while transport oriented development zoning is going along with by a thirty-seven (37 %) percent premium for condos that were situated in mixed land-use neighborhoods [71].

The interface, as well as association, sandwiched between transit nearness along with pedestrian surroundings is demonstrated in an empirical study conducted by M. Duncan [24]. The study confirms and reveals that under the circumstance of high-quality pedestrian environment, a condo in close proximity to a rail transit station has a considerably higher price and value compared to one not proximate to a station [71]. On the contrary, a condo in a small walkable housing neighborhood in close proximity to a park-and-ride station can have lesser values compare to one in an alike neighborhood not close to a station.

Besides street and road design as observed by [71], transit closeness effect is as well accustomed by detailed and explicit neighborhood attributes in addition to station vicinity characteristics. Researchers [12] incorporated as well as employed interaction variables to confirm and test the association between transit nearness and neighborhood earning or income. The results of their study established that the premium given or paid for being adjacent to a rail station is larger compared to low-income residential neighborhoods. The situation on Rosslyn-Ballston passageway of Arlington County advocates that the capitalization and estimation of transit closeness benefits is not simply a function of a real property's nearness to a rail station, but equally the rail station's closeness to the center or focal point of the neighborhood.

In as much as the rail station distance from downtown or else the city center increases, the accessibility-related real property value impact decrease, narrow, shrink, diminish and get thin off [10]. In the same way, authors [37] established that closeness to rail stations through direct New York City service is estimated and valued to some extent higher than nearness to regular study rail stations. Authors [18] indicated that high-speed rail has a substantial and significant impact on home values in the medium as well as small cities but has an insignificant impact in bigger capital cities, due to the competitive nature of real estate market in Chinese capital cities [71].

Transport Facility Effects and Real Property Value

S. Singh [64] conducted a study on urban or city transportation problems in both India along with North America. He found that owing to incessant increases in population resulted from a natural increase in addition to migration from rural or peasant areas as well as smaller towns, availability, and presence of motorized conveyance, boost in household income along with increases in commercial as well as industrial activities have to augment transport demand. The predictable and anticipated effect on residential in addition to commercial real estate markets was positive. However, the range and degree of impacts differ from marginal to greater than 100% in the commercial and profit-making sector from the North American indication [55].

Furthermore, in another empirical study on the UK, S. Singh [64]established that the influence of the road transport network was positive mainly concerning the capital increase in housing accommodation values. On the other hand, the study places less importance on accurate values. Therefore, a quite number of the observed and experienced increase may perhaps be due to optimism or hopefulness of the property markets more willingly than actual effects. In the same way, there is equally some substantiation and confirmation that housing accommodation prices might perhaps decrease instantaneously around and within the transport investment vicinity. Value or price increase was analyzed and estimated in Singh's study in a narrow and subjective way and largely through changes in real property as well as land prices whereas wider assortment of measures has to have been employed [55]. The measures and estimates should have captured variations and differences in accessibility, convenience, ownership or possession patterns for land along with property, site consolidations, numbers of transactions and yields as well as complex measures such as density and concentration of development.

Table 1 – Review of Key Previous Empirical Studies [71]

No	Authors	City	Property Type	Transit Mode	Study Area	Method	Major Variables Used	Major Findings
1.	Landis, J., Guhathakurta, S., Huang, W., Zhang, M., & Fukuji, B. (1995)	San Jose and Sacramento, CA	Single-family houses	BART, CalTrain, and three light rail systems in San Jose and Sacramento	4180 available single-family transactions from TRWREDI data	Hedonic price models	Floor area; lot size; # bedrooms; # bathrooms; household income; % White, Asian, Black, White; % home owners; network distance to transit station; distance to freeway interchanges; within 300 m of transit line; within 300 m of freeway	The capitalization effects of rail transit can be significant. The extent to which transit service is capitalized into increases in home prices depends on the quality of service. BART and San Diego Trolley are more likely to generate significant capitalization effects.
2.	Bowes, D. R., & Ihlanfeldt, K. R. (2001)	Atlanta, USA	Single-family house	Metropolitan Atlanta Rapid Transit Authority (MARTA) rail stations	Atlanta region	Hedonic price model in the semi-log from and auxiliary models for neighborhood crime and retail activity	Lot area; house age; # fireplaces; house has basement; tract proximity to employment; # road miles to CBD center; within one-half mile road distance highway interchange; within one mile to two miles road distance of highway interchange; density of manufacturing employment; density of retail employment; % housing units occupied by renters; % black;	Properties within a quarter of a mile from a rail station are found to sell for 19 % less than properties beyond three miles. Properties that are between one and three miles have a significantly higher value compared to those farther away. Premium paid for being close to a station is greater in high-income than in low income neighborhoods.

No	Authors	City	Property Type	Transit Mode	Study Area	Method	Major Variables Used	Major Findings
							median income;% tract within one-half mile of a freight rail line; density of total crimes; dummy variables of distance to MARTA rail stop	
3.	Cervero, R., & Duncan, M. (2002)	Santa Clara County, CA	Office, commercial, light industrial properties	Light rail and commuter rail	0.25 mile buffer of stations	Hedonic price models	Distance to CBD; floor area; lot size; house age; shop use; street frontage; road width; commercial zone; % college-educated	Distance to HSR station is only significant at one-tailed in seven of eight models. Even if tentatively accept the price-distance effect; the amount is no more than a 3–4 % price premium.
4.	Hess, D. B., & Almeida, T. M. (2007)	Buffalo, NY	Residential property	Light rail	0.5 mile buffer of 14 light rail stations	Hedonic price models	Straight line distance to rail station; walking distance along street network to rail station; parcel area, structure age, # bedrooms; # bathrooms; single-family housing; # fireplaces; presence of basement; distance to CBD, the nearest park, Delaware Park; East side dummy variable; property crime rate; violent crime	Every foot closer to a light rail station increases average property values by $2.31 (using geographical straight-line distance) and $0.99(using network distance); Proximity effects are positive in high-income station areas and negative in low-income station areas;

No	Authors	City	Property Type	Transit Mode	Study Area	Method	Major Variables Used	Major Findings
							rate; median income; occupancy rate change; population growth rate	
5.	Andersson, D. E., Shyr, O. F., & Fu, J. (2010)	Taiwan	Residential property	High-speed rail	Taiwan metropolitan area	Hedonic regression models in log-linear, semi-logarithmic and linear Box-Cox functional forms	Floor area; lot size; structural age; # stories; shop/dwelling use; street frontage; road width; commercial zone; residential zone; mean household income; college-educated; distance to CBD, HSR station, freeway interchange	The small or negligible effect of high-speed railway (HSR) accessibility on residential property prices in the Taiwan region is a reflection of expensive fares in combination with the inaccessible location of the HSR station.
6.	Duncan, M. (2011)	San Diego, CA	Condominium units	Trolly system	1 mile network buffer	Hedonic pricing models with interaction terms	Floor space; structure age; # bathrooms; # bedrooms; # garage space; view; # street intersection; people-serving jobs; % slope; parking area; parcels within 50 metres of a grade-separated highway; network distance to the nearest station; series of dummy variables representing station catchment areas	Station proximity has a significant stronger impact when coupled with pedestrian-oriented environments. Transport-oriented development has a synergistic value greater than the sum of its parts.

No	Authors	City	Property Type	Transit Mode	Study Area	Method	Major Variables Used	Major Findings
7.	Mathur, S., & Ferrell, C. (2013)	San Jose, CA	Single-family house	Light rail system with sub-urban transport oriented development	0.5 mile radius buffer	Hedonic pricing method: fixed effect ordinary least squares regression models	Building area; lot size; house age; # bathrooms; # bedrooms; distance to transport oriented development; distance to light rail line; within 1/8 mile of transport oriented development; within 1/8 mile of light rail line; distance to the nearest multi-family development, bus stop, major street, freeway; % change of median household income; % change in population; % white population	Transport-oriented development 's price effect dissipates after 1/8 mile. Housing price within 1/8 mile were 18.5% higher than the prices more than 1/8 mile from the transport oriented development in post- transport oriented development period; 7.3% higher during the construction period; not statistically different in pre-transport oriented development period.
8.	Delmelle, E., Yan, S., & Duncan, M. (2012)	Charlotte, NC	Single-family house	Light rail	1 mile buffer of light rail	Hedonic price analysis with time series models	Structure age; height; no fuel; central air conditioning; # fireplaces; building grade; network distance to nearest transit station	Proximity to the future rail corridor had a negative influence on home prices before the rail system began operation; housing prices reacted positively to light rail investment during the operational phase

No	Authors	City	Property Type	Transit Mode	Study Area	Method	Major Variables Used	Major Findings
9.	Ma, Ye, and Titheridge, 2013	Beijing	Apartment units	11 rail lines and 1 BRT line	Built-up area within the 6th Ring Road in Beijing	Hedonic regression model in semi-log form	Distance to rail station, city center, nearest sub-centers; ratio of commercial and entertainment land uses; whether has elementary school; administration fee	An average price premium of around 5% for properties near rail transit stations, but no statistically significant effects were detected at BRT station areas. Increase in distance to city center or increase proximity to low- and medium-income neighborhoods will decrease the relative value of station proximity.
10.	Seo, K., Golub, A., & Kuby, M. (2014)	Phoenix, AZ	Single-family house	Light rail	The city of Phoenix	Hedonic model using generalized spatial two-stage least-squares estimation	Living area; lot size; # bathroom fixtures; house age; presence of pool; nearest green park, desert park, golf course; nearest distance from city center; dummy variables of distance from highway exit, highway, light rail station, light rail track; median household income; population density; % covered by trees; % covered by grass; highway lies above ground level; highway lies below ground level	Proximity to transport nodes was associated significantly and positively with single-family detached home values. Proximity to transport links was negative but not significant.

No	Authors	City	Property Type	Transit Mode	Study Area	Method	Major Variables Used	Major Findings
11.	Kay, A. I., Noland, R. B., & DiPetrillo, S. (2014)	New Jersey	Residential property	New Hersey Transit (NJT) rail system with TOD	2 mile radius buffer of eight sampled NJT stations	Hedonic regression in the log transformed form	Distance to nearest study station, nearest New York City (NYC) station; income, # rooms, population density, effective tax rate, % Black or African American,% of HU large multifamily, % of HU single family attached, park accessibility score, violent crime rate, average SAT math score	Access to stations with direct New York City service is valued slightly higher than access to study stations.
12.	Chen, H., Rufulo, A. & Dueker, K. (1998)	22 cities along BJHSR line	Housing units in communities	Beijing-Shanghai high speed rail (BJHSR)	50 km buffer along the BJHSR line	Hedonic pricing methods in the forms of OSL Box Cox, and a spatial econometric model	Housing value; area size; completed or not; floor area ratio; greening ratio; per capital income; population density; whether it is a residential building, apartment, villa, office building; distance to HSR station, city center, main road; whether bus stop, school, park, hospital is nearby; whether located in provincial capital.	BJHSR service has a considerable regional impact on housing values in medium and small cities but a negligible impact in larger capital cities.

Delving into transportation, convenience accessibility and real estate value, Washington, D.C.'s transit Metro rail facility encouraged new downtown commercial as well as residential development along with agglomeration than would else have taken place with the transit metro rail joining or converging downtown from the entire directions; consequently, Singh concluded that market for office as well as other space surrounded by a business center should be built more in off-road transit infrastructures to serve it [22]. Modern and current urban land market theory affirmed that the degree of difference in firm's access to business or trade is undertaken clusters bring out considerable effects on commercial land and landed property market. This is demonstrated in the way firms value major as well as secondary commercial places due to accessibility in the urban areas [65].

Authors [54] as cited by [55], in his study on land value indicators and determinants in medium density residential areas of metropolitan Lagos, established that good drainage, electricity, access roads, telephone, and public water supply are indispensable and where utilities, facilities, and services are sufficiently available, land and landed property values will eventually be high. He concluded that road network is one of the many factors that positively affect property values. He further established that enhancement and modification in transportation infrastructures particularly roads brought about better and improved accessibility and convenience. By means of the Spearman's correlation analysis, L. Oduwaye [54] discovered that there was an association, correlation, connection and relationship coefficient of 0.177 for transport enhancement at 0.01 level of significance.

These abovementioned and aforesaid previous empirical studies merely indicated the association and connection between intensification in transport development along with improvements in accessibility and convenience. On the other hand, the previous works did not empirically and analytically estimate the degrees, extent as well as levels of accessibility, convenience, and connectivity of every nodal point contained by the studied road network. Additionally, the earlier works equally did not take into cognizance and did not also reflect on the effects of demand, supply as well as location on commercial property values or prices [55].

In another earlier study by [21] on variations in relative values alongside routes perpendicular and vertical to certain number of streets, in the course of simulation and replication of door-to-door access costs prior to and subsequent to construction of a subway or passageway found that there was an upward increase in rent gradient close to the subway rail stations. The study was unique compared to many other empirical studies by modeling price impacts within and around a subway rail station to a certain extent rather than the distance to the city center or central business district. The more or higher the price or fee paid for a particular land, the more the capital injected and applied to it, in this manner, increasing its efficiency as well as intensity and concentration of use and accordingly its value.

Another study by [75] however, in attempting to correlate location values and prices of shops by means of accessibility index, employed expert system heuristics to choose comparable properties from a database by means of questions asked concerning the subject property. He adjusted and attuned the values of the comparables in questions so as to account for variations between them along with the subject property, and likewise for values of comparables to report and account for physical dissimilarities. The study outcome was demonstrated and shown on Value Maps after the said values have been acquiescent and reconciled for differences with the exception of those attributable to location and accessibility. It was established that pattern configuration and design of route or road network in addition to impedance for traversal all along the routes influence accessibility as well as locational value through employing network model by means of implication for transport forecasting and planning along with its effects on real property values.

In another study conducted by Kivell (1993), he revealed that in a mono-centric metropolitan area, the center or location that be a focus for highest values, as well as rents, is where transport infrastructures maximize labor presence and availability, proximate linkages and customer flow. This is true because rent is the charge or amount that owner of a reasonably reachable site can impose due to saving in transport costs and expenditures which the make use of the land makes potential. The improved and enhanced the transport network, the fewer and lessen the friction and the better will be the rent charged, which is the fee or payment to triumph

over and overcome the friction of space. The general connotation, implication, insinuation, and inference of these previous empirical studies are that proximity to a mode of transport straightforwardly influences values of adjoining residential accommodations [55].

RESULTS AND DISCUSSION

The enormous greater parts of past studies have operationalized convenience and ease of access through estimates of nearness to rapid transit access points. For instance, those who make use of hedonic multiple regression models on a cross-section of sales of single-detached houses typically incorporate either continuous linear or else non-linear estimates of distance to the adjacent station in an effort to capture the marginal variation in land and landed property values connected with variation in distance or else walking time. Some earlier studies employ a set of categorical, definite or dummy variables matching to a parcel's location and accessibility within a variety of circular rings of distance within and around a rail station [35].

To keep away from such perplexity of factors, E. Campbell [15] in his study employs a hedonic price model, which has been usually used by other scholars like [17] as well as [4]. In E. Campbell's modeling framework, the distance to the adjacent light rail transit station is employed as an estimate of the worth, value or price of access, at the same time as equally controlling for distance beginning from the rail transit line itself. This method or technique is helpful for the reason that stations, as well as rail lines equally, have negative characteristics linked with noise along with other nuisances and some factors that ought to decline or diminish with distance. Incorporating both the distance/expanse to the closest light rail transit station and the distance to the rail transit line in the model assists to partly separate the convenience or accessibility impact as well as the nuisance effect.

Majority of the recent empirical studies confirmed that nearness to rail transit facilities usually does not enhance single-family housing values, whilst the multi-family housing market to a great extent appreciates close proximity to rail transit stations. The premium for closeness to rail transit facilities may perhaps also differ by different development phases as well as rail technologies. Additionally, station area or vicinity

land use might considerably moderate the premium or payment for station access: rail stations with Park-and-Ride conveniences, in general, do not promote and enhance property values in close proximity.

Several metropolises have experienced the promising and potential socio-economic advantages which light rail transit facility can provide. Nevertheless, it has equally been challenged for high costs in erection, construction as well as operations, small ridership along with revenue, crimes noises, and many safety problems [56]. Furthermore, earlier studies have indicated the capitalization effects concerning rail transit station were enormously modest as well as highly variable [41, 73]. It is easier said than done for transit rail facilities to have considerable impacts on land use, city or town development, population, along with employment devoid of compassionate or helpful policies and efforts, akin to citizen support, incentive zoning, and the likes [15, 56].

Additionally, it can take several years for adjoining land values to experience the capitalization impacts of transportation enhancement or improvements [73]. E. Campbell's study [15] employs a hedonic regression or price model to estimate the influences of light rail transit facility on the values or worth of adjoining residential houses. Eventually, the modeling study outcomes validate the hypothesis that the ease of access effect, represented by means of the distance to light rail transit stations, brings a higher percent upward increase in real estate prices between 2004 and 2010 seeing that the distance to the closest rail station facility decreases. In addition to the influence of improved access, this association may perhaps be credited to enhancement made within and around the transit station areas throughout the same time epoch, together with the addition of scenery, landscaping as well as other services and environmental amenities. The modeling study findings also corroborate that the nuisance impact, represented by means of the distance to the light rail transit facility, brings about a lower percent upward increase in real estate prices during the 2004 to 2010 moment period since the distance to the transit line increases.

E. Campbell's results [15] also advocates that annoyance or nuisance effects such as incessant noise as well as overcrowding resulted by light rail transit facilities can cause problems which

transportation planners as well as policymakers ought to address in the unforeseen future. Based on the Campbell's study outcomes, numerous independent variables, including several neighborhood attributes as well as the distances to the central business district and to the Texas Medical Center, contain stronger statistical associations amid the dependent variables than the focal point variables contain with them.

This shows that these extra independent variables, encompassing the distance toward the Texas Medical Center, the distance to city center, and more than a few neighborhood qualities, including median home value, the proportion or fraction of people above the age of 65, and minorities as a percentage of the populace, have more considerable impacts on the value or worth of residential houses situated within a mile of Houston's light rail transit facility than the study's center variables. There exist a number of possible clarifications for the weak results discovered in Campbell's study concerning the association between rail transit facility and real estate prices.

A second likelihood is connected to the data as well as a measurement technique. Certainly, a probable problem with Campbell's study is that it fell short and deficient in getting a complete data on residential home attributes required for a meticulous use of a hedonic regression or price model. In addition, subsequent analyses conducted on other forms of land uses may perhaps come up with different study outcome. Thirdly, B. Weinstein and T. Clower [73] explained the likelihood that rail transit facilities should not be anticipated or projected to increase or improve accessibility. Several past empirical studies, in actual fact, have established that rail transit systems do not influence accessibility for the reason that they have a propensity to serve a small number of origins as well as destinations, and they take an incredibly small portion of the whole number of trips to a neighborhood [73, 30, 50]. A connected fourth likelihood concerns the restricted size of Houston's Metrorail station. The transit line is at present only 7.5 miles long, stretching between the central business district and the Reliant Park [15].

A greater part of the land uses neighboring and adjoining the present or existing transit line are not residential and the transit line merely hits a restricted number of destinations within and around a small segment of a large city; two essentials that may perhaps limit the degree and extent of apparent or seeming benefits from the transit line as it stands at present. Numerous modifications, improvements, and enhancements to the transit line are presently under erection and will join the rail transit facility to an additional segment of this auto-dominated metropolis. The extensions are supposed to encourage additional ridership as well as auxiliary support Houstonians' valuing of transit facilities [15].

CONCLUSIONS

The connection between accessibility, location, real estate values as well as land use blueprint was the thought of earliest urban economic theorists. The theories pointed out that travel or commuting costs were traded off alongside rents as well as accessibility in more intricate and complex phenomena that need treatment that is more complicated. Improvement and enhancement in ease of access lead to decrease, drop, lessening and decline in relative transport expenses of a site straightforwardly all the way through transport subsidy or otherwise not directly by means of community transport investment along with its appearance and manifestation. This was, by and large, validated and confirmed through higher demand that increased land and real property values, intensity or concentration of land use, and values with considerable changes as a matter of fact [33].

As location turns out to be more attractive and pleasant to a household or firm, on account of certain distinctiveness and features, demand for such location increases automatically. Consequently, this leads to a price increase. As a general rule, inner-city or city centers are the focal point of numerous activities. Hence, nearness to the central business district is well thought-out as an attractive and luring attribute that enhances real estate prices. Injecting huge capital outlay in transportation infrastructure lessens and decreases this problem at the city center to some extent [27]. Real estate proximate to the investment and venture neighborhood equally derives benefits from such capital outlay injected.

It is equally a known fact that transportation and property are essential and significant in physical along with economic development of towns, metropolises, and cities all over the world. Housing accommodation and land values have a propen-

sity to increase in neighborhoods, areas, and counties with increasing, expanding and growing transportation networks. They, however, increase and expand less rapidly and quickly in areas, cities or regions with no such improvements and advancements. Rapid as well as the continued increase in housing accommodation and land prices are anticipated in cities or towns with transportation advancements, rapid economic development in addition to population growth [55].

The reviewed empirical studies provide policymakers with new-fangled empirical evidence as well as analytical tools to re-examine value capture as a financing option and to transform, modify, improve, reorganize and restructure investment strategies or opportunities for rail transit services [76].

Another methodological contribution has to do with how to design a hedonic regression model to estimate, confirm and validates these effects statistically as well as spatially in a single model. The proposed study outcomes may perhaps be helpful to private as well as public sectors in relation to buying and constructing real estate along with transportation planning. For example, real estate buyers may perhaps be able to identify and spot the location where the net advantage of accessibility is maximized and achieved. Property development and construction companies may perhaps be able to make a decision on where to erect real estate for profit maximization and sales. Transportation planning and urban development authorities, conversely, might be able to obtain and distribute tax income based on the ease of access benefit and nuisance effects [62].

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